

Educational actions involving community for the sustainable management of turtles in Amazon Basin (Brazil): Projeto

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The project “Pé-de-Pincha”, initiated in 1999 by Federal University of Amazonas (UFAM) in partnership with IBAMA (Brazilian Environmental Institute) and local governments of Parintins, Barreirinha, Terra Santa and Oriximiná cities (distributed in Amazonas and Pará states, in Brazilian Amazon), has developed actions related to the conservation of natural resources together with environmental educational activities. Eating turtles is a common practice in these communities, which accelerated the decline in the amount of individuals of many species from this group (e.g., *Podocnemis unifilis*, *P. expansa*, *P. sextuberculata*). The perception of this problem by the affected communities encouraged the search for viable solutions from technical groups, providing space for the development of environmental education and management for conservation of turtles, within a context of sustainable development. Since the implementation of the project, thousands of turtle eggs were transferred out for incubation areas prepared to protect them from hunters and predators, and later released in their areas of origin. This strategy, part of the field activities of environmental education carried out in partnership with indigenous people and their communities, involved them in a practical way on the issue of environmental conservation from a local problem. One trained also 361 teachers in environmental education, together with 101 environmental voluntary agents coming from communities. During the project 421 activities of environmental education (courses, lectures, artistic presentations, films, puppets and games) were carried out. These activities involved 25,209 people from these communities. Results show, in principle, that addressing the environmental issue with the involvement of community had a major impact in reducing the problem originally proposed, because the people involved started to value the environment in general from an immediate problem, which resulted in concrete actions for improving the quality of life in the communities involved

Theme:sustainable development; environmental education; conservation of natural resources; community participation

Type of Presentation: poster

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IMMUNOCHEMICAL CHARACTERIZATION OF *M. laticollaris* CORAL SNAKE VENOM

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Micrurus laticollaris is one of the most medical important coral snake species in Mexico. Evnenomation caused by coral snake species are treated with Coralmyne®, specific horse anti-*M. nigrocinctus* F(ab')₂ antivenom that show little neutralizing potency against *M. laticollaris* venom. Our objective is to know which are the main lethal components of this venom and to compare immunological differences between rabbit antiserum, horse antiserum and Coralmyne®. Rabbit specific antiserum failed to neutralize homologous venom while horse serum show a neutralizing potency of 0.552 mg/ml. Biochemical studies on *M. laticollaris* venom components shows that it posses mainly phospholipases A₂ (PLA₂) enzymes and alpha neurotoxin. MonoS cation exchange chromatography resolves venom on 12 fractions, eight of them with PLA₂ activity. Purified fraction 2 shows an LD₅₀IV=0.06 mg/kg and sequence homology to short chain alpha neurotoxins;

acetylcholine receptor binding assays show a $K_d=2$ nM. Specific rabbit anti-alpha neurotoxin does not neutralize lethality but is able to recognize related toxins in other coral snake species. MonoS phospholipase-active fractions show high variability in LD50 going from 0.32 mg/kg to non-lethal. Horse anti-M. laticollaris serum is able to neutralize lethality of PLA2 toxins but is unable to neutralize alpha neurotoxin fraction. All three antivenoms recognize PLA2 fractions but barely recognize alpha neurotoxin, none of them is able to neutralize lethality of alpha neurotoxin. Horse anti-M. laticollaris serum is able to recognize and neutralize heterologous venoms. As a general rule, as higher the content of alpha neurotoxin, the lesser the neutralizing potency mediated by horse anti-M. laticollaris serum.

Theme: coral snakes, *Micrurus laticollaris*, antivenom, biochemical characterization

Type of Presentation: Poster

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ONTOGENY OF THE CERVICAL AND THORACIC VERTEBRAS IN *Caiman yacare* DAUDIN, 1802 (CROCODYLIA, ALLIGATORIDAE)

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The *C. yacare* is a highly potential species to zootechny exploration, as so, due to its particular representatively, it deserves additional studies that provide information about its biology. So, the propose of this research was to establish the normal steps in the sequence formation of the cervical vertebra bones and the thoracic ones of a *C. yacare*, in the different stages of pre natal formation. Embryos were collected during the spawning period of 2007. The embryos were submitted to the diaphanous technique by KOH and alizarin stain of the bones. With 24 days of incubation the vertebras are still constituted by cartilage. On the 27th day, on the cranial-caudal direction the vertebral bodies start its ossification. In this period all the vertebras, cervical, thoracic, lumbar and sacral, already present ossification centers in the vertebral body. With 36 days the neural arch of the atlas, still formed by two distinct parts, begins the ossification, as its vertebral center, the neural arch of the axis and the pair of cervical ribs. With 39 days, the vertebral arches of C2 to C8 already present ossification centers. With 42 days, centers of bone ossification are formed in the transversal processes of C2 to C5 and later it continues until C8 on the 45th day. The neural arch of atlas merges on the 48th day, and the others only on the 54th day for the C3 to C4, and on the 57th day for C2, C5 to C8; at this stage already with the formation of the spinal processes of C2 to C8, and the formation of the articular processes overlapping, but without the merge of the transversal processes. The thoracic vertebras present ossification in their bodies on the 27th day. At this period it also begins the ossification of the ribs. The vertebral bodies bone formation progresses until, on the 39th day, a center of bone formation appears in each transversal process from T1 to T2. With 45 days of incubation the vertebral arches already present colorific retention. The caudal articular processes have the ossification on the 48th day and the cranial on the 51st day, with a visible interposition between them on the 57th day. The vertebral arches T1 and T2, with 57 days, are already merged.

Theme: Reptiles, Crocodilians, Morphology

Type of Presentation: poster

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ONTOGENY OF THE LUMBAR, SACRAL AND CAUDAL VERTEBRAS IN *Caiman yacare* DAUDIN, 1802 (CROCODYLIA, ALLIGATORIDAE)

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The *C. yacare* is a highly potential species to zootechny exploration, as so, due to its particular representatively, it deserves additional studies that provide information about its biology. The propose of this research was to establish the normal steps in the sequence formation of the lumbar, sacral and caudal vertebra bones of *C. yacare*, in the different stages of pre natal formation. Embryos were collected during the spawning period of 2007, from the first natural incubation day until their opening day. The morph metric measures were made and the embryos were submitted to the diaphanous technique by KOH and alizarin stain of the bones. The spinal column of the *C. yacare* is composed by eight cervical vertebrae, thirteen thoracic, three lumbar, two sacral and thirty-nine caudal. With 24 days of incubation the vertebrae are still constituted by cartilage. On the 27th day, on the cranial-caudal direction the vertebral bodies start its ossification. In this period all the vertebrae, cervical, thoracic, lumbar and sacral, already present ossification centers in the vertebral body. In the lumbar vertebrae, on the 45th, centers of bone formation appear in the transversal processes. With 51 days the vertebral arches begin its ossification, together with the cranial articular processes, the caudal ones begin only with 54 days. The sacral vertebrae continue the ossification of its bodies, and with 42 days the transversal processes (sacral wings) present the first centers of bone formation. The vertebral arches of S1 and S2 begin its ossification with 48 days, and with 52 days the articular process is already visible. On the 57th day the sacral vertebrae are not merged yet, not even its transversal processes to the body. The caudal vertebra Ca1 to Ca3 present, on the 30th day, the ossification of its bodies, Ca4 to Ca15 with 33 days, Ca16 to Ca33 with 39 days, Ca34 to Ca37 with 45 days and Ca38 to Ca39 with 48 days (Ca1-Ca3>Ca4-Ca15>Ca16-Ca33>Ca34-Ca37>Ca38=Ca39). The hemal process has its ossification in Ca2 to Ca8 with 48 days, in Ca9 to Ca24 in 52 days, in Ca25 to Ca31 with 57 days (Ca2-Ca8>Ca9-Ca24>Ca25-Ca31). The transversal processes begin to form the bones with 48 days and the articular processes with 54 days, period in which the vertebral arches are already formed.

Theme: Reptiles, Crocodilians, Morphology

Type of Presentation: poster

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Comparative Study of Defense Behavior of the Snakes from Genus *Lampropeltis* with particular Reference to their Color Pattern as the potential factor influencing General Fitness.

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Conception of mimicry with the *Micrurus* snakes as a model mimicked by some harmless *Lampropeltis* species gained popularity based on the striking resemblance of their color patterns. Nevertheless it is still controversial and not proved satisfactory. Anyway if the mutation changing the snakes' appearance from so called cryptic into aposematic really influences the rate of survival it could change the intensity and direction of selection of some patterns of defense behavior. In the study presented we compared 21 types of defense reactions of newly hatched snakes (after first skin-shedding) of some species belonging to *Lampropeltis* genus, bearing both types of color. 18 litters (110 specimens together) were used for experiment. Each snake was tested twice within 48 h.

The snakes were confronted with Japanese quail *Coturnix japonica* as the predator model in Open Field Test, and their reactions noted served to construct the Nei dendrograms of behavioral distances. The dendrograms compared the material divided on the level (OTU) of litters, subspecies, and species and finally the aposematic and cryptic colors. One litter of hybrids between species of the two opposite groups i.e. *L. triangulum sinaloe* x *L. getula californiae* was included for comparison. All OTU criteria indicated genetical determination of general behavior patterns as related taxa mostly formed common clusters. Different colors formed different external nodes and hybrid litter remained in one clad with the cryptic colored group. The differences of detailed reactions were compared with the Chi square test of independence. The cryptic and hybrid forms showed more frequent active defense patterns like tail rattling, orientation towards threat, S-shape pose, feigning and real attack both at 0.6 and 0.1 m distance from the predator model. Tossing movements were noted at aposematic forms and only at 0.1 m distance from the threat. For all mentioned above $P \leq 0.001$. No differences were noted in retreat and rapid retreat reactions, which were noted only at 0.1 m distance. The passive reactions – immobility in presence of predator model was found only in aposematic forms. The results show that the aposematic mutation of color could be correlated with weakening of selection for defense behavior thus providing the evidence of its effectiveness for survival.

Theme: snakes, defense behavior, aposematic, cryptic colors, predator-prey

Type of Presentation: _oral

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Age Structure, Body Size, and Reproductive Output in *Leptodactylus latinasus* from Northeast Argentina

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Skeletochronology, counting the number of lines of arrested growth (LAGs) in cross-sections of phalanges obtained by toe-clipping, has become a widely used tool for age estimates in amphibians. We used skeletochronological methods to describe the age structure of a *Leptodactylus latinasus* population from northeast Argentina (Corrientes province, 27°25'51.10"S, 58°44'42.50"W). We also analyzed the body size and age implications for reproductive traits (clutch weight, ovum size and clutch size; CW, OS and CS, hereafter). We captured a total of 51 *L. latinasus* (Male: n = 34, Female: n = 17) from spring 2007 to autumn 2008. We were able to determine the age in 12 out of 34 males and 12 out of 17 females captured. The minimum and maximum ages found were 1 and 3, respectively. We did not find a difference in mean age between the sexes (t-test = 1.82, df = 22, P = 0.082). Mean and SD of LAGs and phalangeal perimeter in microns were: LAG1 = 118 ± 16.3 n = 8; LAG2 = 176 ± 31.6 n = 3; LAG3 = 182 n = 1; PER = 193.6 ± 40.8 n = 24. There was no significant effect of sex on body weight, SVL and hind limb length (Wilk's $\lambda = 0.867$, F_{3,42} = 2.129, P = 0.11), which demonstrates that there is no sexual dimorphism in this specie. Mean and SD of reproductive traits in 10 out of 17 females analyzed were: CW = $0.204 \text{ g} \pm 0.09$, OS = $1.19 \text{ mm} \pm 0.14$, CS = 224.3 ± 51.4 . CW showed a positive relationship with CS ($r^2 = 2.85$, P < 0.05, n = 10) and ES ($r^2 = 0.787$, P < 0.001, n = 10). We found no significant correlation between reproductive traits and body size or age in *L. latinasus* (minimum P value of all relationship analyzed = 0.201). To estimate the relative effect of age on reproductive traits, partial correlation was analyzed, which showed that age had no significant effect on reproductive traits.

Theme: Age, body size, reproductive traits, *Leptodactylus latinasus*

Type of Presentation: Poster

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The role of visual and olfactory cues in the social structuring of the endangered pygmy bluetongue lizard, *Tiliqua adelaidensis*

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The use of visual and olfactory cues are crucial in reptilian social structuring as it enables individuals to identify and mark territories and to recognise group members in social species or conspecifics in territorial species. Social structuring in reptiles can be either complex (lizards position influenced by other lizards) or simple (lizards position is independent of other lizards). For the conservation and management of endangered species, understanding the social system you are working with is crucial, especially for habitat enhancement, translocations, relocations and establishing captive breeding colonies. The pygmy bluetongue lizard, *Tiliqua adelaidensis* is an endangered scincid found exclusively in fragmented patches of native grasslands in the mid north of South Australia. These lizards rely solely on burrows constructed by mygalomorph and lycosid spiders for shelter. We investigated the role of visual and olfactory cues in pygmy bluetongue lizard social structuring. We found that pygmy bluetongues are highly aggressive towards other individuals and are capable of visually discriminating between conspecifics and both inanimate objects and different skink species. We also found that lizards could recognise olfactory cues and discriminate between the scents of conspecifics. We also found that they have a preferred scating area that is correlated with the position of a neighbouring lizard that may be used as a territory marker. Pygmy bluetongue lizards also display kin recognition, with juvenile lizards able to recognise and also prefer a burrow with there mothers scent over an unscented burrow or that of an unfamiliar adult. This study suggests that the pygmy bluetongue lizard has a complex social structure that should be considered in there future conservation and management.

Theme:lizards, ecology, behaviour, conservation biology, endangered species

Type of Presentation: Oral contributed

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A Spatial and Temporal History of the Geckos of the World

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Gekkotan lizards are one of the most diverse clades of squamates and constitute one of the most ecologically important groups of all nocturnal vertebrate insectivores. Gekkotan fossils are known from as early as the mid-Cretaceous and forms of possible gekkotan affinity existed in the Jurassic. Living gekkotans are divided into seven major clades, some corresponding to long-recognized groups (e.g., Eublepharidae, Pygopodidae), and others only recently identified, initially on the basis of molecular phylogenetics. The most diverse group, formerly regarded as the Gekkonidae sensu stricto, actually comprises three groups: two with trans-Atlantic distributions (Sphaerodactylidae and Phyllodactylidae), and one chiefly in the Old World tropics. Each of these groups is more than 100 million years old and the relationship of these clades collectively to the eyelid geckos (Eublepharidae) and the gekkotans of the southwest Pacific (Carphodactylidae, Diplodactylidae and Pygopodidae) may extend back a further 50 million years. Gekkotan innovations, such as the subdigital adhesive system and aspects of the visual system appeared early in the evolution of the

group and have evolved and been lost multiple times in the living lineages.

Theme: lizards, taxonomy, genetics, morphology, palaeontology

Type of Presentation: Oral (Plenary Lecture)

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Sensitivity of Amphibians to Landscape Alteration in Indigenous Reserves, Western Panama.

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Amphibians are sensitive to the alterations that are made to the natural landscape and their populations can be affected negatively. Our investigation analyzed this relationship to help understand the dynamics of amphibians in tropical ecosystems. The research was conducted in the Ngöbe Buglé Reserve in western Panama. We made a qualitative classification of the forest disturbance degree and quantitative analysis related to forest structure against presence of amphibians as indicators of ecosystem health. During 2001 we made three one month trips to the study area. The results reject the hypothesis that states that species richness and the number of individuals were distributed evenly across sites with different degrees of disturbance, thus we can say that the forest has preserved the largest number of species with respect to the other sites where the forest is more disturbed. The assemblage of frogs showed no relationship with the variables that describe the structure of the forest. However the relationship between the basal area and the richness of Eleutherodactylines and Centrolenids should be taken into account as a tool for evaluating the quality of habitat, because they might be a good indicator of the habitat disturbance. We recommend that highland areas should be protected, because they possess a large quantity of pristine forest and rare amphibians with restricted distribution, these should be areas of high priority for conservation since they are threatened by deforestation and other human disturbances. This research was conducted with the support of the German Society for Technical Cooperation (GTZ), to obtain a graduate degree in biology. It has not been published previously.

Theme: amphibians, anurans, conservation biology, community ecology

Type of Presentation: oral: symposium

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Lizards that Rock Together Stay Together: Impacts of Land Clearing on the Social Cunningham's Skink (*Egernia cunninghami*)

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To better understand impacts of habitat fragmentation on population persistence we assessed the effects of land clearing on dispersal and social structure in the rock-dwelling Cunningham's skink, *Egernia cunninghami*, which is distributed in south east Australia. Data from genetic markers (ten microsatellite loci) and mark recapture analysis show land clearing to be associated with reduced dispersal and increased group sizes of related adults. Despite higher adult relatedness within-groups there was no evidence that deforestation was associated with elevated inbreeding. We show that Cunningham's skink is monogamous across seasons, lives in stable, family-like groupings and avoids

close kin as breeding partners. Indeed, inbreeding avoidance is sufficiently strong that at our deforested sites high adult relatedness has restricted mate availability, reflected by a lower proportion of breeding adults. We are now investigating whether mate-choice is driven by a genetic cue, perhaps related to alleles present at the Major Histocompatibility Complex (MHC), a region of the genome coding for immune response and a region at which heterozygosity may confer fitness benefits. In addition, we will assess whether there has been any erosion of variation at MHC loci. We have a clue that this may be the case in deforested habitats as variation at microsatellite loci was lower than naturally vegetated areas. If our prediction that a different MHC type is important to mate choice and if lower MHC diversity is associated with habitat fragmentation, this may explain lower levels of reproductive success for Cunningham's skink in cleared habitats. Finally, loss of variation at MHC loci could result in a greater risk of disease. Molecular assays are being developed to detect the presence and abundance of pathogens (such as plasmodium and nematodes). In order to examine for any relationship between disease and diversity at MHC loci we will screen groups of Cunningham's skink for their pathogen load in both cleared and naturally vegetated environments.

Theme: lizards, conservation biology, genetics, reproduction, ecology

Type of Presentation: oral

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Ecology of the Rough-Skinned Gecko, *Cyrtopodion scabrum* (Sauria: Gekkonidae) in the Suez Canal zone, Egypt

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A study on the ecology of the Rough-Skinned Gecko, *Cyrtopodion scabrum* was carried out on both banks of the Suez Canal area, Egypt from January to December 2007. Activity of lizards varied significantly among seasons. Lizards were most active in autumn and least active in winter. Lizards generally commenced their activity immediately after complete darkness with largest number during the first three hours following sunset and displayed a unimodal pattern. Lizards were commonly seen in open dark, while some were found around artificial light and in daylight either just before sunset or after dawn. Lizards were very often encountered on brick fences and building walls and were occasionally venturing on the ground. During their activity time, lizards assumed different positions, horizontal, vertical, oblique and upside down. Lizards preyed upon a wide variety of food. The main food items eaten by lizards were Hymenoptera, Diptera and Orthoptera. The highest number of food categories was recorded in summer, whereas the lowest was in winter. Food types differed according to habitat type. Larger individuals ate larger prey. Females did not differ from males of the same size in food type or prey size. The reproductive season extended from March through August. The smallest gravid female containing oviductal eggs measured 34 mm SVL in May, while the smallest male with enlarged testes was 33 mm SVL in April. The testicular size and mass declined rapidly in August and reached their minimal. Growth rate of lizards differed between seasons and age groups. Juveniles increased in size more rapidly than adults and in spring and summer than in winter.

Theme: ecology, gecko, *cyrtopodion scabrum*, Suez Canal

Type of Presentation: Oral

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Incubation Temperature and Development of *Podocnemis expansa*

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In species that present temperature-dependent sex determination (TSD) the incubation environment can influence on behavior after hatching, affecting thermoregulation, nutritional status and locomotion performance. Adults of *Podocnemis expansa* (Giant Amazon River Turtle), a TSD species, show sexual dimorphism and females are larger and heavier than males. To evaluate the influence of incubation temperature on the first months of *P. expansa* development, the weight, carapace's length and width of 109 hatchlings with ages between 82 and 168 days were checked every 15 days during four months. On the 2007 reproductive season, 300 *P. expansa* eggs were collected from ten nests at the sandy beaches of Araguaia River, at Luiz Alves district, Goiás state, Brazil. The eggs were distributed in ten incubators with constant temperatures between 28 C and 37 C. To reduce the clutch effect every incubator received only three eggs of each nest. The length of the carapace increased about 3.72 mm/month, and the width about 2.99 mm/month. The weight increased about 3.39 g/month. The average length and weight of the hatchling shown a positive correlation within the age, but there is no significant differentiation in development rates (weight, carapace's length and width) that can be related to incubation temperature. Our results suggest that in the first months of life, male and female hatchlings of *P. expansa* presents the same development rate, and there is no influence on the sex in hatchling development that could favor a sex ratio bias males or females.

Theme: Turtles, *Podocnemis*, developmental biology

Type of Presentation: Poster

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Sexual Dimorphism in *Podocnemis expansa* Hatchlings

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To evaluate the existence of sexual dimorphism in hatchlings of *Podocnemis expansa* (Giant Amazon River Turtle) it was used the method of geometric morphometric. Three hundred *P. expansa* eggs, originating from ten nests at the sandy beaches of Javaés River, at Tocantins state, were distributed in ten incubators with constant temperatures between 28 C and 37 C. To reduce the clutch effect every incubator received only three eggs of each nest. The hatching success decreased to 10% on extreme temperatures and these hatchlings were not considerate in data analyses. The pivotal temperature for this population of *P. expansa* was calculated in 33.5 C. To the sexual dimorphism evaluation 30 landmarks were used on hatchlings' carapace. The landmarks used are the ones generated at the intersections of the vertebral and marginal scutes. The landmarks' superimposition indicated that sexual dimorphism in hatchlings of *P. expansa* does exist. In the anal region males was more compressed then females. Females present the landmarks at the center of the carapace more grouped than males. Therefore, females' carapaces are rounder than males'.

Theme: Turtles, *Podocnemis*, dimorphism, morphometry, pivotal temperature

Type of Presentation: Poster
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Growth of *Podocnemis expansa* and *Podocnemis unifilis* in captive conditions in Rodrigues Alves Botanical Garden, Pará, Brazil

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Studies of turtle growth in natural environments are limited, so studies in captivity are the main way to evaluate development. The Bosque Rodrigues Alves Botanical Garden is an important urban nature reserve with a total area of 150.000 m² that includes important native species of fauna and flora species from the Amazonian region. The reserve has 549 turtles of the following species: *Podocnemis expansa*, *P. unifilis*, *Rhinoclemmys punctulata*, *Kinosternon scorpioides*, *Peltocephalus dumerilianus*, *Mesoclemmys raniceps* and *Phrynops* sp. The turtles are maintained in an enclosure of 333,72 m² with three artificial beaches, a nursery and a lake. Turtles are fed on alternate days with a mixture of fruits, vegetables and dog food (45kg/2 days). The objective of this study was to monitor the growth of individual turtle species (weight and biometric measurements). Twenty-one individuals were measured and weighed in February 2005 and June 2008. The average annual growth rate for *P. expansa* was 98,89 g and 2,77 mm in straight carapace length (N=8), higher than for the other species studied. The mean annual growth for *P. unifilis* was 305,92 g and 13,44 mm (N=11), 6,06 g and 1,21 mm (N = 1) for *Rhinoclemmys punctulata* and 0,0 g and 0,61 mm (N = 1) for *Kinosternon scorpioides*, the lowest values recorded.

Theme: growth, *Podocnemis*, turtles, reptilia, amazonia
Type of Presentation: poster
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Unraveling the evolution of an extraordinarily diverse frog: the Colombian Payasita (*Oophaga histrionica*)

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Diversity among populations of a single species represents the minimum amount of evolution that can be detected and studied in nature. Therefore, geographically variable species offer unique models to test hypotheses on the role of stochastic and selective processes in the evolution of diversity. The dendrobatid frog *Oophaga histrionica* is treated here as a complex of 3-4 nominal species of poison frogs distributed along the pacific lowlands of Colombia and Ecuador. Its more remarkable trait is the extraordinary diversity of brilliant colouration patterns. Based on preliminary evidence, I develop here a conceptual model to derive hypotheses on the ecological and evolutionary mechanisms that might underlie diversification within the *histrionica* complex. Phylogeographic analyses reveal three well structured lineages that, however, have not yet attained reproductive isolation. At a large ecological scale, the species distribution appears to be restricted by elevation and rainfall. At a smaller scale, individuals of a single population are concentrated in patches apparently related to the availability of deposition sites for the larvae as well as on the light and thermal conditions that characterize forest gaps and borders. Divergence in colouration pattern and vocalisations partially tracks geography. Colouration pattern did not evolve as a whole, and some colouration elements,

such as contrast, remain relatively invariable among populations, which could explain why colouration may be “diverse” but may also maintain its aposematic function. However, learning assays indicate that chickens do not generalize the association between food distastefulness and one of the histrionica’s colouration pattern to other colouration patterns of the same species. Altogether, our data suggest that rapid evolution, driven perhaps by sexual selection should be tested as a selective force explaining the extraordinary diversity of this amazing frog.

Theme:Geographic variation, colouration, aposematism, phylogeography

Type of Presentation: Symposium 11: Dendrobatoid Frog Biology.

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Evolutionary correlates of bioacoustic diversity in the frog *Allobates femoralis*

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Anuran advertisement calls are easy to obtain and quantify behavioral traits that are pivotal in species recognition as well as reproductive isolation. Not surprisingly, the analysis of geographic divergence in anuran calls has been used with to solve both taxonomic and evolutionary questions. We have been studying the penencuici frog, *Allobates femoralis*, to compare call divergence in relation to other traits and to understand the evolutionary mechanisms behind it. Our research paradigm deals with the communication system as a whole and therefore includes both its sender (call) and receiver (call recognition) components. We have found that call divergence follows genetic divergence even at a large geographic scale, where complex biogeographic scenarios have been invoked to explain speciation. Moreover, we found redundant evidence that the communication system of *A. femoralis* did not evolve as a whole: call recognition mechanisms have diverged without concomitant variation in call traits. The uncoupled divergence may be partially caused by masking interference by other co-occurring species, as suggested by studies on geographic variation and on the structure of an acoustic community. Nonetheless, our data also indicate that some elements of the call may diverge among populations without concomitant variation in the call recognition mechanisms. Although we do not have a reasonable explanation for the latter pattern, it points out important caveats on the use of calls as taxonomic characters and, on the other hand, confirms the value of the anuran communication system as a research model in evolutionary biology.

Theme:bioacoustics, geographic variation, frogs, behaviour

Type of Presentation: oral, Symposium 3: Sensory Ecology of Anuran Communication

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Forest Succession Since Herpetofaunal Perspective

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In some areas of the tropics forests are recovering on abandoned cattle pastures. We studied herpetofaunal community changes during forest succession after pasture abandonment in Puerto Rico. Twelve sites were selected in a submontane area (100 to 200 masl) to represent four forest

recovery stages; pasture stage and young (1-5 yr after abandonment), middle (10-20 yr), and advanced (>40 yr) forest stages. Forest structure, microclimate, and herpetofaunal community structure were characterized. Total forest height increased during succession, new strata of vegetation appeared in the understory, and the forest gained more vertical complexity. Microclimatic conditions changed during recovery, and these changes were associated with changes in the physiognomy and structure of the vegetation. During one year 7,991 individual reptiles and anurans were observed. Almost 60% were of reptiles. Thirteen species of reptiles and six of anurans were identified. Reptile richness increased from means of 5 to 7 per stage after 20 years of abandonment, while anuran species richness appeared to remain unchanged during forest succession (mean = 3 species per stage). In pastures, species associated with herbs dominated (*Anolis pulchellus* and *Eleutherodactylus antillensis*). With forest recovery, species associated with shrubs and arboreal species became more important (*A. cristatellus* and *E. coqui*). Reptile and anuran density increased from pasture to advanced forest stages (reptiles: 7,000 to 19,500; anurans: 4,200 to 12,400 individual/ha). Density generally decreased during the drier months and increased in humid months. For reptiles, seasonal changes were more dramatic in younger forest patches (<5 year after abandonment), while anurans seemed to show high reproduction after dry months in forest >20 years after abandonment. Our study showed that herpetofaunal community structure changes can be associated with changes in habitat structure during forest succession on abandoned pastures in Puerto Rico. We propose that secondary forests will play an important role in the reestablishment and regeneration of the tropical forest herpetofauna and may be an important resource to maintain regional biodiversity.

Theme:Anurans, chronosequence, conservation, forest succession, pastures, reptiles

Type of Presentation: Oral Presentation

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Morphologic and cytochemical aspects of blood cells from hatchlings of Amazonian giant turtle, *Podocnemis expansa*

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The giant Amazon River turtle, *Podocnemis expansa* presents wide distribution in the Amazon basin and is considered to be the largest freshwater chelonian of South America. This species has been suffering depredations for decades, due to its high economic interest for meat and eggs that are important food sources for riverine Amazonian populations. This high pressure on the natural stocks of the giant Amazon turtle, only attenuated in protected areas, placed it protected by federal and international (IUCN) laws. The aim of the present work was to describe the red blood cells morphology and the cytochemical reactions in the newly hatched babies from *P. expansa*. At the

Abufari Biological Reserve, located in the lower Purus river, Amazon, Brazil, eight newly hatched specimens from *P. expansa* were collected. Heparinized insulin syringes were used to withdraw blood samples from each animal by puncturing the femoral vein. Blood smears were stained with May Grünwald-Giemsa-Wright (MGGW) for morphological characterization and others to cytochemical staining. The periodic acid Schiff/PAS method was performed to glycogen demonstration, and the peroxidase was determined by the ortho-toluidine method in the presence of hydrogen peroxide. To the metachromatic reaction, blood smears were fixed in methanol and stained with toluidine blue and the Sudan black B method to stain lipids. To identify total protein, the blood smears were fixed in formalin steam and stained with Bromophenol blue. For reticulocytes identification, brilliant cresyl blue were mixed with blood in solution (1:1) and stained with Romanowsky staining. The following cells have been identified in the blood of *P. expansa*: thrombocytes, lymphocytes, azurophils, heterophils, eosinophils and basophils with morphologic features similar to those described in the literature for *P. expansa* and other turtles species. PAS Reactions were observed in these cells, except to lymphocytes. In the peroxidase reaction, the eosinophils were positively marked, while azurophils and heterophils were weakly positively marked. The metacromasia reaction was observed only in basophils. The Sudan reaction was observed in heterophils and eosinophils. The identification of proteins by the general method of bromophenol blue occurred in azurophils, heterophils and eosinophils. The reticulocytes (immature red blood cells) showed dark structures constituting a network of basophilic material that indicate the presence of ribonucleoproteins. This work suggests that the cytochemical staining methods are important to help solving problems of leukocytes identification in turtles as well as provide relevant information about the functions of these cells in this important Amazonian freshwater turtle.

Theme: Amazon turtle, blood cells, cytochemistry, physiology, leucocytes, thrombocytes

Type of Presentation: poster

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Effect of used engine oil on predation relations in Amazonian primary terra-firme forest ponds and streams

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We evaluated the effect of contamination with used engine oil on predation behavior and efficiency among inhabitants of small ponds and streams of central Amazonian terra-firme rainforest. We performed experiments using the tadpoles of nine anurans (*Rhinella granulosa*, *R. marina*, *Hypsiboas geographicus*, *Osteocephalus taurinus*, *Phyllomedusa bicolor*, *P. tarsius*, *P. vaillanti*, *Scinax ruber* and *Leptodactylus knudseni*) that breed in forest ponds, and dragonfly larvae of the genus *Gynacantha* and two fish species (*Rivulus compressus* and *Pyrrhulina brevis*), known to be efficient tadpole predators. The effect of contamination on prey selection was evaluated through prey choice tests in aquariums with 10cm water columns. Treatment levels were determined from results of preliminary CL-50 tests on all species, and were 1.3 and 2.5ml used engine oil per liter of water. One test consisted of five tadpoles (each belonging to a different species) exposed to one fish or one dragonfly larva during one hour. We recorded number and species order of tadpoles predated, time to first attack and total number of attacks on tadpoles. From 1-5 tests were performed per treatment level and control with each of 5-15 predators per species. No tadpole of *Phyllomedusa bicolor*, which is unpalatable to fish, was predated upon by control fish, but they were attacked and killed by contaminated fishes, suggesting that their chemical perception capacity was altered by the contaminant. For *Pyrrhulina brevis* time to first attack was significantly higher in contaminated than in control fishes, indicating that perception and/or reaction capacity of predators was hampered by contamination. For dragonfly larvae no difference was observed among treatment and control. The

effect of contamination on predation rate was assessed through tests in which 5-10 tadpoles of each of five species were exposed to one predator in a simulated pond (a 20-liter plastic container with leaf-litter on the bottom). We used a contamination level of 1ml/l and a control, and 6 replicates per treatment and predator species. Exposure times varied from 1-5 days, depending on average predation rate of each predator species. We recorded the number of tadpoles of each species alive and the number of tadpoles found dead at the end of the exposure time. Only in the contaminated containers we found dead tadpoles, indicating that tadpoles died from contamination besides predation. Generally, less tadpoles were alive in contaminated than in control replicas, indicating that, in a structured environment, escape tactics of contaminated tadpoles were less efficient.

Theme: ecotoxicology, anurans, tadpoles, fishes, dragonfly larvae, predation

Type of Presentation: Poster

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Chromosome characterization of nine Ecuadorian poison frogs from *Epipedobates* and *Hyloxalus* genera (ANURA: Dendrobatidae)

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Cytogenetic studies of dendrobatids have been carried out in order to understand their chromosome evolution, and also as a complementary data to elucidate taxonomic problems. In the present study, we have characterized the mitotic chromosomes of nine Ecuadorian dendrobatid species (*Epipedobates anthonyi*, *E. tricolor*, *E. machalilla*, *E. boulengeri*, *E. sp. F*, *Hyloxalus awa*, *H. bocagei*, *H. infragutatus*, and *H. sp. nov.*) using conventional cytogenetic techniques. The results showed the diploid number of 24 for all species. According to the chromosome relative lengths, two well-defined groups of chromosomes were observed in all karyotypes. Despite the conservative chromosome number, morphological differences were detected between the two genera and even between species. *Epipedobates* species have interspecific morphological variations in the large and small groups of chromosomes, whereas *Hyloxalus* karyotypes were very similar to each other in morphology. In addition, we registered a chromosome polymorphism within the *E. machalilla* population, which presents a relative length heteromorphism in the telocentric pair 11 with 3 well-defined clusters. This chromosomal heteromorphism is not related to sex, though it might be related to events of chromosomal mutation by effect of potential endogamy. The NOR site in *Epipedobates* was located in pair 5 with the exception of *E. anthonyi* that showed this band on the 12th pair. On the other hand, in the analyzed species of *Hyloxalus*, C-Banding detected consistent blocks of constitutive heterochromatin in centromeric regions, telomeric, and interstitial segments for all karyotypes. Despite the similar chromosome morphology, the C-Banding pattern was species-specific. These results suggest that these four species may be closely related and genetic changes could have affected the population triggering speciation processes. Additionally, we mapped in the molecular dendrobatid phylogeny of Santos et al. (2003, unpublished data) the diploid chromosome number of all species karyotyped until now. Apparently, numeral rearrangements have taken place during the evolution of the group showing that the karyotypic trend of the family Dendrobatidae is the chromosome number reduction from $2N=24$ to $2N=18$.

Theme: Cytogenetics, amphibians, anurans, Dendrobatidae, Ecuador, *Epipedobates*, *Hyloxalus*, chromosomes.

Type of Presentation: Poster

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Late Pleistocene Species Richness of Terrestrial Turtles in the Ryukyu Archipelago, Japan, with its Biogeographic Implications

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Present terrestrial turtle fauna of the Ryukyu Archipelago, a chain of continental islands delimited by the Tokara Tectonic Strait and the Yonaguni Strait, consists only of three geoemydid species, *Cuora flavomarginata evelynae*, *Geoemyda japonica*, and *Mauremys mutica kami*. Of these, *G. japonica* is endemic to the Central Ryukyus, whereas the other two are endemic southern Ryukyu subspecies having conspecific populations in Taiwan and southeastern continent. From the Late Pleistocene fissure-fillings and cave deposits on several islands of the Central and the Southern Ryukyus, five extinct chelonians consisting of four geoemydids (*Cuora* sp., *G. amamiensis*, *Mauremys* sp., and a species obviously different from the other extant and extinct Ryukyu geoemydids) and one testudinid (*Manouria oyamai*) have recently been found together with fossils of two of the three extant species (*C. flavomarginata* and *G. japonica*). These indicate that the turtle fauna of the Ryukyus was a few times richer in the Late Pleistocene than at the present and that many of the components of the former went extinct around the end of the Pleistocene, presumably as a result of human impact, or rapid climatic change, or both. Distributional patterns of the extinct turtles largely follow the currently prevailing geohistorical scenario of the Ryukyu Archipelago, which has been hypothesized on the basis of distributional patterns in extant non-volant terrestrial vertebrates: initial isolation of the Central Ryukyus from the surrounding landmasses in as early as the Late Miocene, followed by isolation of the Southern Ryukyus from Taiwan and the continent in the Middle Pleistocene. Nevertheless, distributions of endemic extinct *Mauremys* sp. of the Miyakojima Island in the northeastern part of the Southern Ryukyus and of *Manouria oyamai* from several islands of the Central and Southern Ryukyus are incongruent with the currently prevailing scenario, because Miyakojima Island is generally considered to have emerged in no earlier than the Middle Pleistocene, and the gap separating the Central Ryukyus from the Southern Ryukyus has supposedly been interrupting dispersals of terrestrial organisms since the Late Miocene (see above). These two extinct species require additional ad hoc hypotheses or drastic modification of the currently prevailing paleogeographical scenario of the Ryukyus.

Theme:reptiles, turtles, taxonomy, palaeontology.

Type of Presentation: oral: _ contributed

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Antipredator tactics of an Asian colubrid, *Rhabdophis tigrinus*, a snake armed with a peculiar chemical organ

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Rhabdophis tigrinus, an Asian natricine species, is one of the common terrestrial, diurnal snakes in Japan. This snake predominantly feeds on amphibians, including toads, which are usually avoided by predatory animals because of their toxic skin secretions. *Rhabdophis tigrinus* possesses unusual glands, called nuchal glands, on the dorsal surface of its neck. These glands are completely independent of the oral glands of venomous elapid and viperid snakes and Duvernoy's glands of colubrids both ontogenetically and evolutionarily. The nuchal glands typically contain cardiotoxic steroidal toxins known as bufadienolides, which are ultimately obtained from toads consumed as prey, and have been considered to have a defensive function. We investigated antipredator responses of the snake under several different conditions to examine the repertoire of antipredator behavior and determine the factors that affect antipredator responses. We then compared antipredator responses of 27 taxa of natricine snakes, both with and without nuchal glands, to examine the functional association between the nuchal glands and antipredator responses. A total of 17 types of antipredator responses were recognized in *R. tigrinus*. Among them three displays, neck arch, neck butt, and dorsal-facing posture, which often accompany neck flatten and head elevation, were unique responses hitherto undescribed in other snakes. These peculiar responses were often induced when tactile stimulus was applied, and these were more often exhibited at lower temperature, when a simple flight response may not be so effective. Among the 27 natricine taxa neck arch, neck butt, and dorsal-facing posture were exhibited only in species that have nuchal glands. Thus, these three behaviors were considered to be antipredator displays associated with the deterrent effects of the nuchal gland compounds. Interestingly, *R. tigrinus* from a toad-free island (Kinkasan), which lack bufadienolides in their nuchal glands, exhibited these nuchal glands-related displays less frequently and mostly depended on simple flight. To examine whether diet affects antipredator responses of the snake, we reared hatchling snakes with or without feeding toads for three months, and subsequent antipredator responses were compared. Snakes that had been fed toads tended to exhibit neck arch more frequently than those that had not been fed toads. It is concluded that *R. tigrinus* is a unique terrestrial vertebrate equipped with an evolutionary innovated defensive organ, nuchal glands, which has chemically, morphologically, and behaviorally integrated mechanisms.

Theme: snakes, behaviour

Type of Presentation: oral, symposium 13: Sequestered Defensive Compounds and Other Defensive Tactics in Tetrapod Vertebrates.

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Genetic Divergence And Evolutionary Relationships In Six Species Of Genera *Hoplobatrachus* And *Euphlyctis* (Amphibia: Anura) From Bangladesh And Other Asian Countries Revealed By Mitochondrial Gene Sequences

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To elucidate the species composition, genetic divergence, evolutionary relationships and divergence time of *Hoplobatrachus* (*H. tigrinus*, *H. chinensis*, *H. crassus* and *H. occipitalis*) and *Euphlyctis* (*E. cyanophlyctis* and *E. hexadactylus*) frogs (subfamily Dicroglossinae, family Ranidae) in Bangladesh and other Asian countries, we analyzed combined 1544 bp of mitochondrial Cyt b, 12S and 16S rRNA genes of 252 specimens. Our phylogenetic analyses showed 13 major clades corresponding to several cryptic species as well as to nominal species in the two genera. The results suggested monophyly of Asian *Hoplobatrachus* species, but the position of African *H. occipitalis* was not

clarified. The interpopulation sequence divergence was high between Bangladesh and India *H. tigerinus* than intrapopulations divergence. Similarly, *H. chinensis* from Phang Nga, Thailand was highly diverged from other *H. chinensis* from Thailand, Vietnam and Laos. Nucleotide divergence and phylogenetic data suggested the presence of allopatric cryptic species allied to *E. hexadactylus* in Sundarban, Bangladesh and several parapatric cryptic species in the Western Ghats, India. The presence of at least two allopatric cryptic species among diverged *E. cyanophlyctis* in Bangladesh, India and Sri Lanka was also suggested. In some cases, our estimated divergence times matched the paleogeological events of South and Southeast Asian regions that may have led to the divergence of *Hoplobatrachus* and *Euphlyctis* taxa. Especially, Land formation at Bangladesh (15-10 Ma) may have allowed the spread of these frog taxa to Southeast Asian areas, and the aridification of central India (5.1-1.6 Ma) might have affected the gene flow of widely distributed species. The present study revealed prior underestimation of the richness of the amphibian fauna in this region, indicating the possible occurrence of many cryptic species among these groups. However, further studies with intensive sampling are needed for more clarification of taxonomic status and evolutionary process of *Hoplobatrachus* and *Euphlyctis* taxa.

Theme:Amphibians

Type of Presentation: Oral presentation

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Sequestered Defensive Toxins in Tetrapod Vertebrates: Principles, Patterns, and Prospects for Future Studies

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Chemical defenses are widespread among animals, and the compounds involved may be synthesized from nontoxic precursors or sequestered from an environmental source. Sequestration has been studied extensively among invertebrates, especially phytophagous insects and certain marine taxa. Few examples are documented among tetrapod vertebrates, but the number has been increasing due to recent findings involving amphibians and reptiles (including birds). The best-known cases involve poison frogs, which include at least four independent lineages that sequester alkaloidal toxins from invertebrate prey. Additional examples include snakes that sequester toxins from amphibians. Some commonalities observed among species that are known or suspected of sequestration include the combination of consuming toxic prey and exhibiting some form of passive defense, such as aposematism, mimicry, or letisimulation. Some species may be described as exhibiting passive sequestration, in which toxins accumulate rapidly following a meal and require an extended period of time to clear from the tissues, temporarily rendering the predator's tissues toxic. Such passive sequestration resembles bioaccumulation of certain harmful environmental toxins, but is distinguished by the defensive benefit afforded the predator. The accumulation of microbial tetrodotoxin by certain tetraodontiform fishes may represent an analogous case in marine vertebrates. In contrast to such passive sequestration, other tetrapods exhibit specializations that presumably evolved under selection to enhance the sequestration of dietary toxins, notably the presence of novel or hypertrophied storage or delivery systems. For such species, the processes of uptake, transport, modification and storage of toxins largely remain unaddressed. Similarly, the mechanisms by which sequestering taxa tolerate prey toxins require further study. It remains uncertain whether the sequestered toxins of tetrapods bioaccumulate across multiple trophic levels – that is, whether predators sequester toxins that have, in turn, been sequestered by their prey. Such multitrophic accumulation seems especially likely in

cases involving the consumption of phytophagous or mycophagous invertebrate prey and the consumption of poison frogs by snakes. Recognition of additional examples of defensive toxin sequestration in amphibians and reptiles are likely to result from collaborations between field biologists and natural product chemists, which have been so productive in recent years. Candidate taxa for future investigation include specialized predators on social insects, slugs, and toxic amphibians. Similarly, comprehensive studies of the ecology, behavior, and regulatory aspects of sequestration will require broadly integrative studies by teams of ecologists, ethologists, physiologists, molecular biologists, and chemists.

Theme:amphibians, anurans, salamanders, reptiles, snakes, lizards, ecology, predator-prey

Type of Presentation: Oral: Symposium 13: Sequestered Defensive Compounds and Other Defensive Tactics in Tetrapod Vertebrates.

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Translocation as a Management Technique for the Puerto Rican Boa (*Epicrates inornatus*)

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The relocation of animals is perceived by home and business owners and the general public as a humanitarian way of dealing with the problems associated with natural habitat loss. However, surveys suggest that most translocation programs have a high probability of failure with respect to establishing self-sustaining populations. In Puerto Rico the relocation of Puerto Rican boas is an increasingly common wildlife management strategy in the island. However, no studies have addressed the effects of relocation on the snake, nor its effectiveness as a management technique. Due to the prominence of relocation programs as a management strategy, we compare spatial ecology and survivorship of resident adult *E. inornatus* with those of non-resident adult *E. inornatus*. The sample included 6 resident snakes (five females, one male) and 10 non-resident (relocated) snakes (five females, five males). Transmitter equipped snakes were located 1 to 3 times per week. Locations of the snakes were flagged, activity of the snake at the time of observation (basking, moving, eating, denning in cavity or burrow) substrate (cavity, rock, under litter, etc.), habitat type (hilltop, sinkhole, hillside, etc.), date and time were recorded at each location. Resident *E. inornatus* were active $44 \pm 13\%$ of the times when located. Relocated individuals were active $64 \pm 21\%$ of the times located. Home range locations overlapped extensively among individual resident and relocated *E. inornatus*. Average home ranges for resident snakes were 8 ha and varied from 2.9 ha to 23 ha. Relocated individuals showed an average home range of 16 ha, with values that ranged from 2.23 ha to 30 ha. Most of the mortality on *E. inornatus* is due to humans. That's why other considerations have to be considering before implementing a relocation program. Relocated individuals sometimes can harbor diseases to which the resident population is not resistant and the impact could be disastrous. Information on the population numbers of resident snakes and habitat availability has to be considered. Also genetic composition of the population and of the relocated individuals needs to be studied to determine possible impacts on the genetic composition of the species. Relocation of this species cannot be recommended as a standard conservation practice because of its long-term negative impacts.

Theme:tropical snakes, boas, management, relocation, translocation, snake conservation

Type of Presentation: ORAL symposium Herpetofaunal Reintroductions, Translocations, and

Malformations In Mannophryne Collaris And Mannophryne Cordilleriana (Anura: Aromobatidae) In The Venezuelan Andes.

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Mannophryne collaris and Mannophryne cordilleriana are two frog species endemic to the Venezuelan Andes. During the last two decades, their populations have progressively declined. According to the IUCN, M. collaris is endangered (EN) and M. cordilleriana vulnerable (VU). Habitat loss and degradation, high levels of pollution and the presence of pathogens are possible causes for these declines. Previous studies suggested that malformations are not rare in these two frog species. In amphibians, malformations are often the result of environmental stress during development. Thus, their occurrence may be indicative of low survival. To determine the incidence of malformations in M. collaris and M. cordilleriana we examined 254 museum specimens of M. collaris and 16 field specimens of M. cordilleriana. Amelias, limb asymmetries, brachydactyly, and digit fusions in back limbs were observed in both species. The incidence of malformations was 7.8% for M. collaris and 12.5% for M. cordilleriana specimens. Previous evidence suggests that certain toxic pesticides and fertilizers have negative effects over amphibian populations by generating corporal injuries and deformities in individuals that develop in perturbed habitats. The high levels of solid waste deposition in the locations where these specimens were collected suggested pollution as the most likely cause for these malformations. The high incidence of malformations suggests that Mannophryne species may be particularly sensitive to pollution. Thus, identifying areas of overlap between the distribution of Mannophryne species and human activities will be fundamental for the conservation of this species.

Theme:Anurans, Endangered species, Malformations, Mannophryne, Venezuelan Andes.

Type of Presentation: Poster

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Educational actions involving community for the sustainable management of turtles in Amazon Basin (Brazil): Projeto "Pé-de-Pincha".

Aldeniza Cardoso de Lima; Paulo César Machado Andrade; Rosilene Gomes da Silva Ferreira, Nely Mara Vinhote, Paulo Luis Ferreira

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The project "Pé-de-Pincha", initiated in 1999 by Federal University of Amazonas (UFAM) in partnership with IBAMA (Brazilian Environmental Institute) and local governments of Parintins, Barreirinha, Terra Santa and Oriximiná cities (distributed in Amazonas and Pará states, in Brazilian

Amazon), has developed actions related to the conservation of natural resources together with environmental educational activities. Eating turtles is a common practice in these communities, which accelerated the decline in the amount of individuals of many species from this group (e.g., *Podocnemis unifilis*, *P. expansa*, *P. sextuberculata*). The perception of this problem by the affected communities encouraged the search for viable solutions from technical groups, providing space for the development of environmental education and management for conservation of turtles, within a context of sustainable development. Since the implementation of the project, thousands of turtle eggs were transferred out for incubation areas prepared to protect them from hunters and predators, and later released in their areas of origin. This strategy, part of the field activities of environmental education carried out in partnership with indigenous people and their communities, involved them in a practical way on the issue of environmental conservation from a local problem. One trained also 361 teachers in environmental education, together with 101 environmental voluntary agents coming from communities. During the project 421 activities of environmental education (courses, lectures, artistic presentations, films, puppets and games) were carried out. These activities involved 25,209 people from these communities. Results show, in principle, that addressing the environmental issue with the involvement of community had a major impact in reducing the problem originally proposed, because the people involved started to value the environment in general from an immediate problem, which resulted in concrete actions for improving the quality of life in the communities involved.

Theme: sustainable development; environmental education; conservation of natural resources; community participation.

Type of Presentation: Poster

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Linking thermal biology, reproduction and conservation: cool-climate reptiles from southern New Zealand

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The Otago region of the southern South Island of New Zealand (c. 45°S) retains a diverse reptile fauna for a mainland site; however, many lizard species are threatened, one is locally extinct, and the oviparous rhynchocephalian tuatara (*Sphenodon*) disappeared locally a few hundred years ago. Recent evidence shows that gestational temperature affects offspring phenotypes among viviparous lizards elsewhere (including possible temperature-dependent sex determination, TSD), and confirms the existence of TSD in tuatara. Given this background, we are exploring the influence of temperature during embryonic development on offspring phenotypes for Otago reptiles. Our research has implications for conservation management, including captive breeding, species reintroductions, and impacts of climate change, as illustrated with the following projects. (1) Does basking opportunity during gestation influence offspring phenotypes in two viviparous lizards? McCann's skink (*Oligosoma maccanni*) is a non-threatened surrogate for two endangered species of *Oligosoma*. The Otago form of common gecko (*Hoplodactylus* aff. *maculatus* "Otago") represents long-lived, viviparous geckos; preliminary evidence from laboratory gestations already suggests a maternal influence on sex in this species (A. Cree, M. R. Preest and J. Rock, unpubl.). Ultimately we aim to establish whether offspring sex, morphology and performance measures are affected by exposure to gestational temperatures above, at, or below field exposure to preferred body temperatures in these species. Progress towards these goals includes development of thermal regimes supporting successful pregnancies, and exploration of techniques for non-lethal identification of offspring sex (hemipenes are not sexually dimorphic in neonates). (2) Will low soil temperatures in southern climates limit the reintroduction of tuatara (specifically, the production of males) using Cook Strait stock? TSD exists in *S. punctatus* from Cook Strait islands (females from cool nests, males from warm). Proposals exist

to reintroduce tuatara to eco-sanctuaries ≥ 800 km south of their current distribution. We measured soil temperatures from coastal and central sites in Otago to predict hatchling sex. The results suggest that some coastal sites may struggle to produce males without additional management, whereas inland sites, with warmer summers, can potentially produce both sexes. In a global-warming context, cool southern regions of New Zealand may become increasingly important for tuatara even if some sites would currently produce only females. Collectively, these projects demonstrate ways in which research exploring thermal effects on reproduction may benefit future conservation management of both viviparous and oviparous species.

Theme: lizards, sphenodonts, reproduction, physiology, conservation biology, captive breeding

Type of Presentation: Oral, Symposium 1: Reproduction in reptiles: from genes to ecology

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Diversity and Distribution of the New Guinea Herpetofauna

Allen Allison and Fred Kraus

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New Guinea, the world's largest and highest tropical island, has a rich herpetofauna that includes 657 currently recognized species, of which 492 (75%) are endemic. Frogs reach their highest species richness in the central mountains and north coast ranges (accreted terranes). Lizard richness is also highest on the north coast. Snakes reach their highest concentration in savanna regions of the south coast where 2/3 of the species are shared with Australia. The south coast of New Guinea also has the island's highest number of turtle species. Species richness, or alpha diversity, at individual lowland sites ranges from ca. 62 to 103 ($N=7$) and typically consists of about 25-30 frogs, 30 lizards, and 10-15 snakes. Coastal areas also generally have one or two species of crocodiles and at least one species of freshwater turtle (up to nine on the south coast). Lizard alpha diversity is generally similar to that reported for lowland wet forest sites in the Amazon (Da Silva and Sites, 1995) or Borneo (Das, 2007), but snake and frog diversity is much lower in New Guinea than for these other regions, where individual sites generally have more than 70 species of snakes and at least 55 species of frogs. However, beta diversity, appears to be far higher in New Guinea than in the Amazon or Borneo, at least for frogs and lizards. On average the lizards at lowland sites in New Guinea comprise only about 25% of the entire island's lowland lizard fauna, whereas individual sites in the Amazon, which are scattered across a far larger land area than New Guinea, have around 50% of all Amazonian lizards. The situation is similar in Borneo. New Guinea, which is slightly larger than Borneo, has 315 species of frogs compared to 155 species for Borneo. The lowland frog assemblage reported by Das (2007) from Brunei includes about 40% of all Bornean frogs; sites in New Guinea generally have less than 10% of the island's anuran fauna. High beta diversity in New Guinea is related to the complex geological history of terrane accretion, accompanied by uplift and volcanism, at the boundary between the Pacific and Australian tectonic plates.

Theme: amphibians, anurans, reptiles, natural history, taxonomy, community ecology, biogeography

Type of Presentation: oral; Symposium 9: Biogeography of the South and South East Asian Herpetofauna.

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Egg Incubation on the Rocks

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Effects of incubation conditions on reptilian eggs and embryos have been thoroughly studied. Most studies are performed in the laboratory, and usually incubation temperatures provided are constant. Recently, the importance of fluctuations in incubation temperatures on the performance of hatchlings was stressed. Studies of squamate nests in nature showed that deep nests often justify the constant temperatures often used in laboratory studies. However, temperatures in shallow nests and of exposed eggs fluctuate daily. We studied nesting sites of the gecko *Ptyodactylus guttatus* in the Negev Desert during two summers. *P. guttatus* attach their eggs to the ceiling of small natural caves. We followed 20 egg clutches and recorded their state once a week, till hatching. Air and rock temperatures were monitored with data loggers on hourly basis in caves with and without eggs. In 2004 eggs were laid between 14.6-17.7. In 2005, in which average temperatures were significantly lower by 1.2 degrees, fewer eggs were laid and they were laid about a month later than in 2004. Temperatures fluctuated daily with an amplitude of about 10 degrees C around an average of 31 degrees C. Rock temperatures were within 2 degrees C or less from air temperatures, and were higher than the air mainly during afternoon hours. The average volume of the caves was 4 m³, but cave volume ranged between 0.03-9 m³. Geckos preferred to lay eggs in large caves over small ones, even though temperature regimes were not significantly different. Possibly, small caves enable predators an easier access to the eggs. Eggs hatched between 33-79 days after they were laid. Later clutches tended to hatch after a shorter time. Incubation time was shorter in caves facing south compared to caves facing south-east (50.6 and 69.5 days, respectively, $p=0.003$); nevertheless, the average temperature did not differ between the two cave types. The substantial variation in egg laying date and in incubation time we found could not be explained by temperature differences. Geckos that attach their eggs to rocks enable the study of incubation conditions in natural nest sites with minimal interference in the incubation process. This study emphasizes the importance of further laboratory and field studies of reptile egg incubation under variable temperatures.

Theme:reptiles, lizards, ecology, reproduction

Type of Presentation: Oral

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Seasonal behavioral and metabolic changes in a year-round reproductively active subtropical tree-frog (*Hypsiboas prasinus*)

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Some species of subtropical anurans maintain comparable levels of calling activity throughout the year, and therefore must preserve the capacity for muscle activity, despite changes of more than 10°C in mean temperature among seasons. This situation suggests metabolic compensation of skeletal muscle, although previous investigations on amphibians and lizards coincide in that metabolic acclimation is generally restricted to species from temperate climates. We hypothesize that a Brazilian subtropical tree-frog (*Hypsiboas prasinus*), reproductively active throughout the year at moderate elevations, maintains behavioral performance based on metabolic adjustments. Such

adjustments should be evident at different levels of organization. We studied the shifts of a number of variables that may indicate physiological compensation to seasonal temperature variation, namely calling rates; resting rates of oxygen consumption; organ masses; the activity of citrate synthase (CS), a key enzyme for oxygen-dependent respiration, in heart, liver, trunk and leg muscles. The study was performed on males of *H. prasinus* from the Serra do Japi (SP/Brazil - 46°52'W, 23°11'S), active during summer and winter. Both rates of oxygen consumption and activity of CS were measured at 25°C. Males of *H. prasinus* called at equivalent rates at both seasons ($F_{1,23} = 2.092$, $P = 0.162$), but they were 18% larger ($T_{2,24} = -3.88$, $P < 0.001$) and showed increased resting metabolic rates by 27% ($F_{1,23} = 5.674$, $P = 0.026$) during winter. Despite increased resting metabolic rates during winter, the activity of CS was respectively decreased in trunk muscles, heart, and liver by 18% ($F_{1,23} = 3.372$, $P = 0.079$), 50% ($F_{1,23} = 46.711$, $P < 0.0001$), and 75% ($F_{1,23} = 189.613$, $P < 0.0001$) during this season. This dramatic decrease in liver aerobic capacity during winter was partially compensated by a 38% larger organ mass during this season ($F_{1,23} = 13.911$, $P = 0.001$). In this way, *H. prasinus* show seasonal changes in several metabolic and morphometric variables. Winter phenotypic adjustments seems to be composed by both compensatory mechanisms to the decreased environmental temperature and a seasonally oriented aerobic depression of several organs. Additionally, the maintenance of calling rates throughout the year, along with the decreased activity of CS in both heart and trunk muscles during winter, suggests that *H. prasinus* maintain calling behavior during summer at sub maximal levels. FAPESP: PT-2003/01577-8.

Theme: anurans, behaviour, physiology

Type of Presentation: Poster

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Tadpoles' responses to an exotic and a native predator: to what are they responding?

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The American red crayfish, *Procambarus clarkii*, native to the USA and Mexico has been introduced worldwide, being nowadays the most important freshwater commercial crayfish in the world. During the 1970's, it spread from Spain into the Southwest of Portugal and has recently been proven a highly efficient predator of all anuran species existing in this area. When coping with predators, most amphibians are able to modify their morphology, behaviour and life history traits in order to increase their odds of survival. However, the fact that there are no native crayfish species in the SW of Portugal can be an indication that these amphibians probably lack or have inefficient anti predator defences against this exotic crayfish. Hence, in order to assess if amphibian larvae have already evolved morphological and behavioural anti predator responses towards this predator, and if they are similar to the responses to a native predator, laboratory experiments were run at CBA Field Station, in Grândola, SW Portugal. Tadpoles of *Discoglossus galganoi* and *Bufo bufo*, two species having different phenologies, were submitted to the chemical stimuli of either a crayfish or a dragonfly larva (native predator). In a second treatment, predators were fed or not fed with conspecific tadpoles. Throughout the experiment several traits were registered, such as tadpole morphology, weight and behaviour. Our data suggest that both amphibians are responding to the native predator, since they showed reduced growth and developmental rates in the presence of the fed dragonfly larvae. This often happens to animals living under predation risk and is a result of a reduction in their activity. However, this did not happen in the crayfish treatment, which indicates that apparently these amphibians have not developed effective defensive mechanisms against this introduced crayfish.

Theme:amphibians, anurans, ecology, behaviour, conservation biology, morphology, predator-prey
Type of Presentation: oral
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Geographical distribution of neotropical lizards *Enyalius* (Leiosauridae) in Brazilian biomes

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The occurrences and distribution patterns of species have a great importance when used in the management of strategic and wildlife conservation. The genus *Enyalius*, lizard inhabitants of the Brazilian forests, presents wide territorial distribution. However, new species have been recognized or reclassified recently, and new records of species have been reported in other places. At the moment, there are nine species recognized and one not described (in the present study). In this study, we showed the current geographical distribution of genus *Enyalius* in different Brazilian biomes. All data were obtained in the specific literature about the species considered, and also in some scientific collections. In all of the Brazilian regions there have been records of specimens in areas with some kind forest formations, with almost of them living in the domain of the Atlantic Forest biome. The species most widely distributed was *E. catenatus* between southern and northeastern Brazilian regions, whereas *E. erythroceneus* and *Enyalius* sp n. were limited to one place. Only *E. leechii* lives in the Amazonian Forest. The genus was also registered in fragmented forests of the Cerrado (*E. brasiliensis*, *E. bilineatus*, *E. catenatus* and *Enyalius* sp n) and of the Caatinga (*E. bibronii*, *E. catenatus*, *E. erythroceneus*, and *E. pictus*) biomes. The species presents different degrees of dependance with forest habitats. However, the link to these environments has been a striking feature to define *Enyalius* so far, as lizards are endemic to Brazilian forests.

Theme:Reptiles, lizards, ecology, natural history, taxonomy.
Type of Presentation: Poster_contributed
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Natural History of Stream Inhabitant Treefrog *Hypsiboas caipora* from Atlantic Forest, Brazil (Amphibia, Anura, Hylidae)

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We studied the natural history of *Hypsiboas caipora*, which inhabits the Atlantic Forest from highlands at Serra de Paranapiacaba, São Paulo, Brazil. The study was carried out in a monthly field study, from December 2003 to May 2006, at Pilar do Sul Municipality. We worked 118 nights and spent approximately 630 hours, with an average of 5:40 by night. We used transect sampling method with 200m at stream for recorded the individuals. The transect was marked apart 5m for mapping the individuals. We used natural marks for individual recognition and animal focal method for territorial and reproductive behaviour description. All recorded individuals were weighed and measured. We obtained records of 676 males, corresponding to 159 different individuals, and 13 records of 11 females. Adult males were registered calling in all months along the year, from the marginal vegetation of streams inside the forest. Continuous reproduction occurs throughout the year. Females moved to stream only in reproductive events and the egg-mass was deposited in the stream, where

the tadpoles develop. The end of the metamorphosis occurs synchronically in the wetter months (December and January). Recruitment of adult males at the reproductive site started in February and continued along the year. Temporal differences in recruitment seem related to distinct reproductive strategies. The population of adult males may include individuals from at least two different generations. Social communication in adults, besides the vocalizations, involves visual signaling in close range interactions, probably to facilitate the localization and to exhibit the behavioral condition of the emitter. Males call isolated, but more frequently aggregated under clearings. The operational sexual ratio was largely biased to males in the reproductive site, probably with direct effects on acquisition of females. Males attempt to establish a territory along the stream, but few males are successful. Territorial behavior comprises crescent escalated aggressiveness, eventually resulting in fights. In this fights, males used the prepollical spines to injury the opponent. Fights seem to be an ancestral condition in the clade formed by Bokermannohyla, Hypsiboas, Aplastodiscus. This is confirmed by the large quantities of adult males with scars on the dorsum (except Aplastodiscus) in analysis of specimens from scientific collection, could be mainly due to the fights. Moreover, the high levels of territoriality in adult males of *Hypsiboas caipora* must be due to the differences among individuals to obtain direct and indirect resources for reproduction, heterogeneously distributed in time and space.

Theme: amphibians, anurans, ecology, natural history, reproduction, behaviour,

Type of Presentation: _Poster_ contributed or __symposium, number of symposium__

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Diversity of Amphibians and Reptiles from the Pacific of Valle del Cauca, Colombia

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The moist tropical forest is an ecosystem characterized by its exuberance and for possessing one of the greatest plant and animal diversity in the world. In Colombia it is widely extended throughout the plains of the Amazons and the Pacific region (Chocó biogeography). This diversity and composition of animals presented in this type of ecosystem is unique and has a very high endemism. However, this biodiversity is in danger do to intense human intervention of the habitat. One of the most affected groups are the amphibians and reptiles, which in fact are highly vulnerable as a consequence of illegal animal trafficking, human consumption and their life characteristics. With the purpose of providing relevant information about the diversity of amphibians and reptiles associated with the moist tropical forest of the Colombian Pacific, many annual samplings (visual and auditory counts, manual captures) were done between the years 2003 and 2008 in five locations in the low zones in the Department of Valle del Cauca. The species richness of these two groups, in the five locations are composed of 78 species, 27 amphibian species belonging to seven families (Brachycephalidae, Bufonidae, Dendrobatidae, Caeciliidae, Centrolenidae, Plethodontidae, Ranidae) and 51 reptile species belonging to 15 families (Anguidae, Boidae, Corytophanidae, Colubridae, Elapidae, Emydidae, Geckonidae, Gymnophthalmidae, Hoplocercidae, Iguanidae, Kinosternidae, Polychrotidae, Teiidae, Tropidophiidae, Viperidae). The Brachycephalidae family was the most diverse of the amphibians with ten species, while the Colubridae family was the most diverse of the reptiles with 13 species. The presence of the Colombian wood turtle (*Rhinoclemmys melanosterna*), the Large-nosed Wood Turtle (*Rhinoclemmys nasuta*) and the brown wood turtle (*Rhinoclemmys annulata*) are highlighted considering that they are registered in the red book of reptiles of Colombia as a threat and the last two having insufficient data

Theme: reptiles, amphibians, Diversity, moist tropical forest ,

Type of Presentation: Poster

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Nocturnal habitat use of two sympatric species of *Anolis* in the medial basin of Barbas River Filandia, Quindio, Colombia

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The preference for a nocturnal habitat of two sympatric species of *Anolis* ^{Fig 1} *Anolis eulaemus* and *Anolis ventrimaculatus*, was established, in a locality of the Colombian Andes. Samplings were taken in 16 points, spread throughout three remnants of the landscape (continuous forest, forest patches and riparian forest) in the municipality of Filandia in the district of Quindío. For each individual found, the characteristics of the place where it slept were registered (perch type, perch location, diameter of the leaf and perch height). The two species of *Anolis* were mainly found in the continuous forest (74.4 %) showing a greater preference for this remnant of the landscape. *A. eulaemus* slept with a greater frequency in herbages (41,01%) while *A. ventrimaculatus* preferred to use ferns (36,18%); both species used the leaves more frequently than any other part of the plant. Significant differences were not detected in the preference of a particular perch height in any of the species, stratification according to sex and gender type was also not found. In the three remnants of landscape an overlapping of the spatial niche at the level of microhabitat sleeping use was detected for both species. However, because there was no major difference in the preference of nocturnal perches, and taking into account the great availability of these in the remnants, it is suggested that competition between both species of *Anolis* at the level of nocturnal habitat use does not exist.

Theme: *Anolis* lizards, Habitat use, Colombian Andes,

Type of Presentation: Oral

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Road kills rate of snakes in Central Andes of Colombia

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Roads cause direct effects and indirect effects on the fauna and natural ecosystems. In Colombia the studies are few on this aspect. In the present manuscript, we estimated the road kill rate of vertebrates, and we registered the species most susceptible to this factor of mortality in a seven kilometer road located in the municipality of Filandia, department of Quindío, Central Andes of Colombia. 127 vertebrates (115 snakes, 4 birds, 7 amphibious and one mammalian) were registered, dead on the road. Since the largest number of vertebrates found were serpents, we decided to focus on them. Snake roadkill rate was of 0.29 individual/day/Km (two snakes per day in the road segment monitored). There were no differences between sections of the highway or throughout the period of sampling in respect to the number of dead snakes. The species that exhibited greater mortality was the snake *Atractus werner* (72 registered individuals) followed by *Liophis epinephelus* (12 registered

individuals). The *Urotheca decipiens* (colubridae) was also found in this area, extending its reported geographical distribution. The ecological effects of roads depend on several biotic and abiotic characteristics of ecosystems. Thus, beginning to record roadkill rates in Colombia would offer the baseline data to optimize the implementation of handling plans of local ecological effects on roads, and would increase the general knowledge of the variability of those effects on the landscape.

Theme:Snakes, Roads, vehicular traffic, ecological impact, Colombia.

Type of Presentation: Poster

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AMPHIBIAN DIVERSITY BEFORE AND AFTER A CATASTROPHIC DECLINE EVENT IN CENTRAL PANAMA: MOLECULAR CHARACTERIZATION USING DNA BARCODES.

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Amphibian populations around the globe are experiencing unprecedented declines. Concurrent with this crisis, amphibian taxonomy is witnessing a steady increase in the rate of new species descriptions, driven in part by the discovery of previously cryptic species through molecular methods. When declines strike before a fauna can be fully characterized, the true extent of the loss of amphibian diversity will be underestimated. In this study we use protocols from the Barcode of Life campaign to describe the Neotropical amphibian diversity within a single well-studied site, both prior to and following a decline event in central Panama. We obtained DNA sequence data from the COI Barcode plus 16S gene fragment (1086 aligned base pairs analyzed) for each of 298 samples representing 1-12 individuals of each of 63 named species of amphibians collected over 8 consecutive years from a system of transects covering just 4 km near the continental divide at 700 m elevation in Central Panama (Parque Nacional Omar Torrijos H.). Molecular genetic analyses revealed an additional 12 cryptic or potential species, suggesting that species diversity at this well-studied Central American site was still underestimated by 20% when the decline event hit in 2004. Based on the 8 years of mark-recapture data included pre- and post-decline surveys, the 63 named species were assigned into one of four conservation categories: Gone, Critical, Declined, Least Concern and Data Deficient. While 29% of named species were categorized as Gone, 50% of the 12 cryptic species were placed in this category based on the status of their named sister taxon or morphological analog, suggesting that at this site cryptic species are on average harder hit than known taxa. Finally, we estimated the loss of evolutionary history at this site with increasing scope of amphibian decline. Using ML phylogenetic analyses of the local amphibian community (as reflected in the 298 samples), we calculated that with the disappearance of the Gone taxa, 25% of the evolutionary history will be lost. If the Critical and Declined species are also lost, 58% of the former community phylogenetic diversity will have disappeared. This study offers a novel use of DNA barcode data for conservation and community-scale biodiversity studies.

Theme:amphibians, genetics, conservation biology

Type of Presentation: oral

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European Amphibians Under Threat of Negative Impact by Invasive Fish Rotan (*Perccottus glenii*): New Data

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The invasive fish rotan *Perccottus glenii* distributed widely in Europe. Rotan actively consumes amphibian larvae, competes with aquatic Urodeles and brings parasites. Successful reproduction of some European amphibians stops after penetration of rotan in their breeding sites. Consumption of amphibian eggs by rotan is often mentioned in scientific literature despite absence of any studies on this matter. The current work was performed for estimation of influence of rotan upon early developmental stages of amphibians. For this purpose, eggs of three amphibian species (*R. temporaria*, *R. arvalis*, *Bufo bufo*) and several method approaches were used. First of all, estimation of taste qualities of amphibian eggs was conducted. Under laboratory conditions tamed rotans were offered with eggs using forceps. Most fishes rejected eggs of toad and frogs after seizing however all the fishes readily consumed alternative food (pieces of earthworm). Thus, during intraoral testing fishes perceived amphibian eggs as uneatable items. Secondly, palatability of eggs placed in aquaria for twenty-four hours was investigated. In this experiment, palatability of eggs was also rather low despite the presence of fish foraging motivation. Thirdly, in a pond, rotans were noted near the clutches however nor egg consumption was registered. Fourthly, prolonged observation of number and condition of frog egg clutches in a water body inhabited by rotan was conducted. During several days the number of clutches increased and almost all clutches were undamaged. Fifthly, feeding of rotan collected in a pond in proximity to frog clutches was investigated. In intestines of the fishes diverse invertebrates and even adult smooth newts were registered but amphibian eggs were absent. So, results of the experiments and field observations support that, contrary to the current opinion, amphibian eggs are uneatable for rotan and apparently these eggs are not consumed in water bodies. However relative protection of eggs, the most number of small water bodies with rotan is unsuitable for reproduction of newts and frogs because of total elimination of amphibian larvae due to predation by rotan. In addition, investigation of potential influence of rotan on amphibians via transformation of parasite complexes was started and preliminary results will be reported. This investigation was supported by the Russian Academy of Sciences: Biological diversity and dynamics of gene funds; Biological resources of Russia: fundamental bases of rational use, RFFI # 08-04-00679.

Theme:amphibians, anurans, conservation biology, predator-prey

Type of Presentation: oral: contributed

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Dermis Saprophytes Molds from *Dendropsophus columbianus* in Caloto – Cauca, Southwestern of Colombia

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Amphibians are very susceptible to acquire microorganisms through the skin, as saprophytes molds, which are potentially pathogenic and may affect the viability of populations. Therefore, identifying and understanding the different mold types present in a locality would allow setting adequate strategies for the conservation of anurans communities who may be affected. In environments with the presence of cattle activities, is expected that the mobility of cattle facilitate the dispersal of molds present in the soil. In order to identifying saprophytes molds affecting a local population of *Dendropsophus columbianus*, and evaluate the dispersal of these molds in the area of interest due to the mobility of cattle, mold isolations were carried out using a pour plate method in potato-dextrose agar (PDA). Frog skin and cattle hooves molds samples were obtained using a sterile swab over their

surfaces. In order to evaluate the presence of mold in the soil of the study area, a small soil sample (10 cm deep) was collected and mold cultures was carried out in PDA using dilution technique. We identified 11 genera of mould. *Penicillium* and *Trichoderma* were in the soil, cattle hooves and skin of *D. columbianus*. Moreover, *Cladosporium* and *Paecilomyces* were also present in frogs. Although most of the identified molds have mutual symbiosis, the potential parasitic relations cannot be ignored since the molds would be opportunistic. Moreover, the presence of common mold genera in frogs and cattle hooves, suggests that the cattle could act as vectors for mold dispersion, rather than as fixed hosts.

Theme:Amphibians, Ecology, Conservation Biology

Type of Presentation: Poster Contribution

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Interpopulational Variation in Parasitism by Helminths in *Eurolophosaurus nanuzae* (Rodrigues, 1981) (Lacertilia, Tropiduridae) at Serra do Espinhaço, Brazil

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Spatial variation in biodiversity are currently one the most central themes in biogeography and modern ecology. Parasites constitute a large biodiversity, and thus are good models to investigate the spatial diversity patterns. *Eurolophosaurus nanuzae* is an endemic tropidurid lizard found in many localities along the Espinhaço Mountain Range, at Brazil. We analyzed the community composition and structure of helminth fauna in lizards from four populations of *E. nanuzae* (Serra do Cipó, Serro, Diamantina and Rio de Contas). We found 1,584 helminths (6.2 ± 9.2 mm; range: 1-93) from eight species in 169 lizards: *Physaloptera lutzi*, *Physaloptera retusa*, unidentified *Physaloptera* larvae, *Subulura lacertilia*, *Strongyluris oscar*, *Parapharyngodon* sp., *Parapharyngodon sceleratus*, and one cestode species. The richest fauna was found in Serro (seven species in 57 lizards), and the poorest was found in Rio de Contas (three species in 4 lizards). The highest abundance of helminth (982 helminths in five species) was observed in Serra do Cipó. At Serra do Cipó the species with most large prevalence and mean intensity of infection were *Physaloptera* larvae, *P. lutzi* and *S. lacertilia*. In Serro, the most prevalent species and with the highest mean intensity of infection were *Physaloptera* larvae, *P. lutzi*, *P. sceleratus* and *S. oscar*. In Diamantina, the species with most large prevalence and mean intensity of infection were *Physaloptera* larvae and *P. lutzi*. Finally, at Rio de Contas, all species found had great prevalences and mean intensity of infection. *Physalopterids* prefer the lizard stomachs, whereas the other helminth species were found predominantly in the intestines. Cestodes were always found in the small intestine. Our results are the first to analyze the distance effect on faunal similarity of helminths in lizards of the Neotropics. In general, the faunas of helminths of *Eurolophosaurus nanuzae* had a high similarity between the localities, both qualitatively and quantitatively. The similarity between helminth faunas was not correlated (r_s) with geographical distance between localities both qualitatively, and quantitatively ($P > 0.05$). The cluster analysis revealed two distinct groups: Serra do Cipó and Rio de Contas (the two farthest localities), and Serro and Diamantina. The helminth fauna of lizards have, in general, low host specificity, and tend to be the same across large geographic areas.

Theme:lizards, *Eurolophosaurus nanuzae*, ecology, interpopulational variation, parasitism, helminths

Type of Presentation: Poster

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Herpetological collections as tools in diversity studies

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The diversity and distribution of species can be related with many factors, as temperature latitudinal gradients and the evolutionary history of a given clade. In principle, the influence of ecologic parameters on species diversity seems to be more easily identifiable and understood in ectotherms vertebrates, as variation in environmental temperatures strongly affect physiological and behavioral parameters in these animals. Under this scenario, the present study tested the hypothesis that the family lizards Gymnophthalmidae and Tropiduridae are more diverse in open areas (Cerrado and Caatinga), in comparison with forested areas (Floresta Amazônica and Mata Atlântica), due to the high temperatures and increased availability of sunstroke usually associated with non-forested habitats. Moreover, we also tested the hypothesis that the present distribution of these groups was strongly influenced by the evolutionary history of the clades, specifically by the ancestor environment where the clade has originated. The data used in the present study was obtained from herpetological collections in Brazil, and maps of family distributions were built based on this information. The percentage of species on different Brazilian biomes (Floresta Amazônica, Mata Atlântica, Cerrado and Caatinga) was calculated, and Chi-square tests were performed in order to compare the frequency of species in each biome. Diversity indices were also compared among families, and ancestral habitat reconstructions, based on parsimony, were performed for Gymnophthalmidae and Tropiduridae. The largest diversity of Gymnophthalmidae was observed in forested areas, and this pattern seems strongly affected by the presumed origin of this clade in the Amazon Forest. In contrast, the Tropiduridae family is more diverse in open habitats, as originally predicted, but it is not possible to infer the influence of the ancestral habitat where the clade has originated because the ancestral reconstructions were ambiguous. The present study is very important because this is the first time that the general diversity and distribution of Tropidurinae and Gymnophthalmidae are compared, as well as there is no record of studies based on data available from Museum Collections investigating biodiversity in tropical lizards.

Theme: Lizards, ecology, conservation biology.

Type of Presentation: Poster

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Farming of Chelones (*Podocnemis* spp.) in tank-net for communities of Medium and Low Amazonas river

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The management of chelonians at Amazônia have been developed for the local communities as alternative of income source in the places where the natural populations have been diminished. It was objectified to evaluate the system of breeding of chelonians (tracajás, *Podocnemis unifilis*; tartaruga, *P. expansa*; iacás, *p. sextuberculata*) in tank-net. The experimental delineation to evaluate the effect of the density of culture in tank-net (20, 40 and 60 animals/m³) and the performance of fingerlings in three different hidric systems, was used the units of creation in 10 tank-net (2 m X 3 m X 2m) mounted in 2005. The analyzed variables had been length and final width and height of carapace, final weight, daily weight gain and alimentary conversion. The experimental delineation was in randomized block with joint analysis for areas- Terra Santa, Parintins and Barreirinha. In the analysis of performance in different hidric systems it was tested tank-net in white (4), clear (3) and black (3) water rivers. The *Podocnemis unifilis*, 36 months, in clear water presented a biggest improvement ($P<0,078$). The *P. expansa*, 34 months, created in clear water were more weighted ($P<0,045$), 2383.5 g, than in white (11074.25 ± 197.30 g) and black (928.65 ± 197.74 g). *P. sextuberculata*, with 22 months, created in clear water presented biggest ($P<0,22$) growth in weight (186.38 ± 46.41 g) than animal created in white (142.45 ± 35.10 g). The biggest daily weight gain of tracajás was in clear water (0,26-1,16 g/day). The alimentary conversion of tracajás in white water varied of 3.42-9.44:1, in black of 2.4-3.8:1 and in clear of 4.4-10.12:1. The greatest mortality rate was in the iacá, 48.17%, and the more resistant, the tracajá, with 17.7% . Significant differences between the used densities of culture had not been found, but creations with 50-65 animals/m³ had presented a trend to have greater daily profits in weight. The parasitism of leechs was detected in more than 50% of the tank-net, mainly, in black and clear waters. This system of creation presents a profitability around 12-13%, having a total cost of R\$10,414,00 producing a gross income of R\$14,260,00 and a net income of R\$3,846,00, being viable for rural populations. The average weight of the abated turtles and tracajas had been 1555.88 ± 26.94 and 771.94 ± 356.96 g and produced meat (flat slice, back and front leg) 473.58 ± 8.20 and 234.96 ± 108.65 kg respectively.

Theme:Farming, tank-net, *Podocnemis*, chelonians, community

Type of Presentation: poster

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Results of 14 years Reptile Monitoring in the Netherlands

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In 1994 we started a monitoring network for all seven indigenous reptile species: Slow Worm (*Anguis fragilis*), Sand Lizard (*Lacerta agilis*), Common Wall Lizard (*Podarcis muralis*), Viviparous Lizard (*Zootoca vivipara*), Smooth Snake (*Coronella austriaca*), Grass Snake (*Natrix natrix*) and the Adder (*Vipera berus*). The monitoring network exists of over 500 localities which were visited seven times a year under favourable weather conditions and in a standardized way. During each monitoring visit all sightings of reptiles were counted. The database allows us to analyze trends for each species at a national and regional level. In 14 years we succeeded in creating a representative network for all indigenous species leading to significant trends. We show results and discuss trends for each species. Some species show stable numbers, whereas others are declining or increasing. For some species the increasing numbers can be explained by global warming (Sand Lizard, Common Wall Lizard), whereas declining species may suffer from habitat fragmentation or water draw-down. The effect of fragmentation and water draw-down have been quantified for the Viviparous Lizard and the Adder.

Theme:reptiles, snakes, lizards, monitoring

Type of Presentation: poster

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Are Cuban Protected Areas Well Sited? An Analysis Using Eastern Cuban Amphibians

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Cuba is the largest Caribbean island and harbours the most diverse amphibian fauna in this area, including 64 species. Estimates of IUCN consider 47 species as threatened, and together with the 95% endemism rate, make this a very vulnerable fauna. Reserves alone are not adequate for nature conservation but they are the cornerstone on which regional strategies can be built, so it is necessary to set prior targets. We used GIS technology to model distribution and obtain potential distribution maps of every of the 40 species inhabiting Eastern Cuba, by correlating species presence with landscape variables (habitat type, altitude, slope, river/stream presence, road presence and human buildings presence). These maps were summed to obtain high-richness and high endemism areas. Then, we overlaid the produced maps with a map of the existing Cuban network of natural protected areas to examine coincidences between areas with relevant features of amphibian biodiversity and protected areas using contingency tables to highlight possible gaps. Also, we examined the proportion of the distribution area of each species included in protected areas and the proportion that was excluded from them, considering both the complete network and the different categories in the Cuban system of protected areas. Distribution maps and lists of species inside/outside of the protected areas generated in this study must help to decision-makers and conservationists to develop species-based conservation strategies.

Theme: amphibians, anurans, conservation biology, endangered species

Type of Presentation: poster

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Mainland versus island differences in behaviour of Podarcis lizards confronted with dangerous prey: the scorpion Buthus occitanus

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Rapid divergence in behavior of populations invading novel habitats is often considered adaptive as it may allow a species to exploit novel resources. In habitats with low productivity, insectivorous lizards often consume high proportion of plants, marine invertebrates, or even result to scavenging. In arid habitats scorpions can be extremely abundant compared to other potential prey, suggesting that behavioural or morphological adaptations that would allow lizards to consume these prey may be selected for in environments with low food abundance. We explored the behavioral response of two closely related species of Podarcis lizards living in different habitats of Spain, on the mainland

(Solsona, Lleida, Catalonia; *Podarcis hispanica*) and on a dry volcanic island (Columbrete archipelago, Mediterranean; *Podarcis atrata*), towards a potentially dangerous prey (the scorpion, *Buthus occitanus*). We used an experimental approach in which the scorpion was tethered by the base of the tail to a 1m long nylon thread tied to the end of a pole. We set the scorpion on the ground 15 cm from the lizard, and recorded the response of the lizard immediately after stimulus presentation. If the response was positive (i.e. the lizard moved towards the scorpion) the scorpion was moved by the researcher at sufficient speed to keep it near the lizard while preventing capture. If the lizard did not respond to the moving stimulus in 3 minutes we considered it a negative response. Our results show that whereas insular lizards attacked scorpions and consequently considered them to be potential prey, mainland lizards tended to flee or ignored them. Sexual differences in the response (attack, ignore or flee) to scorpions were pronounced in the insular habitat. Males tended to attack scorpions while females tended to ignore them. Inter-specific and inter-sexual differences in the response of lizards may be mediated by body size differences between populations and sexes. Insular lizards are bigger than mainland lizards, and males in both populations are bigger than females. The rapid changes in behavior allowing insular lizards to recognize scorpions as potential prey may have allowed these animals to capitalize on an abundant food resource in a depauperate environment.

Theme: lizards, behaviour, predator-prey

Type of Presentation: Poster

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Sexual selection, physiology and performance in lizards: do big boys always get the girls

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In many lizard species males will actively defend territories to obtain access to females. Alternatively, males can guard females to prevent other males from copulating with them or may try to use a sneaker strategy to try to obtain matings. Consequently, sexual selection can be expected to act on performance traits increasing the success rate of a male's strategy. Previous work has suggested an overarching role of body size in this respect, suggesting that size may be the principal feature determining the outcome of territorial conflicts and/or male mating success. However, recent studies focusing on performance traits directly related to male dominance (e.g. bite force, sprint speed, endurance capacity) suggest that these may actually be more important in determining male mating success. If these performance traits are associated with externally visible badges or ornaments, this may provide both males and females insights into the fighting capacity or overall quality of a male. Here we review recent studies and provide new data on the importance of whole-organism performance in shaping male mating success in lizards. Additionally, we examine the role of different morphological traits in shaping performance, and explore the role of circulating hormone levels in generating differences in morphology that may affect male performance.

Theme: lizards, behavior, ecology, morphology, reproduction

Type of Presentation: Oral, Symposium 12: Ecophysiology of Reptiles

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Moving Forward on Global Conservation Assessments: Updating the Global Amphibian Assessment

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Global conservation assessments are critical tools for the identification of priority species and areas, and are therefore essential for informing conservation action. The nature of both growing global threats and declining biodiversity, however, call for frequent updates to existing assessments so that they can more accurately reflect the needs of specific taxa, regions or habitats. The Global Amphibian Assessment was first launched in 2004, with a subsequent update published in 2006, and a second assessment (2008) underway. Herein we report on the current assessment. Species accounts, distribution maps and preliminary conservation categories (as per the IUCN Red List Categories and Criteria) were generated for all new and revalidated amphibian species, and were reviewed by authors and/or assessors for each species, whenever possible. As from the last (2006) update and up until December 2007, 364 species have been added to the GAA, bringing the total number of amphibian species in the database to 6260, after removal of junior synonyms. With regards to higher taxonomy, 94% of the species in the current update are anurans, 5% are salamanders and only 1% is comprised by caecilians. The new taxa are distributed among 36 families, 11% of which are caudate families, 6% are gymnophionids and 83% are anurans. Of these families, Strabomantidae (59 spp.), Hylidae (48 spp.) and Bufonidae (32 spp.) report the highest number of species. For generic richness, however, Hylidae reports the greatest number of genera (15), followed by Bufonidae and Microhylidae, with 13 genera each. Over half (53%) of the new/revalidated species are found in the Neotropics. The countries with the most new/revalidated species reported are Brazil (52 spp.), Peru (49 spp.), Bolivia (24 spp.) and Papua New Guinea (22 spp.). The discovery and description of new species is biased by research effort and the taxonomic expertise of individual researchers. We will further discuss the conservation status and habitat occupancy of species in the current update in relation to those already in the GAA database.

Theme:amphibians, anurans, salamanders, caecilians, conservation biology

Type of Presentation: Oral

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Sex as a threshold trait: Overturning traditional paradigms on evolution and modes of sex determination in reptiles

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Sexual phenotype in vertebrates was once thought to derive from a more fundamental dichotomy in the genotype of males and females -- either a master sex gene (such as SRY in eutherian mammals) or gene dosage (suspected in birds) determines the developmental pathway taken leading to either a male or a female phenotype. We now know that vertebrates show remarkable variation in sex determining mechanisms, including many variants of chromosomal sex determination, polygenic sex determination, environmental sex determination, and cases where environment and genotype interact to determine sex. In this talk we argue that reptiles are predisposed to developing environmental sex determination, and that sex can be viewed as a threshold state in both genotypic and environmental sex determination. Transitions between genotypic and environmental sex determination, or between heterogametic and homogametic sex, need not involve major innovation in the complement of genes

or chromosomes involved in sexual determination and differentiation. More subtle changes in the strength of regulatory signals relative to a threshold are sufficient to drive major transitions between modes of sex determination. Disparate mechanisms of vertebrate sex determination may be much more closely related than previously thought -- a continuum of states rather than disjunct modes. Species where genotype and environment interact to determine sex, such as in *Bassiana duperryi* and *Pogona vitticeps*, will provide valuable models for addressing questions on topics as diverse as the mechanisms of sex determination, the evolution and maintenance of sex determination, and sex ratio evolution and sex allocation.

Theme:reptiles, lizards, genetics, developmental biology

Type of Presentation: Oral, Symposium 1: Reproduction in reptiles: from genes to ecology

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Effects of Forest Thinning on Reptile Community Structure in South-Eastern Australia

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The Box-Ironbark woodlands of south eastern Australia were extensively logged during the gold-rush of the mid 1800's. As a consequence of this, large regions of coppice regrowth developed increasing the canopy cover of this previously open woodland. In 2003, Parks Victoria initiated an ecological thinning trial by selectively reducing coppice regrowth at certain sites by approximately 50%. This significantly reduced the canopy cover of the thinned sites and altered the thermal environment. We undertook a study analysing the impacts that this procedure has had on reptiles by comparing communities within thinned sites to nearby control sites in three regions. Physiological and behavioural traits were assessed in the laboratory to gain a greater understanding of microhabitat selection by reptile species within the sites. Thermal preference in a gradient was selected as the behavioural trait because of its relationship with habitat use and fitness. Optimal sprint performance was measured as a physiological parameter because of its link with ectotherms being able achieve their functional requirements in the field. These two variables were compared with field temperature data to determine the capability that a species has to reach its physiological potential and the duration of time per day that is available for maintaining a preferred body temperature. Overall five skink species, one agamid, one varanid and one species of blind snake (*Rhamphotyphlops*) were recorded in the sites. There was a noticeable increase in abundance at sites that had undergone the thinning treatment for some species but not for others. The data also suggested that species richness is higher within sites that have undergone the thinning treatment. Species with relatively high thermal preferences were found to have a closer correlation to habitat preferences than those that had lower or less tightly constrained thermal preferences in the laboratory. Although the Box-Ironbark ecological thinning trial is a relatively young project (effectively less than three years), reptile communities within the study areas are showing an adjustment in community structure due to the new habitat structure.

Theme:reptiles, community ecology, lizards, physiology

Type of Presentation: Poster presentation

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Primers for Neobatrachian mtDNAs, mt Genomic Structures in Afrobarachians, and Ranoid Phylogeny

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We designed twenty primers for amplifying mitochondrial (mt) DNAs of neobatrachian frogs of which nucleotide substitution and gene rearrangement rates are known to be faster than those of other amphibians. The primers could amplify almost total length of mtDNAs of all tested neobatrachians (7 species of 7 families) without hassle PCR condition settings, showing their usefulness. Among the tested taxa, two species belonging to *Laurentbatrachia* (sensu Frost et al. 2006; = epifamily *Arthroleptoidae* sensu Vences and Glaw 2001), *Trichobatrachus robustus* (*Arthroleptidae*) and *Hyperolius viridiflavus* (*Hyperoliidae*), showed unique amplification patterns. To elucidate the higher relationships among ranoid frogs (*Ranoides*, sensu Frost et al. 2006) and search mt genomic rearrangements potentially becoming a new phylogenetic indicator for the ranoid taxa, we sequenced whole mtDNAs of these species. The *Trichobatrachus* mtDNA has two duplicated regions (trnH-S-nad5 and CR-trnL-T-P-F), and all one of two copies definitely became pseudogenes (i.e., nad5 and six trns) excluding duplicated control regions (CRs) with nearly identical sequence. This mtDNA also showed translocations of nad5, five trns, and light-strand replication origin (OL) from those of other frogs. The *Hyperolius* mtDNA possesses two pseudogenes (nad2 and trnM) and two nearly identical CRs; and five trns and OL are rearranged. The duplicated condition observed in these mtDNAs seems to be actual examples of the “duplication and random-loss” genomic rearrangement. Several duplicated regions, however, are difficult to be explained by the traditional tandem duplication model. The derived arrangement of trnN-OL-trnA found in both *Trichobatrachus* and *Hyperolius* is also shared in two xenosyneunitanurans, *Hemisus marmoratus* (*Hemisotidae*) and *Breviceps adspersus* (formerly in *Microhylidae*; but *Brevicipitidae*, sensu Frost et al. 2006). Although preliminary phylogenetic analyses based on mt genomic sequences preferred a paraphyly of the taxa possessing the unique gene order and suggested the *Microhylidae* + (*Laurentbatrachia* + (*Natatanura* + *Xenosyneunitanura*)) relationship, several statistic tests (AU and KH) did not show any significance between these incongruent evolutionary hypotheses. Considering the complicated formation process of the unique gene order, the derived trnN-OL-trnA arrangement can be regarded as a novel synapomorphic character which supports the *Afrobatrachia* clade.

Theme:amphibians, anurans, genetics
Type of Presentation: Poster_contributed
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Genetic differentiations in two Japanese newts of genus *Cynops* as revealed by nucleotide sequences of mitochondrial DNA

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Asian newt genus *Cynops*, ranging from China to Japan, includes seven species. Of these, two (*C. pyrrhogaster* and *C. ensicauda*) are endemic to Japan, whereas the others are distributed in China. We surveyed the phylogenetic relationships among samples of the two Japanese species using

nucleotide sequences of cytochrome b gene of mitochondrial DNA. The results indicated the presence of remarkable differentiation and sister-group relationship between the two species. *Cynops pyrrhogaster*, from the mainland of Japan exclusive of Hokkaido, was composed of three clades (eastern, central, and western clades). The eastern clade consisted of samples from Tohoku, Kanto and a part of Chubu districts. The two local races (Tohoku and Kanto races), previously recognized in this assemblage on the ground of mating behavior, external morphology and allozyme variation, were not recognized. Likewise, in the central clade consisting of samples from Chubu, Hokuriku, most Kinki and eastern Chugoku districts, the Sasayama race, which has been recognized on the basis of the characteristic mating behavior and ventral coloration, was not also recognized. The western clade, from southwestern Kinki, western Chugoku, Shikoku, and Kyushu districts, was divided into two sub-clades, one from the southern and western parts of Kyushu and the other from southwestern Kinki, western Chugoku, Shikoku, and most Kyushu districts. Within the former sub-clade, the southern Kyushu local group, recognized by the allozyme study, was also recognized, but the degree of divergence from the remainder was not so prominent as in the previous allozyme study. These discordances between the results of the present and the foregoing studies suggest that asymmetric introgressions of mitochondrial DNA have possibly been induced by secondary contacts between populations representing once diverged clades. *Cynops ensicauda*, which is endemic to the Ryukyu Archipelago, was divided into two clades (the Okinawa and Amami clades), that correspond to two subspecies proposed in a morphological study and supported by allozyme studies. Our results also showed that the Okinawa clade was composed of two sub-clades, which coexist with each other in the northern part of Okinawa-jima Island. These sub-clades were not recognized in the foregoing allozyme study, and this rejects the possibility of the presence of cryptic biological species on this island. Such phylogeographical pattern as shown by newts on the Okinawa-jima Island is likely to have been formed through its initial geographic division into two isolated assemblages and their attainment of subsequent sympatry before acquisition of reproductive isolation mechanisms.

Theme:amphibians, salamanders, genetics

Type of Presentation: _ oral: _ contributed

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Impacts of inbreeding depression on the larval development of *Rana dalmatina*.

Aurélie Johanet

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Inbreeding depression is of major concern in the management and conservation of endangered species. Inbreeding depression is reduced fitness in a given population as a result of breeding of related individuals. In fact, inbreeding reduces genetic diversity, increases proportion of homozygous genotypes and the expression of deleterious recessive alleles responsible of individual genetic load. We have estimated inbreeding and its impact by three genetic experiments in wild populations of *Rana dalmatina*. The results show a positive correlation between heterozygosity, genetic variability and fitness in short term (post metamorphic individuals) and in long term (adult fitness). Therefore, a decrease in fitness is related with an increase in inbreeding coefficient. The interest of this study is based on the choice of the biological model. Indeed amphibians have a patchy repartition with small and isolated populations which seem to undergo inbreeding depression. However, the increase of gene flow can decrease population survival by mutant migration badly adapted. Then, it is important to evaluate the impact of inbreeding depression on populations before putting conservation measures in place.

Theme:amphibians, anurans, reproduction, genetics, conservation biology

Type of Presentation: Poster

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Fine-scale reproductive character displacement in female palmate newts (*Triturus Helveticus*)

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Reproductive character displacement is commonly described as larger phenotypic differences between species in sympatry than in allopatry. However, little is known about the opportunity of selection generating phenotypic divergence between allotopic and syntopic sites within the sympatric area. We investigated this hypothesis in two amphibians in their contact zone where syntopic and allotopic sites alternate. To test the syntopic effect of *Triturus vulgaris* on *Triturus helveticus* phenotype, we studied morphology of adult males and females controlling for environmental factors (i.e. land use and flooding risk). Using linear mixed-effects models, we found that in forest, individuals were larger and traits associated with shape were smaller. Females of *T. helveticus* showed a higher tail when in presence of the other species. Since *T. vulgaris* females exhibit smaller tail heights than *T. helveticus* females, this pattern is consistent with reproductive character displacement. Results suggest that mispairing engages a mating cost for male newts. Our study emphasizes that evolution of recognition system could generate selection at a local scale inside a sympatric area. We are actually conducting a genetic study on microsatellite markers. Our first results suggest introgression with smooth newt and high genetic structure which would explain maintenance of such local adaptations. To test the hypothesis of reproductive character displacement, we are also carrying out a behavioural experiment measuring the effect of enlarged tail height in female *T. helveticus* on mating preference in syntopic and allotopic males.

Theme:salamanders, reproduction, behaviour, genetics, endangered species, morphology

Type of Presentation: 1 oral presentation

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Rapid divergence in Mediterranean insular lacertid lizard populations

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Experimental introductions provide opportunities to test ideas about the reasons of phenotypic divergence and the relative importance and timing of behavioral, physiological and morphological changes, which can provide a better understanding of the processes of biological diversification and speciation. In 1955, Milutin Radovanović and 1971, Nevo and co-workers introduced several populations of Italian Wall Lizards (*Podarcis sicula*) on small islands in the Adriatic (Mediterranean basin) then inhabited only by Dalmatian Wall Lizards (*P. melisellensis*). We visited those islands again and found remarkable rapid phenotypic divergence between the source and founder populations. On the other hand, autochthonous *P. melisellensis* populations were out competed. We detected not only clear differences in body size and shape of head and extremities but also in physiological performance traits such as maximal running performance, exertion and bite force. Comparisons in a phylogenetic frame with other island and mainland populations suggests that

divergence is extremely rapid, occurring within 1 – 30 generations, and we found rates of phenotypic changes ranging from -0.072 to 0.027 haldanes. These findings suggest that this lacertid lizard may rapidly adapt to a novel environment and may provide an example of the competitive exclusion capability of *P. sicula*.

Theme: lizards, ecomorphology, performance, evolution

Type of Presentation: Poster

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Anuran chytridiomycosis from the Eastern Andes of Colombia

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The decline, reduction and disappearance of amphibians species is a phenomenon observed for several years at around of the world. Numerous causes have been suggested that affect the presence of the amphibians in intact and modified habitats; one of them is the chytridiomycosis, an infection by chytrid fungus, *Batrachochytrium dendrobatidis* (Longcore, 1999). In this study, was detected the chytrid fungus in anurans from four different localities of Valle del Cauca where cases of mass mortality, decrease and disappearance of amphibians have been observed. The diagnosis was made through histological cuts of ventral skin in three different areas. 466 individuals from 40 species were analyzed, of which 22 individuals from 16 species resulted infected. The years when the infection was detected, represent the last records of the species for some localities suggesting that chytridiomycosis may have contributed to local disappearances

Theme: Colombia, *Batrachochytrium dendrobatidis*, Anurans, Amphibians, chytrid fungus

Type of Presentation: Poster

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Poisonous, but non-venomous, snakes? Common garter snakes accumulate tetrodotoxin from newt prey.

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The common garter snake (*Thamnophis sirtalis*) preys upon the highly tetrodotoxic rough-skinned newt (*Taricha granulosa*). Once resistance to a chemical defense becomes established the possibility arises of bioaccumulation or sequestration of toxin in the predator. We investigated the location and quantities of tetrodotoxin (TTX) accumulation in common garter snakes (*T. sirtalis*) after ingestion of rough-skinned newts (*T. granulosa*), the influence of newt toxicity and time on the accumulation of TTX in the snakes, and possible consequences of that accumulation for snake predators. After snakes

had eaten newts, several tissues were screened for TTX with a high performance liquid chromatography technique. Tetrodotoxin was purged from most snake tissues within one week. However, snakes harbored significant amounts of TTX in their liver one month or more after consuming just one newt, and at least 7 wk after consuming a diet of newts. Using multiple regression, we found that snake toxicity (based on total amount of TTX in snake liver) was positively affected by newt toxicity and decreased over time. The estimate of the half life of TTX in snake liver based on first order kinetics was 9.7 d, significantly longer than the 3–4 hr half life in rat liver. The difference may be due to a TTX-binding protein in snakes or simply the results of metabolic differences between endo- and ecto-therms. Regardless, the persistence of TTX in snake liver has potential consequences for predators of the snake. One field-caught snake discovered with a half-digested newt in its stomach contained approximately 108 µg TTX. Three weeks after eating just one newt in the lab, snakes contained an average of 42 µg of TTX in the liver. Based on TTX-susceptibility of birds in previous studies, we predict that even this lower dose could severely incapacitate or kill avian predators of the snake, such as herons, hawks, and crows. Though mammalian predators of garter snakes, such as raccoons, foxes, and badgers, are less susceptible to TTX and typically larger in mass, they may be negatively affected by this dose of TTX as well. Snakes from the study population seem to exhibit more bright red coloration than their con-specific counterparts, which contrasts with their black background. Whether snake toxicity resulting from bioaccumulation of TTX from newts constitutes a chemical anti-predator mechanism in snakes requires additional empirical investigation.

Theme: garter snakes, rough-skinned newts, chemical ecology, tetrodotoxin, sequestration, bioaccumulation

Type of Presentation: oral, Symposium 13: Sequestered Defensive Compounds and Other Defensive Tactics in Tetrapod Vertebrates

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The Threatened Leiopelmatid Frogs of New Zealand: Natural History Integrates with Conservation

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Natural history is concerned with all levels of organisation from the individual organism to the ecosystem, stressing aspects dealing with identification, life history, distribution, abundance, and inter-relationships. Over recent decades, these aspects have been the focus of research on the threatened Leiopelmatid frogs of New Zealand, effectively integrating natural history with conservation. Such integration enables informed assessment of species relationships, distributional status, behaviour, and ecological requirements. Systematic observations inform us about morphology, taxonomy, identification, distribution, habitat, diet, reproduction and activity. They reveal a broad dichotomy within the genus *Leiopelma* between four slender [terrestrial] species (*archeyi*, *hamiltoni*, *pakeka*, *waitomoensis*) and three sturdier [more aquatic] species (*auroraensis*, *hochstetteri*, *markhami*). There have been marked declines and losses of species, with the three largest species now extinct and known only as subfossils (*auroraensis*, *markhami*, *waitomoensis*). One likely reason for these declines is the introduction of mammalian predators to New Zealand, initially the Polynesian rat *Rattus exulans*. Distribution surveys of extant *Leiopelma* have clarified their current status, extending the known ranges of some (*archeyi*, *hochstetteri*), and confirming the restricted ranges of others (*hamiltoni*, *pakeka*). Observations on captive *Leiopelma* produced new information on behaviour, reproduction, development, and evolutionary relationships, with direct relevance to captive management of threatened populations. Long-term demographic studies of terrestrial *Leiopelma* also integrate directly with conservation, monitoring temporal changes in abundance and

density. They represent some of the most lengthy population research on anurans, providing conservation-relevant data on population growth, spatial behaviour, survival rate and longevity, revealing K-selected traits with some frogs living for 35+ years. Population monitoring of *Leiopelma archeyi* in its New Zealand stronghold was critical in alerting conservation agencies to the species' sudden decline in the late 1990s, associated with chytridiomycosis. As a consequence, research on disease pathology increased in recent years, involving veterinarians and herpetologists, and leading to the instigation of new hygiene protocols for frog research and management in New Zealand. The taxonomy of *Leiopelma* still needs more resolution, awaiting further genetic and ecological investigation. Nevertheless, our knowledge of the natural history of these frogs has substantially informed conservation management, embracing programmes dealing with translocation, adaptive management, captive breeding and disease prevention.

Theme: Anurans, ecology, natural history, reproduction, behaviour, conservation, developmental biology, taxonomy, captive breeding, morphology

Type of Presentation: Oral, Symposium 8: Herpetological Conservation & Biology

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Lessons Learnt from Two Translocations of *Leiopelma pakeka*, an Endangered Terrestrial Frog from New Zealand

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The surviving population of *Leiopelma pakeka* was confined to a 16ha forest remnant on Maud Island, New Zealand, until translocations increased its range. The first transfer in 1984-85 was of 100 to restored forest elsewhere on Maud Island (Boat Bay). The latest in 2006 was of 60 to Karori Wildlife Sanctuary, Wellington. We compare these two translocations, learning lessons about the suitability of the release environment, design of release, and translocation success. On Maud Island, 43 frogs were released at Boat Bay in 1984, then 57 in 1985. 75% were subsequently captured and at least 73 young were recruited into the population. The 1984 releases settled closer to the liberation point than those released in 1985, later arrivals evidently avoiding sites already occupied. Translocated frogs became heavier than in the source population, reflecting a lower population density and greater per capita food supply. The population remained relatively stable, with high annual survival after initial settlement (97%), and the gradual loss of founder individuals being offset by local recruitment. In Karori Sanctuary, 30 frogs were placed in a 2x4m predator proof mesh enclosure in February 2006. Their sizes (most >40mm SVL) indicate they were predominately females, so 30 more frogs in the male size range (<40mm SVL) were transferred from Maud Island in October 2006, initially into another 2x4m enclosure. In April 2007, 58 surviving frogs were mixed into roughly equal numbers of males and females. Using an adaptive management approach, half were retained in an enclosure, the rest released into the wild in adjacent forest, where there were at least two potential predators, the house mouse *Mus musculus* and little spotted kiwi *Apteryx owenii*. Survival in the enclosure remained high (27/29), and by February 2008 breeding had occurred. The number seen in the wild declined markedly, however, suggesting poor survival in the presence of a limited range of predators. We conclude that releasing 100 frogs into a predator-free environment at Boat Bay was a success, but releasing fewer into an environment with potential predators may have failed, although frogs survived and bred in a protected enclosure nearby.

Theme: Anurans, ecology, reproduction, behaviour, conservation biology, captive breeding, predator-prey

Type of Presentation: Oral, Symposium 5: Herpetofaunal Reintroductions, Translocations, and Supplementations

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The Renal Sexual Segment of Snake *Rhabdophis tigrina*

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Adult male snakes and lizards possess hypertrophied regions of the distal portion of the nephron, the renal sexual segment (RSS). The RSS of the male kidney is believed to provide seminal fluid that mixes with sperm and is released into the female cloaca during copulation. This study is the first to describe microstructure and ultrastructure of seasonal variation and its relationship with reproduction in the snake *Rhabdophis tigrina*. The results showed that the RSS is secretory only when the testes are spermatogenically active and RSS had a cycle that can be related to the spermatogenic cycle and mating activity in *Rhabdophis tigrina*. The height of single layered epithelium of the RSS in *Rhabdophis tigrina* is from $50.66 \pm 2.37 \mu\text{m}$ to $112.27 \pm 38.38 \mu\text{m}$, of which the highest is in May, whereas the lowest is in July. And the height of epithelium of seminiferous tubule is from $62.10 \pm 10.81 \mu\text{m}$ to $126.62 \pm 14.17 \mu\text{m}$, which is contrary to that of the RSS, the highest is in July and the lowest in May. Thus, the hypertrophied RSS of the kidneys have not Synchronization with the testes. In the July when the epithelium of the RSS is highest, nuclei of the epithelium cells are heterochromatic, oval in shape with a diameter of $5 \sim 8 \mu\text{m}$, The cytoplasm contains numerous spherical dense granules and less RER. Along the apical border granules appear to be released into the lumen along with cytoplasm, i.e., an apocrine mode of secretion. Microvilli are conspicuous on the luminal border of the epithelial cells.

Theme: Snakes, Reproduction, Morphology

Type of Presentation: Oral

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Dunes, Shrubs and Lizards: Short-term Effects of Vegetation Management on Reptile Communities in Nizzanim Sands (Israel)

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We study effects of partial vegetation removal from stabilized dunes on reptiles in Nizzanim, southern Mediterranean coast, Israel, within a long-term multi-disciplinary project (other teams study rodents, invertebrates and plants). The main goal is to assess partial vegetation removal as a management tool for the preservation of unique elements in the biota of coastal sands. Data collection started in May 2004 and we compare plots with different vegetation cover, treated vs. non-treated plots, pre- and post-manipulation. In March 2005 we treated seven of nineteen study plots (4000 m^2 each). Methods for the evaluation of the herpetofauna on the dunes include: pitfall traps, nocturnal reptiles track transects, diurnal lizards activity transects, foraging behavior observations and incidental reptile observations. Captured reptiles are measured, marked or photographed for individual identification and released. Data from untreated dunes show that unstabilized dunes ($\sim 10\%$ vegetation cover) are dominated by three lizard species (*Acanthodactylus scutellatus*, *Sphenops sepsoides* and *Stenodactylus sthenodactylus*), all desert dwellers, limited in the

Mediterranean climatic region along the coast to sand habitats. In semi-stabilized dunes (~25% cover) two additional lizard species (*Acanthodactylus schreiberi* and *Chalcides ocellatus*) are found, both of Mediterranean distribution. In stabilized dunes (~40% cover) additional Mediterranean species are added to the fauna, mainly two lizards (*Mabuya vittata* and *Ablepharus rueppellii*), while some desert species effectively disappear (*A. scutellatus*). Snakes and tortoises also occur in the study plots, but add mainly species richness data, due to sporadic and relatively low encounter rate (compared to lizards). *Acanthodactylus scutellatus* characterizes unstabilized sand, while *A. schreiberi* characterizes stabilized sand. Since these two species share semi-stabilized dunes, we consider them effective potential indicators for management impacts. Preliminary post-manipulation data in treated plots show, in some of the species, similar trends to those seen in naturally (untreated) semi-stabilized dunes. However, species composition in most manipulated dunes is more similar to their original composition, and is still far from the composition of naturally shifting or even semi-stabilized dunes. One of the reasons for this lag in colonization of treated dunes by species typical to shifting dunes seems to be the distance to source populations, thus we have recently initiated a translocation experiment of *A. scutellatus* specimens to several of the treated dunes. It is still too early to determine the extent of rehabilitation of desert and psammophilic species assemblages on stabilized dunes following partial vegetation removal; hence, this experiment must be monitored for several more years.

Theme: reptiles, turtles, snakes, lizards, community ecology, conservation biology,

Type of Presentation: oral, contributed

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The importance of natural history, landscape factors, and management practices, in conserving pond-breeding salamander diversity.

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I have analyzed presence, abundance and patterns of coexistence of 11 species of pond-breeding salamanders from 178 managed sites in Ohio, Indiana, Illinois and Michigan. These sites include 17 that have been monitored for 11-14 years and 10 sites that have been monitored from 4-7 years. The two most abundant species, *Ambystoma tigrinum* and *A. texanum*, use open habitats such as grasslands and savanna, and are found in single species communities significantly more often than expected by a null model. Several other species were more likely to coexist with certain species in assemblages and communities of 4 or more species occurred significantly more often than predicted by null models. All of these sites have fishless seasonal or semi-permanent wetlands and forested upland habitat. Among populations with long-term data, five species declined at some sites and two species increased at some sites. The declining species all prefer mature forest upland habitat and typically breed in fishless seasonal wetlands, whereas the increasing species use more open upland habitats and semi-permanent to permanent wetlands. Regression and General Linear Models indicate that the timing of prescribe burns was the most important factor in determining the relative abundance of pond-breeding salamander larvae. Most species were negatively affected by springtime prescribed burns. It took a mean of 4.6 years for populations of these species to recover to pre-burn levels. *A. tigrinum* was also negatively affected by prescribed burns, however their mean time to recover was just 1.6 years and this was typically followed by an increase that exceeded pre-burn abundance. *A. texanum* was not significantly affected by spring burns. Conservation oriented management practices should avoid springtime prescribed burning of wetlands and surrounding upland habitats that are used by pond-breeding salamanders.

Theme:amphibians, salamanders, community ecology, natural history, conservation biology

Type of Presentation: Oral, Symposium 8: Herpetological Conservation & Biology

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Hunt, management and productive values of caimans in the Amazon

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Caiman hunting for subsistence, commerce or traffic is a secular practice in the Amazon. Thousands of animals have been harvested annually for many decades; however subsistence hunting is the less impacting form, however indices of un-sustainability are found locally. Traffic routes of caiman products influence the commerce of these species in the Amazon. The process that culminated with the end of skin exploitation in the Amazon (until end of the 1970's), and the subsequent skins exploitation in the Brazilian Pantanal (during the eighties) was monitored or even stimulated by changing traffic routes to neighboring countries of Brazil. The creation process of the Sustainable Development Reserve (SDR) Mamirauá, at the end of nineties dislocated the dried-salted meat illegal commerce from mid-Solimões River to lower Purus River, in Amazonas State. Commercial routes also changed, initially directed in Colombia, actually to Para State. Traffic to Colombia was relatively hidden, but illegal selling of caiman meat in some estuarine cities of Amazon River is conspicuous. Production net and illegal commerce in lower Purus is complex and well structured. Local stakeholders activities economically depend on traders from Para state, principally on a system based on a goods exchange. Caiman' hunting occurs most of the year in the region and is based on the use of baited hooks, the real impact on natural populations is unknown. Commercial harvest precedes scientific management in the Amazonas state, principally based on local political agenda. In SDR Piagaçu-Purus we are implementing the BAJAQUEL Project, which principal aim is subsidizing scientifically future sustainable management of caimans (and chelonians) in that region. Economic management inside conservation units permitting wildlife uses will tend to increase in the next decades. Standardized research effort and the implementation of a monitoring program that provides useable indices of population trends are prerequisites to caiman population conservation in the flooded forest of central Amazon.

Theme:reptiles, crocodilians, ecology

Type of Presentation: Oral, Symposium 7: The biology and management of crocodilians.

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Water balance and locomotor performance of three species of Brazilian toads differing in habitat levels of specialization

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Although many amphibian species show dramatic population declines in response to habitat destruction (i.e. habitat specialists), some species seem less sensitive to changes in their habitat, and a few species can even secondarily invade such modified habitats (i.e. habitat generalists). The latter species generally inhabit open, native areas and exhibit extensive geographical ranges and large population numbers. Physiological restrictions have been proposed as a possible mechanism to explain interspecific differences in sensitivity to habitat modifications. Specifically for amphibians, characters associated to water balance and sensitivity of locomotion to dehydration may be important bottlenecks for invasion of new habitats. To test this hypothesis, we compared locomotor performance at different combinations of temperature and hydration levels, rates of evaporative water loss, rates of water uptake and ventricular mass of three species of toads from Botucatu/SP /Brazil: *Rhinella icterica* and *R. ornata*, two species more tightly associated to preserved Atlantic Forest, and *R. schneideri*, a more generalist species from open areas, more commonly found on modified habitats. We estimated rates of evaporative water loss from the rate of body mass loss of animals kept in wind tunnels ($30^{\circ}\text{C} \pm 1^{\circ}\text{C}$, $50\% \pm 5\%$ of relative humidity, and air flow at 1.5m.s^{-1}), and rates water uptake from the rate of body mass gain of dehydrated animals placed in a bottle with distilled water (1 cm deep). We determined locomotor performance by the mean distance of six jumps (cm) at three temperatures (15°C , 25°C and 35°C) and two levels of hydration ($100\text{-}85\%$ and $85\text{-}70\%$ of completely hydrated body mass). Although rates of evaporative water loss were equivalent for both species, *R. schneideri* showed 31% higher rates of water uptake than *R. icterica*. As both species do not differ in ventricle mass, the observed differences in rates of water uptake are probably not explained by differences in cardiac output. Both species presented significant individual variation in locomotor performance and the distance jumped decreased with dehydration by 85%, 81%, and 65% respectively at 15°C , 25°C , and 35°C for *R. schneideri*, and by 87%, 98%, and 70% respectively at 15°C , 25°C , and 35°C for *R. icterica*. While general activity may be restricted by water availability in the environment for both species, *R. schneideri* may present advantages by reabsorbing water more rapidly from saturated soil or free water once dehydrated. FAPESP: JP-06/54699-1, IC-06/05611-4.

Theme: anurans, physiology, ecology.

Type of Presentation: poster

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Mitigating Development Impacts on Great Crested Newts in the UK: Conservation or Cosmetic Surgery?

Brett Lewis Richard A. Griffiths Jim Foster

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In the UK conflict between development and legislation frequently occurs when protected species are found on sites scheduled for development. When this occurs, a mitigation plan is frequently implemented, with the intention of reducing the impact of the development on the species concerned and compensating for any habitat loss. Typically, such mitigation involves the capture and exclusion of animals, and their removal to areas that have been subject to habitat creation, enhancement or restoration. In 2005 and 2006 population assessments of great crested newts (*Triturus cristatus*) were carried out at 13 sites that had been subject to mitigation during the 1990s. In addition, all ponds lying within 500 m of the mitigation sites were identified and surveyed for the presence – likely absence of great crested newts. The surveys revealed the presence of great crested newts at all

mitigation sites – but not at in all ponds within mitigation sites. A standardized scoring system revealed that the status of the newt populations at the mitigation sites was variable – with some populations containing ‘small’ and others ‘large’ populations. Habitat loss and fragmentation in the vicinity of the mitigation sites was assessed by a comparison of landscape data drawn from Ordnance Survey maps from 1904-1939 with those from 2006. This showed a decrease in farmland and the number of ponds, and a corresponding increase in development over this period. Equally, those ponds that have survived are now much closer to potential barriers to dispersal than they were in the early part of last century. Despite this loss in habitat and increase in fragmentation, the aquatic and terrestrial habitat in the immediate vicinity of mitigation sites is generally good. Overall, the population assessments show that it is possible to maintain great crested newt populations in the face of habitat changes, at least in the short to medium term. What is not known is how these populations compare to those that previously existed in the area, or how viable these extremely isolated populations are in the long-term.

Theme:amphibians, salamanders, ecology, conservation biology

Type of Presentation: Oral, Symposium 5: Herpetofaunal Reintroductions, Translocations, and Supplementations

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Testing the assumptions of hatch-and-release and head-starting programs in two Indian river turtles (Batagur dhongoka and Batagur kachuga)

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Controversy often surrounds turtle conservation projects that rely on moving nests to hatcheries as well as the practice of head-starting turtles due to possible unforeseen life history implications (e.g. changes in sex ratios) and a lack of emphasis on protecting all life stages of the turtles. Many programs have been implemented without having defined means of determining their success. We have begun our efforts with this in mind and have set out to test some of the assumptions of the aforementioned methods. From 2006 to present, our conservation actions for the three-striped roof turtle (Batagur dhongoka) and the red-crowned roof turtle (Batagur kachuga) in the National Chambal Sanctuary in northern India have centered on a hatch-and-release program. In 2006, 968 Batagur kachuga and 8,193 Batagur dhongoka were released within 24 hours of hatching and 2007 we released 1,654 B. kachuga and 13,134 B. dhongoka. Our efforts are on-going in 2008. Additionally, in 2008, all hatchlings were equipped with a decimal coded wire tags for permanent cohort identification. Surveys for marked turtles will be conducted after monsoon floodwaters fully recede in early November both within and outside the sanctuary as it is possible that the flood waters may transport the hatchlings hundreds of kilometers. In addition, a modest head-starting program was developed in 2005. To date 1,188 B. kachuga have been retained at two nurseries, with an anticipated first release in November of 2008. The release of the head-started turtles will include three age classes (n= 250 per class) to test which age class has the better post-release survival rate. A TSD study based on temperature data from hatchery nests and the use of endoscopy will also be reported. Lastly, we will discuss the use of modeling to determine the intensity and duration of our conservation actions required to demonstrate a reversal of the current population declines for both species.

Theme:turtles, conservation biology, head-starting, India

Type of Presentation: Oral, Symposium 15: Development and Implementation of Recovery Programs for Endangered Chelonians.

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Spatial Economic Analysis of Early Detection and Rapid Response Strategies for an Invasive Species

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Economic impacts from invasive species, conveyed as expected damages to assets from invasion and expected costs of prevention and/or removal, may vary significantly across spatially differentiated landscapes. We consider the effect of these spatial differences on early detection and rapid response (EDRR) policies, commonly exploited in the management of potential invaders around the world, for the Brown Tree Snake (*Boiga irregularis*) on the island of Oahu, Hawaii. EDRR consists of search activities beyond the ports of entry, where search (and potentially removal) efforts are targeted toward areas where credible evidence suggests the presence of an invader. EDRR costs are a spatially dependent variable related to the ease or difficulty of searching an area, while damages are a population dependent variable. We find that optimally applied EDRR that integrates the costs, damages, and biological parameters of the snakes' potential presence can save the island \$270m in present value losses to social welfare over 30 years.

Theme:Brown Tree Snake, economics, prevention, control, snakes, Hawaii, early detection, rapid response

Type of Presentation: Oral, Symposium 2: Invasive Reptiles and Amphibians: Global Perspectives and local solutions

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Natural History And Snake Conservation In The Midwestern United States

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Effective conservation of any animal requires an understanding of its biology. For snakes, as in many cases regarding reptiles and amphibians, maintaining adequate habitat for populations is generally a crucial constraint to successful conservation. Satisfactory protection requires an accurate appreciation of what it is that needs protecting, yet we often make management decisions based on incomplete or inaccurate information. Using examples from my group's work on the Copper-bellied Watersnake (*Nerodia erythrogaster neglecta*) and the Eastern Massasauga (*Sistrurus c. catenatus*), I will illustrate the importance of researching fundamental natural history to successful snake conservation efforts. While the specific findings of the work will not extend equivalently to other snakes, the basic implications will be broadly applicable. 1) Presumptions regarding the biology of a species may be incorrect, leading to inappropriate conservation priorities. 2) Efforts based on observations restricted to particular life stages will fall short of protecting populations and even individuals. 3) Populations may frequently require larger landscapes than we are ready to admit. 4) Semantics may lead to unintended consequences, either when conveying information or establishing

protective efforts. The need for studying natural history lives on - only by understanding the basic biology of a species may we know how to protect it.

Theme:snakes, reptiles, conservation, management, natural history, ecology

Type of Presentation: Oral, Symposium 8: Herpetological Conservation & Biology

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Central role for venom in predation by the Komodo dragon and the giant extinct Megalania

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It has previously been argued that the Komodo dragon, *Varanus komodoensis*, evolved to prey on pygmy elephants (*Stegodon sondaari*) and other large prey, but it remains unclear how this might have been achieved. Here we investigate three possible mechanisms and evaluate their likely role in the predatory ecology of *V. komodoensis*; (a) a powerful bite-force, (b) hypertoxic bacteria and (c) envenomation. Using three-dimensional (3D) computer modelling we show that bite force in *V. komodoensis* is particularly weak, precluding the use of a bone-crushing action typical of mammalian carnivores. We also find no convincing evidence for the role of pathogenic bacteria in prey capture and reject the notion that *V. komodoensis* utilises toxic, bacteria-loaded saliva as part of its predatory ecology. We demonstrate here that *V. komodoensis* possesses a highly complex venom system, with the capacity to induce coagulopathic and shock-inducing hypotensive bioactivity, and venom volumes sufficient to immobilise large prey such as pygmy elephants. We further propose that the much larger and related Australian fossil varanid, *Varanus (Megalania) prisca*, was also a venomous predator capable of all but the largest Australian Pleistocene megafauna. Such extraordinary animals may well have had a role in shaping Aboriginal cultures as well as that of *Homo floresiensis*.

Theme:reptiles, snakes, lizards, genetics, predator-prey

Type of Presentation: oral

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Spatial Ecology and Population Density Estimates of the Namaqua Dwarf Adder, *Bitis schneideri*

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Preliminary movement and population density data are presented for the arid adapted viperine, *Bitis schneideri*. Data were collected using a mark-recapture field investigation during a single austral summer at two sites on the Namaqualand coast, Northern Cape, South Africa. Snakes were located through active searching and by following tracks left in the sand. All captured snakes were sexed, measured (Snout-Vent Length; Tail Length), weighed and uniquely marked by clipping ventral scales. At each capture location, a GPS reading was recorded, while track variables (distance moved between lie-ups, displacement between lie-ups, proportion of track exposed) were quantified. Snakes were released at point of capture. In total 104 snakes were captured, marked and released over a period of five months. Fourteen (eight males; five females; 1 juvenile) snakes were recaptured, three of these on two occasions. Mean daily displacement did not differ between sexes, nor did monthly

activity patterns. Our data indicate that individual snakes utilize relatively small areas with all recaptured snakes located within 217 m of their previous capture. Data collected from following snake tracks indicate that individuals move with an average meander function of 1.2. Adult males and females movements produce similar meander functions while juvenile movement is characterized by a higher meander function. Recapture models indicate that these snakes occur at relatively high densities in suitable habitat. Future investigations will supplement the presented data and additionally include quantification of ecological foraging requirements, micro-habitat characterization, and broad-scale habitat suitability modelling.

Theme:snake, ecology, natural history, behaviour, conservation biology, endangered species

Type of Presentation: Oral Symposium 8: Herpetological Conservation and Biology.

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Habitat Disturbances and Florida Box Turtles: What to do when Paradise Changes?

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Terrapene carolina bauri is a terrestrial, sedentary omnivore with relatively low fecundity and high adult survivorship, delayed sexual maturity, low nest and hatchling survival, and long life span. From 1991-2006, I studied a population of *T. c. bauri* on Egmont Key in west-central Florida. The island was affected by tropical storms and a large-scale attempt to remove nonindigenous vegetation in 1995-1996. In order to assess the effects of habitat changes on turtles, I estimated survivorship, recruitment into the population, and population growth rates. Adult survival did not vary between sexes or among years, nor did survivorship vary between juveniles and adults. Furthermore, neither adult nor juvenile survival differed significantly from pre- to post-disturbances. However, dispersal rates varied among areas, and pre-disturbance dispersal rates were greater than post-disturbance. Strong recruitment occurred in the years following the disturbances, and population growth rates remained about the same as they were prior to the storms and vegetation changes. These results suggested few long-term demographic effects on the turtle population, at least for 6 years post-disturbances. Instead, box turtles moved to habitats mostly in the center of the island and minimally affected by the disturbances, where they remained. However, major changes occurred in individual growth rates. Adult male growth rates increased by 19% after the disturbances, whereas female growth rates decreased by a similar percentage. Juvenile growth rates briefly increased, but as these animals became subadults their growth slowed post-disturbance, a change more pronounced in females than males. After the disturbances, the onset of male sexual maturity decreased by ca 1 yr (from 10.8 to 9.5 years), female maturity was delayed by 2.5 years (from 8.5 to 11.0 years), and the subadult life stage was extended from 2 to 3.5 years. With resources and habitats similarly available to adults, adult females likely diverted resources from growth to reproduction, whereas males allocated resources to somatic growth. Subadult growth decreased regardless of sex, implying that fewer or lower quality prey were available to small turtles in the years following disturbance. Habitat disturbances affected individual growth rates according to sex and life stage, which in turn affected population structure (particularly sex ratio). Life history traits influence whether populations recover from habitat disturbances, and how long recovery will take. Stage-based effects, such as on individual growth, may help to explain why turtle populations recover slowly following catastrophic disturbance, even when adult survivorship is high.

Theme:Ecology, Turtles, Conservation Biology

Type of Presentation: Oral Contributed

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Identification of antibacterial and antiviral activities and identification of new genes from skin secretions from different species of Colombian frogs.

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In spite of significant advances in molecular biology, more than 30% of compounds used by modern medicine are derived from nature. Many of these compounds have been discovered serendipitously. Antimicrobial peptides are natural antibiotics, providing a first line of attack against microorganisms invading body fluids and skin. Several hundred such peptides have been isolated from species as diverse as spiders, scorpions, fruitflies and fish. However, for obvious reasons, more than 20% are produced by the skin glands of frogs and toads. We have attempted to start characterizing activities secreted by anurans species found in different regions of Colombia. Colombia has a unique and very rich biodiversity with more than 700 different amphibian species. A technique is being used which allows to grow intact frog skin derived micro-organs (MOs) in vitro in the absence of serum (Differentiation. 2005 Mar;73(2-3):79-87, J Gene Med. 2005 Jul;7(7):926-35.). The advantage of this approach is that the skin glands remain intact and continue to secrete the peptides at similar levels as those secreted in vivo, for several days in culture. MOs are cultured in serum free medium and the culture medium is collected every two days and stored at -800 C for further analysis. We have collected and partly characterized over 50 different Colombian frog species. Over ten species contain particularly powerful antibacterial activity (some broad spectrum against *S. aureus*, *Salmonella*, *Enterobacter* and *E. coli* and some specific to only one of these species). Skin secretions from *Sphaenorhynchus lacteus* strongly protect against the cytotoxic action of the yellow fever virus an RNA virus of the arbovirus family. Activities described are specific and do not affect somatic cells. We further report the identification of a gene derived from the species *Sphaenorhynchus lacteus* which codes for a novel antimicrobial peptide of the dermaseptin family. We have also started a whole peptide analysis of the secretions from most species collected using LC MS/MS technology with the help of an Orbitrap apparatus. At present more than 500 secreted peptides have been sequenced, out of which three totally novel genes of unknown function have been identified.

Theme: Amphibians, Antimicrobial peptides, Micro-organs, Virus, Dermaseptin

Type of Presentation: Oral and Poster

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Grass Snake *Natrix natrix* Habitat Use and Range Size in Southern England

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In the UK, grass snakes (*Natrix natrix*) occur in a variety of habitats from dry heathland to wet marshland. They also occur in areas that comprise a mosaic of semi-natural woodland and farmland. Within this landscape their use of the different habitat components are poorly understood. To rectify this, the habitat preferences and range sizes of grass snakes were studied within a 48 ha study area situated in south Dorset, UK, between 1992 and 2000. The area comprised a mosaic of nine main habitat types including mixed deciduous woodland (46%), grazing pasture, (34%) bounded by

vegetated banks, and two large ponds (Figure 1). All captured snakes were individually marked using PIT tags. Between 1993 and 1995 sixteen large grass snakes were implanted with radio transmitters enabling each to be tracked for up to 23 months. However, the data from only one male and eight females were sufficient to estimate range sizes. In addition to the 232 locations recorded for these snakes a further 420 captures were made of 193 non radio-tagged snakes. Although the areas where the radio-tagged snakes were found were used as a guide for searching for non radio-tagged snakes other areas were also searched extensively. A total of 301 searches (486 hours) were completed for both radio-tagged and non radio-tagged snakes and the precise location of each individual was recorded along with data on body size (SVL: cm), body mass (gm) and sex. The two sets of location data for radio and non radio-tagged snakes were analysed separately. RANGES7v0.81 software was used to estimate habitat use, habitat preference (Jacobs Index) and range size for radio-tagged snakes whilst the data obtained from the non radio-tagged snakes were pooled and analysed using Bailey intervals and Neu's method. The results showed that both radio-tagged (Table 1) and non radio-tagged snakes preferred habitat edges (field, woodland and pond boundaries) and avoided open pasture and woodland. The selection of habitat edges suggested that grass snake ranges were typically linear and that concave polygons were the most appropriate method for determining range size (mean = 2.5408 ha; SD = 2.40963; range: 0.18 – 7.25 ha). This study has demonstrated the importance of habitat edges, particularly hedgerows, as corridors enabling grass snakes to travel through a landscape and between feeding areas and egg laying sites.

Theme: reptiles, snakes, ecology, behaviour, conservation biology

Type of Presentation: Oral

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Fluorochrome stainings show heterochromatin differences among karyotypes of three populations of *Engystomops petersi*

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The Amazonian frog *Engystomops petersi* Jiménez de la Espada, 1872 has a huge geographic distribution, being found from Ecuador to Brazil and Bolivia. Many calls and cytogenetic variations have been found in its diverse populations, although they share several morphological characters, raising many doubts about its taxonomy. The cytogenetic divergences involving chromosome morphology, heterochromatin and NOR distribution are so notable that impair the correct recognition of chromosome homeologies between different populations. In this work, in order to find new chromosome markers for the study of *E. petersi*, chromosome preparations of specimens from Puyo (Ecuador), Yasuní (Ecuador) and Rio Branco (Acre, Brazil) were sequentially stained with the base-specific fluorochromes DAPI and mythramycin (MM). Some of the preparations were previously C-banded and other ones were silver stained after all. Different classes of heterochromatin were distinguished in all of the karyotypes and many bands could be strongly noted only after C-banding. Probably it resulted from a higher exposition of these regions to the fluorochromes provided by C-banding. In spite of that, different responses could be noted among the populations. One of them regarded the centromeric heterochromatin. In C-banded karyotypes of specimens from Ecuador the centromeres were strongly stained by DAPI and also stained by MM. Instead, the chromosomes of the specimens from Acre had the centromeres strongly MM+. Also in the karyotype of Acre, one brightly interstitial region DAPI+ was found at the long arm of a submetacentric

chromosome (11), a characteristic not found in the other karyotypes. While terminal regions brightly stained by DAPI were found in two metacentric and one submetacentric chromosome pairs in the karyotype of Puyo, in the karyotype found in Acre, only two pairs of the metacentric chromosomes had terminal DAPI+ bands. The karyotype found in Yasuní greatly differed from the others, since it had at least four metacentric chromosome pairs with terminal DAPI+ bands. An interstitial DAPI+ band exclusively found in the subtelocentric chromosome (pair 8) of the karyotype from Acre provided a clear distinction between it and the subtelocentric chromosomes X and 11 from the karyotypes found in Puyo and Yasuní, respectively. In all of the karyotypes, the NORs were weakly evidenced by MM and their occurrence greatly differed among them. These findings reinforce the interpopulational differences in *E. petersi* and suggest that studies on repetitive DNA sequences may be helpful for this species. Auxílio: Fapesp

Theme: amphibians, anurans, genetics

Type of Presentation: Poster

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Reproductive behavior of *Podocnemis erythrocephala* (Testudine, Pelomedusidae) in captivity.

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Studies of the reproductive biology, particularly copulation and courtship behavior are relatively unknown for most South American species of turtles. For the four Amazon *Podocnemis* species, there are no published descriptions, even anecdotal ones, describing the courtship behavior. Between February and July 2006, we used 20 females and 39 males, to describe the courtship and copulatory behavior of *Podocnemis erythrocephala*. The experiments were conducted with 450h of observations in 150 sessions, of 3-6h per day, by the means of registering all of the behavioral patterns that occurred. In each session we used one female and three males. The behavioral patterns observed were grouped into three categories: initiation of the first phase of courtship—identifying the other turtle, precopulation, and copulation. The primary phase involves the initial behavioral patterns of the male searching for the female, and the results of this search; the second phase involves the mounting attempts of the male and the response of the female; the copulation includes copulation attempts and the final movements after copulation. During the first two phases the females can either passively or aggressively reject the attentions of the male. The total mean time of the interactions between the pairs culminating in copulation was 12 min (10 to 20 min.), n= 18 .

Theme: courtship behavior, *Podocnemis erythrocephala*, Amazon, turtles

Type of Presentation: Poster

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Evolutionary and Ecological Relationships of the Venoms of the Closely Related Coral snakes *Micrurus dissoleucus* and *Micrurus mipartitus*

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The venoms of coral snakes (genus *Micrurus*) clinically produce flaccid paralysis; the high-rate of mortality results from respiratory failure. While studies have investigated potential human effects, the neurotoxic effects have been poorly investigated in terms of venom evolutionary relationships. The purpose of this study was to investigate the physiological effects on neuromuscular junction of the venom of the closely related species *Micrurus dissoleucus* and *Micrurus mipartitus* to be able to compare their venoms in terms of ecology. While both species are likely to be specialist-feeders on reptiles, they occupy very different habitats. *M. dissoleucus* lives mainly in xeric to semiarid or seasonal dry regions while *M. mipartitus* is found in a wide range of habitats including lower montane wet forest and cloud forest. We examined the neurotoxicity of *M. dissoleucus* and *M. mipartitus* venoms in chick biventer cervicis muscle preparations and the venoms were also compared by mass spectrometry. *M. dissoleucus* and *M. mipartitus* venom produced a progressive decrease in the amplitude of miniature end-plate potentials, with the indirect stimuli, until these were abolished, both venoms significantly inhibited contractile responses to the exogenous nicotinic agonists (i.e. ACh and CCh) but not KCl, showing mainly a post synaptic effect with different doses and times of blocking. These results allow for a relation of toxicity to ecology and shed additional light on the forces driving venom evolution.

Theme:Snakes, Ecology, Physiology, Predator-prey.

Type of Presentation: Oral

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Physiological color change provides thermal benefits to the high-Andean frog *Dendropsophus labialis*

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Colouration is a crucial phenotypical trait affecting various aspects of organismal ecological performance. The frog *Dendropsophus labialis* exhibits colour variation both inter and intra-individually, but the evolutionary forces implied in this colour variation are still unravelled. We investigate whether colouration plays a role favouring thermoregulation. These organisms rely on basking to maintain relatively stable body temperatures and, since the heat exchange can be modified by the properties of the surface exposed to the solar radiation, the colour variation is an ideal scenario to test the thermal adaptive value of colouration. To determine which variable, temperature or light, triggered the colour change process, we conducted factorial experiments and measured the frogs' colouration using digital images. Light had the biggest effect on colour change, suggesting that chromatophores respond to variation in light intensity. To test the effect of colouration on the heat exchange, we performed experiments with agar models varying colour and brightness. The frogs' natural colourations, brown and green, did not play an important role in thermoregulation, so other explanations such as cryptic colouration seem to be more plausible. On the other hand, the thermal load of the agar models was significantly affected by brightness, with dark colours accumulating higher temperatures over time. Therefore, we suggest that rapid changes in skin brightness during basking play an important adaptive role in thermoregulation.

Theme:amphibians, anurans, natural history, physiology.

Type of Presentation: oral paper

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Piku in trouble -- Conservation of the pig-nosed turtle in the Kikori Delta, Papua New Guinea

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The pig-nosed turtle, *Carettochelys insculpta*, is considered to be in decline throughout much of its range. Exploitation by indigenous communities of New Guinea has been exacerbated by the introduction of modern technologies, particularly outboard motors, and increases in human populations along riverbanks since tribal warefare was brought to a halt. In Indonesian New Guinea, additional pressures come from exploitation to service international markets for turtle pets, meat and medicinals. However, firm data on the impact of these pressures and the magnitude of declines are lacking, impeding conservation action both internationally and by local communities. Our study, based in the Kikori Delta of Papua New Guinea is investigating the nesting biology and harvest of the pig-nosed turtle in the Kikori region with a view to provide the fundamental underpinning of community-led conservation of what is for them an important food resource and for the Western world, an iconic species. I present data on levels of use in 39 villages, compare rates of sale through local markets with those recorded in the 1980's by Mark Rose, nesting biology and sources of natural and harvest mortality, and on the joint WWF/Oil Search program of community awareness and conservation action.

Theme:reptiles, turtles, ecology, natural history, conservation biology, endangered species

Type of Presentation: Oral, Symposium 15: Development and Implementation of Recovery Programs for Endangered Chelonians.

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Green Iguanas (*Iguana iguana*) in Puerto Rico: It is Time for Management!

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Iguana iguana is native to Central and South America, and was introduced into Puerto Rico in the 1970's as a result of pet trade. In the last 20 years this species has become established in Puerto Rico and is extremely abundant in some localities. Because the ecology and natural history of this species has not been studied in Puerto Rico, its effects on local biodiversity are still unknown. The objectives of our research are: (1) to estimate its relative abundance; and (2) to study its reproductive biology in Puerto Rico. Population censuses were performed in one kilometer transects at Canal Blasina (CB) in Carolina and Parque Lineal (PL) in San Juan. At each transect, we tallied sex, age distribution, and behavior of each individual observed. Results of these monitoring surveys revealed that iguanas along the CB are three times more abundant than those along PL (max. number of individuals in reproductive season, 223 and 85, respectively). We noticed that population densities increased during the colder and dryer months of the year in PR. Statistical analyses testing for relationships between population densities, mean daily temperature, and mean daily precipitation, revealed that temperature was the only variable that significantly explained the changes in population densities observed at CB and PL ($P=0.0210$, & $P=0.004$, respectively). Furthermore, our data from two consecutive years at these localities revealed that the abundance of *I. iguana* in Puerto Rico is four times higher than in some localities of Central America where they encounter native predators. Given the high population densities and their reproductive biology, a proper management plan to control the species should be developed. Our future work includes testing control strategies, and determining the potential impact

of this species on mangrove ecosystems.

Theme: Reptiles, lizards, ecology, reproduction

Type of Presentation: Poster; contributed

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Where are the Lanceheads? Detection, Occupation and Environmental Effects in a Cryptic Snake

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Environmental variations condition the spatial distribution of most of the terrestrial organisms, probably including snakes by affecting their occurrence and detection. Previous studies suggest ecological relationships between snakes, water and weather conditions, but few of those consider detectability problems in their analysis. Such problems are relevant as snakes are cryptic animals and thus may be present at site and yet not detected. The Lancehead, *Bothrops atrox*, is responsible for most of the snakebites in the Brazilian Amazon and is one of the most frequent species found in Amazonia: hence, the need to understand its occurrence and activity. Data were collected on the presence/absence of *B. atrox* in a 25 km² area of terra-firme rainforest near Manaus, Amazonas. In this area, 47 sampling plots of 250 x 10 m were visited from four to five times within a one-year period. A maximum likelihood analysis was employed to estimate the effects of environmental variables (stream presence, stream order, prey [anuran] availability and rain occurrence) in this species' occupancy and detection probability. It was observed that *B. atrox* usually occupies areas close to streams, being most easily detected close to first order streams. Rainfall occurrence had a strong influence in *B. atrox* detectability, while prey availability doesn't seem to be related to its detection.

Theme: Herpetology, Snake ecology, Lancehead, Occupation, Detection, PRESENCE.

Type of Presentation: Oral presentation - Contributed

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Hemogregarine (Apicomplexa: Hepatozoidae) Prevalence in Free-Living Snakes of Central Amazonia

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Haemogregarines are intracellular parasites which use reptile and amphibian as intermediate hosts infecting their erythrocytes. Between 2005 and 2006 we covered a 25 km² area of dry-land rainforest at the Reserva Florestal Adolpho Ducke, Manaus, Brazil. We captured 40 specimens of *B. atrox* that were individually marked. Within that period we also captured 10 specimens of eight other

snake species. We prepared blood smears that were fixed with methanol, stained with Giemsa and evaluated through all its extension, searching for hemoparasites. Samples were collected between October 2005 and April 2006 (rainy season) and between June and August 2006 (dry season). For *B. atrox*, among the 40 captured snakes, eight were positive for haemogregarines. In the rainy season we collected 28 blood samples and only two (7.14%) were positive. In the dry season we collected 13 blood samples and six of those (46.15%) were positive. The only recaptured *B. atrox* had a negative blood sample, taken on rainy season (February 2006) and a later sample taken in the dry season (August 2006) had a positive result. The low prevalence found in the rainy season contrasts with the high prevalence found in samples collected during the dry season. For the other 10 snakes of eight different species, three samples were positive for haemogregarines (*Chironius fuscus*, *Lachesis muta* and *Micrurus lemniscatus*). Six species (seven specimens) were negative for haemogregarines (*Anilius scytale*, *Atractus major*, *Chironius fuscus*, *Corallus caninus*, *Liophis typhlus* and *Oxyrhopus melanogenys*). All three positive samples were collected in the dry season and no positive samples were obtained in the rainy season, similarly as observed for *B. atrox*. Results suggest that a variation in the infection rates of snakes could be occurring throughout the year. This variation could be due to: 1) complete elimination of the parasite in host-favorable environmental conditions, followed by re-infestation when conditions become unfavorable; 2) Increase of circulating gametocytes in certain environmental conditions (e.g. food restriction on dry season) with lower chance of false-negative smears, resulting in an increased number of positive samples observed; 3) Increase of circulating gametocytes in the intermediate hosts' blood could facilitate transmission to the definitive host through a higher charge of parasites in the ingested blood. Results observed in this study, do not simply describes the prevalence of haemogregarin in free-living *B. atrox*, but also suggests the importance of considering environmental and seasonal factors when working with parasites, especially those of free-living animals.

Theme: Snakes, Parasites, Hemoparasites, Reptiles, Infection, Prevalence.

Type of Presentation: Poster - Contributed

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A rapid and reliable behavioral test for the analysis of olfactory function in tadpoles. Our experience with an olfactory epithelium-specific xenobiotic agent.

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Amphibian larvae represent an excellent experimental model to study the extraordinary ability of the olfactory epithelium to regenerate its neuronal population continuously throughout life, in both physiological and pathological conditions. We have developed an experimental design in which we were able to demonstrate that immersion of *Rhinella arenarum* larvae in zinc sulphate (ZnSO_4) in sublethal concentrations provokes a massive degeneration of the olfactory tissue. The data we obtained also indicates that the normal architecture of the olfactory epithelium is restored by the third day after ZnSO_4 treatment. However, the functionality of this recovered epithelium remained to be analyzed. We decided to study this topic at its most complex level of expression, namely, the behavioral level. Thus, in the present work we try to design and perform a simple and reliable method to test larvae behavior that may help to answer the crucial question: 'Do the "recovered" tadpoles smell or not?' The method we propose here consists in analyzing the responsiveness of larvae to an olfactory stimulus that indicates the presence of food. We tested different experimental settings to eliminate the influence of cues arising from visual and lateral line sensory systems. We also tested different experimental conditions, such as food deprivation before the test and number of individuals used for the test, in order to improve the sensitivity of the method. The test was performed in ZnSO_4

treated animals right after the end of the immersion and at several times post-treatment, as well as in control animals. We observed that shortly after treatment there is no response to the olfactory stimulus, whereas since the second day and thereafter the responsiveness is restored and exhibits the same timing that the response registered for control animals. These results are in accordance with the previous histological observations and suggest that the sensorial ability of the olfactory epithelium recovered after injury is as efficacious as that achieved during the normal physiological turnover of the olfactory neurons. On the other hand, these observations argue in favor of both the utility of behavioral tests to assess the functionality of the olfactory system and the possibility of using them in “non traditional” species, such as amphibians.

Theme:Anurans, behavior, physiology

Type of Presentation: Oral presentation

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National Strategy for the Conservation of the Amphibians in Venezuela

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Given the importance of amphibians and the threats for their survival, the Ministry of Environment of Venezuela and the herpetological scientific community had shown concern for the evidence which demonstrate the population decline of certain anura species along the Andean and Coastal Range. For this reason the Ministry and Conservation International Venezuela, with the participation of Fundación La Salle de Ciencias Naturales and the Instituto Venezolano de Investigaciones científicas and other collaborators, have written the National Strategy for Amphibian Conservation in Venezuela, which is the first in the world. This preliminary document has been discussed and consulted with national specialists in five national workshops (open to the public). It includes twelve chapters of the current knowledge and the action plan proposal organized in seven strategic lines with the actions suggested.

Theme:Amphibians, conservation biology, National Estrategy, Venezuela

Type of Presentation: Poster

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Hibernation Ecology Of The Eastern Massasauga Rattlesnake In Michigan

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The Eastern Massasauga (*Sistrurus c. catenatus*) is a candidate species for listing as federally threatened, and as endangered or threatened in all states in which it occurs except Michigan, where it is listed as a species of special concern. We report on an ongoing study of the hibernation ecology of

populations of massasauga from Michigan. Although our knowledge regarding specific locations and structures used by snakes during hibernation is improving, it is often unclear why these locations are chosen, and very little is known about factors that may contribute to overwintering success. Our objectives for this study were to determine the physical structure of hibernacula and their distribution in the landscape, as well as to determine the physical and biotic factors that contribute to successful hibernation. Understanding the specific habitats chosen for hibernation and how those habitats are distributed in the landscape is crucial for developing successful management plans for this declining species. We located hibernacula in the fall using radiotelemetry and made observations of snakes throughout the winter using a flexible fiber-optic borescope. We report on findings from sites with and without crayfish. Where present, crayfish burrows provided the usual hibernation sites. In the absence of crayfish burrows, snakes used a variety of structures including mammal burrows, root mounds, stumps, and sphagnum hummocks. Hibernacula tend to be located on the edge of snake activity ranges and some snakes traveled large distances between summer activity centers and hibernation sites. They also demonstrated strong fidelity to their hibernation locations. We collected data on groundwater chemistry, soil composition and ground temperature at known hibernacula and at randomly chosen locations and will report on analyses of those data.

Theme:reptiles, snakes, rattesnakes, ecology, conservation, natural history, hibernation, behavior

Type of Presentation: Poster

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Conservation Genetics of the Endangered Earless Dragon (*Tympanocryptis pinguicolla*) in the Vanishing Native Grasslands of the Australian Capital Territory and New South Wales

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Native temperate grassland once dominated the natural landscape of Southeastern Australia. European settlers cleared most of it for agricultural purposes in the 1800's, and today it continues to be transformed by urban and rural development. This has had devastating effects on the fauna dependent on this endangered ecosystem. The Grassland Earless Dragon (*Tympanocryptis pinguicolla*) is a small diurnal lizard, which occupies the last remaining remnants of this habitat type. It was once widespread, but now appears to exist as small, disjunct populations isolated from one another by landscape fragmentation. The primary aim of this research is to define the Evolutionary Significant and Management Units for *T. pinguicolla* using molecular genetics techniques. More specifically, we will investigate the hypervariable sequences of the mtDNA control region to establish the level of population structuring across this species current range, and build a microsatellite library to examine the genetic variation present at these loci in order to determine levels of inter- and intra-population variation and to estimate gene flow and dispersal rates among populations. Understanding the relatedness among *T. pinguicolla* populations is an essential component for determining management guidelines for this endangered reptile. This research will help to identify factors that are important for this species persistence in this highly-altered and fragmented landscape, and how it may respond to further habitat destruction, stochastic demographic phenomena, and climate change.

Theme:conservation, endangered species, Evolutionary Significant Units, genetics, lizards, Management Units, microsatellite DNA, mtDNA control region

Type of Presentation: poster

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Monitoring Amphibians and Reptiles in Europe

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The project EuMon "EU-wide monitoring methods and systems of surveillance for species and habitats of Community interest" develops tools to optimize and promote biodiversity monitoring in Europe. These tools are relevant for the development of an EU Herpetofauna Monitoring Network and for the national duties concerning the reporting due to Article 17. We will highlight outputs that help designing such a network. We will give (i) general recommendations for survey design and data analysis for biodiversity monitoring, (ii) we will show examples from our database of existing herpeto-monitoring schemes in Europe, (iii) we will provide definitions of a comprehensive framework for integrating monitoring schemes across methods, species and countries, (iv) we will give guidelines how to promote volunteer involvement, and (v) we will explain methods determining national responsibilities and conservation priorities for species conservation.

Theme: amphibians, reptiles, monitoring, conservation, Europe

Type of Presentation: oral

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The role of paleontological information in the conservation of crocodylians

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Extinct species can inform efforts to preserve their living relatives. They provide a critical baseline for studying the responses living organisms to ecological changes, including the means to predict whether particular morphological or physiological features are correlated with likelihood of extinction or ability to recover from a bottleneck; but they also suggest a broader range of ecological tolerances than might be expected only from the modern. In a phylogenetic context, fossils also constrain the timing of lineage divergences and biogeographic events. The crocodylian fossil record, covering the past 80 million years, is an excellent source of this kind of information. It suggests that while some lineage divergences are very deep, most divergences within species-rich clades (caimans and *Crocodylus*) took place within the past 10 to 20 million years, challenging the commonly-held misconception that crocodylians are evolutionarily static "living fossils." Crocodylian historical biogeography is dominated by dispersal, including multiple crossings of marine barriers, and suggests that some lineages currently restricted to freshwater arose from coastal or marginal marine ancestors; indeed, this ability to disperse complicates our understanding of the population genetics of species groups distributed across archipelagos. The relationship between sensitivity to ecological change and morphological specialization is weak within the group, and crocodylians have shown a remarkable ability to rebound from diversity lows (most of which in the past resulted from global temperature fluctuations), especially when area of appropriate habitat expands; but ability to recover and diversify is correlated with the presence of potential ecological competitors, suggesting that efforts to preserve and expand crocodylian-friendly ecosystems must include an emphasis on limiting the spread of invasive species.

Theme: crocodylians, taxonomy, palaeontology, endangered species, conservation biology

Type of Presentation: Oral, Symposium 7: The biology and management of crocodylians.

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The Indigo Snake Initiative: Turning the Tide of Rare Snake Conservation

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Project Orienne: The Indigo Snake Initiative is a newly formed conservation organization focused on the range wide conservation of eastern indigo snakes (*Drymarchon couperi*). Despite being on the United States Endangered Species List indigo snakes have received little attention relative to many other listed species (i.e., charismatic mega-fauna). The Indigo Snake Initiative is turning attention to this snake by providing expertise and resources to create one of the largest snake conservation efforts in the world. To achieve conservation outcomes, we are currently working on land acquisition, land management, reintroduction, inventory, monitoring, and research programs. We have two primary approaches to indigo snake conservation. First, to purchase, protect, and manage land in areas where indigo snake populations remain strong. Second, to conduct research to understand the cause of snake declines, mitigate the factors that have caused the declines, conduct land management to restore habitats, and reintroduce snakes into areas where they have been extirpated. The Indigo Snake initiative is a collaborative effort including over 15 partners working together as a coalition. I will present the strategic plan for this organization as well as some of our research projects focused on determining the factors responsible for the snakes decline.

Theme:reptile, indigo snake, conservation, captive breeding, reintroduction, land protection

Type of Presentation: oral contributed

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Comparative placentation: what does it tell us about the evolution of viviparity?

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Mammals display an impressive variety of placental types from the epitheliochorial in which the uterine epithelium remains intact to the endotheliochorial and haemochorial in which first the uterine epithelium and then the uterine endothelium as well as the uterine epithelium are breached. This diversity of placental types is difficult to understand in terms of natural selection and a recent explanation which has attracted interest - the “viviparity-driven conflict hypothesis” - posits that competition between mother and embryo causes a rapid tug-of-war between the two genomes resulting in an antagonistic coevolution and diversification of reproductive traits. Conflict for resources, in this view, promotes fast - and somewhat random - diversification of feto-maternal interaction. While these discussions on the origins and reasons for this variety of placental types in mammals are interesting, they do not adequately encompass groups of animals other than mammals which have also evolved complex placentas. Moreover, unlike in mammals where there has been only one origin of viviparity, in some animals such as squamates, many origins of viviparity have been independently evolved and are moreover, relatively recently. In squamates, all the placentas so far studied are of the epitheliochorial form albeit with considerable variation of this type. If competition for resources drives diversity of placental types in mammals, why not also in squamates and then why have so many squamates, independently, all evolved the same major placental type? This paper argues that the reason for the diversity of placental types is more likely to be found in fundamental cell biology and in particular, transport across maternal plasma membranes. In the

epitheliochorial, all transport must be across the plasma membranes of both the uterine epithelial cells as well as uterine endothelial cells, whereas in the other placental types membrane transport is sequentially reduced such that in the haemochorial there is no maternal plasma membrane barrier. If placental transport of nutrients which are more important in some species than others is more efficiently driven by plasma membrane-bound molecules than by diffusion from blood, then this could select for that placental type. Thus for some molecules, it is proposed that an epithelial barrier is a more efficient transporter than no barrier and this is dubbed the “Efficient Barrier” model of placental diversity.

Theme:reproduction, lizards, physiology, morphology

Type of Presentation: Oral, Symposium 1: Reproduction in reptiles: from genes to ecology

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An Outline of Illustration of *Chelonia mydas* and Related Early Marine Chelonian Works

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Understanding thought processes and attitudes behind early marine turtle literature and illustrations of *Chelonia mydas* are vital in the attempt to place them into perspective in the historical record. The earliest surviving record of human endeavors is found in rock art. Even in these times, humans were struggling to better understand their world, documenting it through pictures, with the oldest rock art images evolving to modern photographs. This metamorphosis progressed through a variety of media such as stone, p

Theme:*Chelonia mydas*, reptiles, sea turtles, turtles, ethnozoology, historical works & illustrations

Type of Presentation: Poster - Contributed

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Analysis of the stomach contents of two species of turtles of the Amazon: *Peltocephalus dumerilianus* and *Podocnemis erythrocephala*.

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Knowledge about the feeding habits of turtles is of vital importance for their conservation. The purpose of this study was to identify differences in food items found in the stomachs of *Peltocephalus dumerilianus* and *Podocnemis erythrocephala* in different seasons and habitats. The feeding of these species was studied from the analysis of 126 stomach contents, 43 of *P. dumerilianus* and 83 from *P. erythrocephala* that were collected in Barcelos, Daraquá in the basin of Rio Itú, Rio Negro-AM, in the period May to August 1998. Turtles were collected in fyke nets Stomachs were also obtained from the local river people when they were buthcering turtles to eat. Turtles caught in fyke nets were stomach flushed without sacrificing the animal (Legler, 1997). All contents were preserved in 70% EtOH. The analysis was performed by volumetric method and expressed as percentage (Hyslop, 1980). The frequency of occurrence that considers the percentage of each item of the total number of stomachs was used to describe the feeding habits. For comparison between the variables season and

habitat, we used both the volume and frequency of occurrence of food items. Both species had the same food items - seeds, fish (remains of meat, bones and scales), plant material (leaves and bark, seeds) and parts of insects and crustaceans. The differences occurred in relation to the total volume of content and in relation to the frequency of occurrence of items. Seeds and plant material predominated in the diet of one species appearing in a relatively high percentage of the total volume of content. *P. erythrocephala* is predominantly herbivorous species, with 88.8% of the volume of their stomach contents presenting seeds and vegetable matter. The consumption of fish was higher in *P. dumerilianus*. This result was different from that found in Venezuela for the species (Perez and Paolillo, 1997). Possibly *P. dumerilianus* has preference for consuming animal matter as molluscs and fish, but in the absence of those they consume seeds.

Theme: turtles, ecology

Type of Presentation: Poster __ contributed or __ symposium, number of symposium

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Paternity analysis using microsatellite markers in clutches of *Podocnemis erythrocephala* (Testudines, Podocnemididae) from two localities of the Brazilian Amazon.

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The genus *Podocnemis* comprises six living species, among those *P. erythrocephala* (irapuca) is the smallest species and is easily distinguished from its congeners because of its small size and distinctive male bright red head markings. The South American podocnemids represent a large resource for the inhabitants of the region, being exploited for their meat, eggs, oil and other valuable products. Data are available with respect to the reproductive biology of the species of the genus *Podocnemis*, however little has been done more specifically with respect to the system of reproduction. Considering the total absence of these data in *P. erythrocephala*, and with the goal of contributing data on their system of reproduction, the main goal of this study was to identify the type of relationship among individuals of each nest of the irapuca using microsatellite markers. Using 4 microsatellite loci, we analyzed 6 nests in the Brazilian Amazon (Santa Isabel do rio Negro and Parintins), and we observed the existence of multiple paternity in this species. All juveniles from each nest were analyzed. The genotypes of each juvenile from each nest were identified, and because a sample of female's DNA was not available, the maternal genotype was inferred using homozygous individuals in each nest. The analysis of paternity type we used the method of counting of alleles in each locus at each nest. Our results show that this species is promiscuous; we observed multiple paternity in 5 of the 6 nest analyzed. The nest with single paternity was from the region of Parintins. Studies of reproductive biology, including types of paternity, in addition to being important for the understanding of evolutionary and genetic processes, also provide information that aid chelonian management projects. Our data suggest one possible difference between reproductive patterns of the different populations. This study provides important information with respect to the relative contribution of pairs involved in mating, and should be considered as the natural reproductive strategy for the preservation of genetic diversity of this species. In future studies, it would be interesting to compare nests of different localities to determine if there exists a difference in reproductive strategies in this species among different localities, and with this information to form differentiated management programs.

Theme: *Podocnemis*, irapuca, paternity, microsatellite, reproduction, turtles

Type of Presentation: Poster

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Evidence for mimicry of scorpions by the gecko *Gymnodactylus geckoides* (Squamata, Gekkonidae) in Northeast Brazil.

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Mimicry comprehend the morphological and behavioral adaptations that provide better efficiency in the exploration of the environmental resources, therefore, it is an important strategy that improves the capacity of survival of the organisms. Evidences for mimicry of scorpions by lizards are not observed frequently. There are some registers related to the family Gekkonidae, for example, juveniles of the Chinese gecko *Teratosincus roborowskii*, similar to the sympatric scorpion *Mesobuthus* sp. Evidences for mimicry involving the Brazilian geckos *Gonatodes humeralis* and *Coleodactylus brachistoma* and scorpions were recently reported in Central Amazon and Cerrado Biome respectively. We present here new evidences for mimicry of scorpions for another species of gecko, *Gymnodactylus geckoides*, in an area of the Caatinga biome located in the city of Pentecoste, State of Ceará, in northeast region, Brazil. The mimicry behavior was observed repeatedly in an individual of *G. geckoides* after this being placed together with a specimen of *Hemidactylus mabouia*, captured in the same area. In the occasion, we made detailed photographic registers of the behavior using a digital camera Fujifilm s9100. Three species of sympatric scorpions were abundantly found in the same pitfall traps, fact that demonstrates the magnitude of its populations and the determination of the micro-habitat explored by each species, corroborating with the evidence of mimicry adaptation for *G. geckoides*. The scorpions species found in the area were: *Rhopalurus rochae* (Family Buthidae), *Bothriurus asper* and *Bothriurus rochai* (Family Bothriuridae). The stimulation that induced the initiation of the mimicry process consisted of the direct contact between the lizards or, simply by the approach of the *H. mabouia*. The behavioral process consisted of the rising of the tail with a subtle bending and immobility, thus the lizard demonstrated similar position to the one of the scorpions. Dorsal and caudal color patterns, as well as the tail bending directed to the previous extremity of the proper lizard indicate the mimicry relationship between *G. geckoides* and sympatric scorpions and strengthens the knowledge about the presence of this behavior in the Family Gekkonidae.

Theme:reptiles, lizards, behaviour,

Type of Presentation: Poster

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Comparative analysis of the trophic resource use by *Rana temporaria* populations inhabiting alpine and subarctic habitats

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The Common Frog (*Rana temporaria*) is widespread in Europe, surviving in extremely harsh environments, like the subarctic and alpine regions. Climate change has a high impact on the ecosystems of those regions and amphibian populations inhabiting them are known to be more vulnerable than populations at lower latitudes and/or altitudes. Studying the life-history of Common Frog populations in these extreme habitats is thus useful for predicting their response to global

changes. Trophic resource availability and use were studied in Common Frog populations from the subarctic (Kilpisjärvi, Finland) and from alpine populations above 2000 m (Retezat National Park, Romania). For comparison, low altitude (700-900 m) populations were included in the study. Ice free period ranges from about 3 months (Finland) to 5-6 months (alpine) up to 7-8 months (low altitude). There were no significant differences in size between the populations studied. Trophic resource (i.e. prey) availability was estimated from pitfall traps and netting. The dwarf vegetation, lacking complexity and stratification allowed for a good estimation of the availability and accessibility. Trophic resource use was assessed by stomach flushing, after a weak anaesthetizing of individual frogs. Prey availability differed only marginally significant between stations and zones. There was a weak correlation between frog body size and prey size, while prey diversity was strongly predicted by frog body size. Prey taxa diversity and the average number of prey per stomach increased from low altitude towards high altitude and peaked in the subarctic populations. Despite this higher trophic resource use in subarctic populations, frogs still manifested selectivity in feeding, with some taxa being preferred while others avoided.

Theme:amphibians, anurans, ecology

Type of Presentation: poster

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Setting priorities in conservation – from reactive to proactive

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The conventional approach in species-based conservation for setting priorities is to focus on species and/or populations at high risk of extinction. This is mostly based on the use of existing Red Lists at different space scales, ranging from global to local. This approach did not stop until now the worldwide decline of amphibians and reptiles. We argue in favor of shifting the prioritization criteria from preventing extinction of endangered species, to preventing abundant and widespread species from becoming endangered. The present-day distribution of herpetofauna in Europe was shaped by Pleistocene-Holocene glaciations, and is the result of recent colonization from the southern Iberian, Italian and Balkan glacial refugia. The Balkans are the centre of endemism in Europe, with ca. 28% of amphibians and 21% of reptiles being endemic. They are also a centre of intense speciation within some taxonomic groups. Many widespread amphibian and reptile species still abundant in the Balkans are becoming rare and endangered at their western and northern range limits (e.g. *Bombina orientalis*, *Pelobates fuscus*, *Emys orbicularis*, *Zamenis longissimus*, *Lacerta viridis* complex, *Lacerta agilis*). Moreover, molecular studies have indicated that genetic diversity is much higher in populations from the Balkans (e.g. *Triturus cristatus* superspecies, *Mesotriton alpestris*, *Pelobates fuscus*, *Pelobates syriacus*, *Emys orbicularis*) and support the southern richness-northern purity pattern. The Balkans still maintain a high proportion of natural biomes and habitats when compared with the rest of Europe, but rapid changes are occurring. While significant conservation efforts are made to maintain endangered populations with low genetic diversity and small chances of survival on medium and long-term, very little is done to protect the core habitats with high habitat, species and genetic diversity from the Balkans. The reactive management approach of focusing on endangered species only aims to limit the effects of man-induced changes. A proactive approach is required aimed at preventing the decline of common and widespread species, focusing on populations with high genetic diversity. Protecting areas of natural habitats in the Balkans that support abundant and diverse populations is consistent with applying the Precautionary Principle and will result in long-term benefits with relatively moderate costs on short-term. The development of networks of protected areas in the area might allow the mitigation of the present day decline through repeated

recolonization and genetic rescue.

Theme: amphibians, reptiles, conservation biology, Europe

Type of Presentation: oral

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Specializations for Placentotrophy in African Skinks and Their Evolutionary Implications

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Certain viviparous skinks show remarkable reproductive specializations that are strikingly similar to those of therian mammals. In the African lizards *Eumecia anchietae* and *Trachylepis ivensi*, females ovulate minuscule eggs, and provide the nutrients for embryonic development by placental means. In typical viviparous squamates, nutrients are provided by the ovulated yolk. Our studies of placental morphology and development have revealed the structural basis for maternal - fetal nutrient transfer in these skinks. In both species, the uterus secretes nutrients that are absorbed by the fetal membranes. In *T. ivensi*, the newly ovulated egg undergoes invasive implantation into the uterine tissues. Chorionic cells strip away and replace the uterine lining, and establish an intimate relationship with uterine blood vessels. Such an extraordinary form of implantation has never been described outside of eutherian mammals. The presence of such specializations in squamate reptiles raises important functional and evolutionary questions. Among these is the question of whether placentotrophy has evolved convergently in African skinks and in the placentotrophic *Mabuya* of South and Central America.

Theme: lizards, reproduction, developmental biology, reptiles, morphology, evolution, viviparity

Type of Presentation: Oral, Symposium 1: Reproduction in reptiles: from genes to ecology

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Functional Morphology of the Placentae in the Viviparous Thamnophine Snake *Storeria dekayi*

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All viviparous squamates develop placentas that sustain their developing embryos during gestation. Such placentas provide oxygen and water to the embryo, but species vary in the nature and degree of nutrient provision. Our lab has been studying placental structure and function in viviparous thamnophine snakes of North America (Colubridae: Natricinae). We have used a battery of anatomical techniques in studies of placentation in the brown snake, *Storeria dekayi*, including light microscopy, scanning electron microscopy (EM), and transmission EM. By mid-gestation, two placentas have developed that are strikingly different in functional morphology. The chorioallantoic placenta shows specializations for maternal - fetal gas exchange (well vascularized tissues, attenuated chorionic and uterine epithelia, and a fragmented shell membrane). In contrast, the yolk sac placenta (omphalallantoic placenta) shows specializations for maternal secretion and fetal absorption. The uterine epithelium is secretory, and the omphalopleure shows microvilliated absorptive cells, similar to those found in garter snakes (*Thamnophis*). Comparisons of *S. dekayi* to other thamnophines and

to oviparous species (*Pituophis guttatus*) permit a reconstruction of the evolution of placental structures and their oviparous homologues in snakes.

Theme:snakes, reproduction, developmental biology, reptiles, morphology

Type of Presentation: poster, Symposium 1: Reproduction in reptiles: from genes to ecology

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Reproduction in Reptiles: A Retrospective and Prospective Vision

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The international symposium “Reproduction in Reptiles: From Genes to Ecology” offers an opportunity to consider the history and rationale of research in the field, as well as current research trends and future prospects. Historically, studies on reproduction in reptiles were rooted in a non-Darwinian scala naturae, in which a “reptilian” grade was seen as ancestral to a mammalian one. Thus, studies on reptiles were deemed significant for what they might reveal about eutherian mammals. Through the maturation of comparative biology during the 20th century, reptilian taxa became viewed as worthy of study in their own right. Several conceptual advances ushered reproductive research on reptiles into the modern era, including (1) the development of life history theory; (2) the use of phylogenetic (cladistic) approaches, and (3) the use of explicit tests of falsifiable evolutionary hypotheses and assumptions. As evident from contributions to our symposium, contemporary research on reproduction in reptiles is multi-disciplinary and diverse, and draws on descriptive, experimental, and analytical methods that range in scope from molecular genetics through ultrastructural analysis through experimental ecology. Phylogenetic analysis continues to prove valuable in directing research and interpreting data. As evident from our symposium, a dynamic tension exists between our need for development of “model” species that are understood at molecular through organismal and ecological levels, and wide-ranging explorations of phylogenetic diversity. The crisis in biodiversity makes studies of diverse taxa particularly critical, as much of this diversity may be gone within the present century.

Theme:reptiles, lizards, snakes, turtles, crocodilians, sphenodonts, reproduction, developmental biology, morphology, behaviour, genetics, ecology, natural history, physiology,

Type of Presentation: Oral, Symposium 1: Reproduction in reptiles: from genes to ecology

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Preliminary Results on the Higher-level Relationships of Squamate Reptiles based on 24 nuclear loci

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Assembling the Tree of Life program is an NSF-funded initiative to understand the evolutionary relationships among all living organisms. The Deep-Scale project is part of this program and our aim is address higher-level relationships among squamate reptiles. The group Squamata includes snakes, lizards, and amphisbaenids, which are characterized by possessing hemipenes (paired copulatory organs), among many others synapomorphies which unite them. This group contains many examples of 'model organisms' for biological studies, such as the evolution of limb-loss, viviparity, adaptive radiations, and numerous ecological and life history trait attributes, which make them ideal candidates for these and many other investigations. Our understanding of the phylogenetic history of squamates, traditionally based on morphology, has hypothesized relationships illustrating a linear progression of tongue morphology, which placed the Iguania, with a fleshy-blob tongue used for food gathering, as the basal lineage, with the transition to Scleroglossa that included the geckos with chemoreceptive tongues, and finally to the Autarchoglossa, which included the Scincophora and Anguilliformes that possess snake-like tongues used primarily for chemoreception. Recent molecular analyses using mitochondrial and nuclear DNA place the Iguania in a more derived position, closer to snakes and the Anguilliformes. However, these analyses were based on few gene regions and small numbers of nucleotides. Here we present preliminary results of the Deep-Scale project from 24 nuclear protein coding loci, approximately 18 kb in size, for a sample of taxa representing the major clades of Squamata. The loci were selected specifically for this project by a process targeting single-copy genes, with an appropriate amount of genetic variation among vertebrates, and regions attainable using single PCR and sequence reactions. Parsimony and preliminary Bayesian analyses largely agree with recent molecular studies, with only minor differences. We discuss these differences and the implications of the molecular data for the evolution of squamate reptiles.

Theme:molecular data, squamates, systematics, tree of life

Type of Presentation: oral

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Post-prandial thermogenesis in the Brazilian lancehead, *Bothrops moojeni* (Serpentes: Viperidae)

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Snakes were for long considered as being incapable to generate heat fueled by aerobic metabolism, except for brooding pythons. However, recent studies proved that at least some species are capable to produce and to keep elevated body temperatures without muscle contraction or external heat source. Such thermogenic capacity supported of metabolic rate that follows the process of digestion and assimilation of food (specific dynamic action - SDA). Snakes have a low maintenance cost and most of species can stand long fasting time, particularly following a great meal ingestion. The energy produced during the digestion of such great meal can generate a significant increase in the body temperature. The present study investigated thermogenic response after feeding in the Brazilian lancehead, *Bothrops moojeni*, using thermal images taken in temperature controlled environment at 30°C. The 12 snakes were divided into two groups and followed for 72 hours after fed a meal representing 10-20% and 30-40% their body weight, respectively. The results showed thermogenic digestion response with an increase up to 1.6 °C of skin temperature. Thermal heat production peak occurred between 33 to 36 hours after feeding in both groups, and the duration of thermogeny varied with the meal size. The result shows high correlation with the data on SDA in snakes. The significant increase of body temperature after feeding and its maintenance for extended time suggest a physiological advantage to keep high metabolic rate despite of environmental temperature.

Theme:Bothrops, moojeni, thermogenesis, specific dynamic action

Type of Presentation: Poster

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Reptiles Spatial And Weather Distribution Of Parque Ecológico Altamiro De Moura Pacheco, GO.

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In this present work, we studied the spatial and temporal event of reptiles species at Parque Ecológico Altamiro de Moura Pacheco, located in Goianópolis, Goiânia, Nerópolis and Terezópolis towns, in Goiás state, in an attempt to estimate the spatial population through the seasonal time. The activities started in February of 2007 with bimonthly collections of 10 days in the field. 9 collecting points were marked reaching all study area, with antropogenics formations (poulties, orchard and pastures), mesophytic woods and gallery woods. Two collecting methods were used: 10 capture stations with pit-fall, four 20 liters buckets buried in ground, in "Y" formation, connected with canvas, being checked at 8:00 a.m., 3:00 p.m. and 5:00 p.m. and scanning with herpetological hook in day and night time above leaves, in termite mounds and fallen trunks, like wise searching for animals vestiges like, for example shed skins. 150 species were collected representing two Orders, Squamata and Chelonia. In Squamata were registered the suborders, Amphisbaena, Sauria and Serpentes. In suborder Amphisbaena were registered one specie of Amphisbaenidae family (representing 3,7%), suborder Sauria with Anguidae and Gekkonidae families (1 specie each, representing 7,4%), Scincidae, Teiidae and Tropiduridae families (2 species each, representing 22,22%), suborder Serpentes with Boidae family (3 species, representing 11,11%), Colubridae family (10 species, representing 37,03%) and Viperidae family (2 species, representing 7,4%). From Chelonia Order were registered species from Chelidae and Testudinidae families (with 1 specie each, representing 7,4%). The studied community shows spatial distribution influenced by relief and vegetation, and weather distribution due to precipitation and air temperature.

Theme:reptiles,conservation biology,ecology.

Type of Presentation: _Poster_ contributed

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A model to estimate home range of species for management purposes that accommodates small datasets

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Current methods of calculating home range rely on large datasets, gained over extended periods. When a species is sparsely distributed, individuals remain inactive for extended periods of time, and/or there are resource constraints, developing credible home range estimations are problematic. In our poster presentation we present a method for estimating home range, based on simulations developed in ArcView 3.2. This model assumes that tracking data are dependent and sequential and

can therefore be treated as repeated measures data. This removes the imperative to discard data to meet the assumption of independence. Outliers are also not discarded. All sequential data points are used to generate a curve similar to that of the simulation, and the programme then compares the input data with the model, and uses Mahalanobis distances to estimate which model curve best fits the data. As the home range boundary progressively extends, output includes a running estimate of the projected total home range of the target individual. The output includes a measure of variation over a pre-determined number of previous days as a surrogate confidence level for the day's home range estimate. When the average deviation drops to an acceptable level (e.g. <5%), data collection can be terminated. We present evidence of the efficacy of the programme to calculate home range estimates with fewer data points with a measure of confidence, using simulation data developed using human subjects to create a 'random walks' database, within both a constrained and unconstrained area. The use of a stopping rule enables a suitable sample size to be reliably determined.

Theme: community ecology, behaviour, conservation biology

Type of Presentation: poster - contributed

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The State System of Protected Areas (SEUC – Amazonas) and its Contribution to the Maintenance of Amphibian and Reptile Diversity in the Brazilian Amazon

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Forty six priority areas for conservation of herpetofauna have been indicated for the Brazilian Amazon, of which eighteen are located in the state of Amazonas, Brazil. The State System of Protected Areas (Sistema Estadual de Unidades de Conservação – SEUC) has 34 protected areas (PA), totaling 16.5 million hectares. A national innovation, this System has focused on biological assessment aiming at supplying relevant information to create new PA and to elaborate management plans for those in the process of implementation. In this context, this study assessed SEUC's contribution to the protection and maintenance of amphibian and reptile diversity in the Brazilian Amazon, using the map of priorities for Amazon herpetofauna conservation, developed by the Brazilian Ministry of Environment (MMA). About 20 % of the state's PA have their herpetofauna systematically inventoried. Technical reports available refer to short term studies, without use of traps where none reached stability in species accumulation curves. The average number of species indicated by such assessment is 31 amphibians and 26 reptiles, totaling more than 100 different species. Most are widely distributed in the Amazon Forest, and several records contributed to enlarging the geographical distribution for some of the species. Special attention must be given to endemic species, for those with restricted distribution, and for those which are threatened, mainly the Crocodylia, Testudines, Squamata (Boidae and the large Teiidae), and Dendrobatidae (Amphibia). Among the 18 areas previously indicated as priority for herpetofauna conservation eight are included in SEUC. However, due to political boundaries and private property most of priority areas for herpetofauna are not completely included in PA. Thus, if the legally PA are not enlarged, important portions of Amazon herpetofauna will remain under permanent threat, and part of herpetofauna could be lost. Two new PA (Barcelos and Pauini municipalities) are currently being created, which will reduce the number of unprotected priority areas from nine to seven. Based on the available data

it was not possible to conduct further analyses upon herpetofauna assemblage. Nonetheless, most of mentioned diagnoses are the results of initial efforts in data collection, revealing important information for herpetofauna conservation, and a large potential to increase knowledge about these groups, including records of new species. These indicators reveal the importance of SEUC's strategic actions, contributing to public policies of conservation in the state of Amazonas, contributing to fill gaps of knowledge about regional biodiversity, especially about Amazon herpetofauna.

Theme:Herpetofauna, protected areas, conservation, Amazon, Brazil

Type of Presentation: Oral

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Patterns and mechanisms of limb and digit evolution in tropical plethodontid salamanders.

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Tropical plethodontid salamanders display unique patterns of the evolution of body and limb dimensions, and of manus and pes reduction and elaboration. The number of body segments is fixed in the large bolitoglossine clade (which includes more than 40% of the living species of salamanders), with the exception of the widely distributed species of Oedipina (25 species), which have a greatly elongated body and tail and diminutive limbs and digits. Superficially similar species, long referred to *Lineatriton lineolus*, have independently converged on similar morphology, by elongating the individual vertebrae. Furthermore, this seems to have occurred twice, within a subclade of Pseudoeurycea. The manus and pes of tropical salamanders displays diverse form and function, and fully webbed or pad-like structures with ill-defined digits (all present internally, however) have evolved several times (in species of Bolitoglossa, Chiropterotriton and Oedipina). The largest salamander genus, Bolitoglossa (95 species), displays a full range of manus and pes, and digit, variability. New evidence shows that the likely ancestral state for Bolitoglossa was a reduced, pad-like structure. Thus, the fully webbed species of Bolitoglossa characteristic of lowland environments (where a functional role of the webbed structures was postulated by P. Alberch), and the mainly free digits in species that inhabit upland sites, have both evolved homoplastically. These latter species display anatomy that differs from that of the unwebbed to slightly webbed digits of other bolitoglossines. The developmental basis (which involves paedomorphosis and heterochrony) of the unique digits of Bolitoglossa is discussed and the earlier work of Alberch is re-evaluated.

Theme:salamanders, limbs, morphology, development, evodevo

Type of Presentation: Oral, symposium 4: Evolutionary Transitions of Body Shape in Extant Amphibians and Reptiles: Call for Integrative Approaches

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AmphibiaWeb and HerpNET: On the Cutting Edge of Herpetological Biodiversity Informatics

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AmphibiaWeb has provided on-line information on amphibian conservation, declines, and natural history since 2000. The AmphibiaWeb database contains an up-to-date list of all amphibian species recognized worldwide, by family, striking a balance between the most current taxonomic research and standards accepted by the herpetological community; more than 12,000 photos of amphibians from around the world via CalPhotos; and 2,400 species accounts, including many for new species. AmphibiaWeb now provides cutting-edge dynamic mapping for amphibian species by overlaying vouchered, georeferenced museum specimen data (via HerpNET) onto Global Amphibian Assessment's expert opinion maps. Among other new features, AmphibiaWeb also now provides a separate, publicly available compendium of newly named amphibian species from the scientific literature. Additionally, AmphibiaWeb serves as a testing ground for new ways to map phylogenetic information by integrating amphibian phylogenetic data from AmphibiaTree with georeferenced specimen data from HerpNET. HerpNET began in 2003 with the goal of providing a single interface for searching geospatial data for all herpetological collections. Since then, participation has grown to 59 institutions representing 12 countries, with 48 institutions available online. Our major goals for this network were to: 1) advance the development of scalable, interoperable technologies for distributed databases; 2) train the next generation of scientists in biodiversity informatics; and 3) make these locality and specimen data available globally and publicly to allow repatriation to their country of origin. By August 2008, 80% of the unique localities for 3.7 million specimens will be georeferenced and available online, with an additional 276,035 georeferenced localities available from eight non-North American collections. Georeferenced museum data available on this scale are essential for biodiversity research and species distributional modeling, and invaluable for accessing specimen data from areas currently too politically sensitive to collect. HerpNET has also developed a cache providing faster data access for dynamic mapping of museum specimens. Additionally, HerpNET staff hosted 10 georeferencing workshops in four countries, providing the opportunity for museum curators and staff to discuss use and challenges of geospatial data and data standards. Future implementations will seek funding to add more institutions, especially large, historically important collections, and to improve the data portal.

Theme:amphibians, reptiles, biodiversity informatics, collection data, maps

Type of Presentation: Poster

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Biogeography of the South and Southeast Asian Herpetofauna

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South and South East Asia is a large area with outstanding biological diversity. The area incorporates multiple biodiversity hotspots, crosses continental plates, and includes perhaps Earth's most famous biogeographic boundary. Recent years have seen the description of many new reptile and amphibian species for the region through new fieldwork and morphological and molecular research. The new taxonomies and revised distributional data have important consequences for conservation assessments as well as prompting a reassessment of biogeography. New phylogenetic analyses (particularly of molecular data) potentially allow improved tests of hypotheses of historical biogeography for South and Southeast Asian reptiles and amphibians. However, limited progress has been made in integrating data across regions and taxa, and in clarifying the nature and content of the key spatial and temporal biogeographic hypotheses and how best to test them. This talk will be an introduction to the symposium "Biogeography of the South and Southeast Asian herpetofauna", the aim of which is to gather together a diverse range of researchers to provide new data and up to date overviews, and generate discussion about major themes and approaches. New molecular phylogenetic results will be presented for an expanded test of the 'Out of India' hypothesis for Asian caecilian amphibians (Gymnophiona).

Theme: amphibians, caecilians, reptiles

Type of Presentation: Oral, Symposium 9: Biogeography of the South and South East Asian Herpetofauna.

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Migration or History: Explaining Changes in Genetic Diversity of *Rana temporaria* Populations in Southern Sweden.

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Many species exhibit a spatial structure, where local populations are subjected to various levels of gene flow depending on habitat connectivity. This type of spatial structure is evident in amphibian populations due to landscape heterogeneity, as most amphibians are closely tied to water. These local populations undergo differential dynamics including mortality and migration rates. Through time, local extinctions as well as recolonizations are common in amphibians, but their genetic consequences have seldom been investigated. Using genetic approaches we investigated variation in genetic diversity among *Rana temporaria* populations sampled in southern Sweden at two occasions separated by one frog generation. The aim of the study was to estimate how history and spatial heterogeneity are related to changes in genetic diversity and population structure. Among nine populations for which population size has been estimated yearly since 1990, 578 individuals were sampled in 2000 and 2003 and genetic variation was estimated using 6 microsatellite loci. Both the mean number of alleles and the observed heterozygosity exhibited significant changes from 2000 to 2003. While both of these estimates taken separately were associated with recent population sizes (1-2 years before sampling), the difference between allelic richness in 2000 and 2003 was significantly correlated with the population size average over 7 to 13 years. The observed changes in genetic structuring of populations between sampling years were apparent, but neither in 2000 nor 2003 was this differentiation explained by geographic distance. Although migration patterns among populations and landscape fragmentation often explain most of the genetic differentiation, population dynamics are also playing a role in the levels of contemporary genetic variation. We argue that the results allow us to better understand the consequences of population size fluctuations on genetic diversity and differentiation that occur in amphibian populations.

Theme: Population size, Conservation Genetics, Amphibians, Common frog, *Rana temporaria*

Type of Presentation: oral, Symposium 10: Conservation Genetics of Amphibians and Reptiles in the 21st Century

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Colonization of newly created small ponds by newts: population patterns and individual variation

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Although pond creation is a fundamental tool in amphibian conservation, rates at which species colonize newly created habitats are poorly understood. Equally, patterns displayed by populations represent the sum of the patterns displayed by individuals, yet there are few data describing variation between individuals in how they use new ponds. In 1998 four small ponds were created on the University of Kent campus to monitor natural colonization by amphibians. The ponds were constructed from PVC liners, were identical in size and shape, and were spaced out at 2 m intervals. In 1999 all four ponds were used by all three species of newts native to the UK. The population sizes of all species increased over the next three years, peaking in 2002-2003. In the great crested newt (*Triturus cristatus*), there was considerable variation between individuals in capture rates and the timing of movements into the ponds. Some individuals stayed in a single pond all season, others wandered between ponds, and some newts skipped breeding altogether for up to two successive years. Some individuals were more likely to enter aquatic newt traps than others. In the winter of 2005 the ponds were drained and refilled, and in doing so all predatory invertebrates were removed. This had no discernable effect on the numbers of newts returning to breed over the following two years, but in 2008 the number of first-time breeders increased significantly, presumably because of enhanced recruitment following pond drainage two years earlier. Some great crested newts that colonized the ponds in 1999 are still returning to the same ponds nine years later, and must therefore be at least 10 years old. There is a relatively high rate of pond occupancy by newts within the wider landscape, and their use of small ponds may be related to wider metapopulation dynamics.

Theme: Amphibians, salamanders, natural history, reproduction, behaviour, conservation biology

Type of Presentation: oral contributed

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The Brazilian Amphibian Conservation Action Plan

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Brazil has the highest amphibian diversity in the world, with 825 known species. The idea that there is a scarcity of knowledge about species composition data, taxonomy, geographical distribution, natural history and ecology of all this diversity is a consensus within the scientific community. Besides the absence of more detailed information about amphibian species in many regions, some of them are already suffering due to the intense process of anthropogenic change, as in the central region of Brazil and the south of Amazon. In September 2005, the Amphibian Conservation Summit (ACS) took place as a response to the alarming findings of the Global Amphibian Assessment (GAA),

which brought together scientists from around the world to determine how to address the decline and extinction of amphibians. The ACS wrote the Amphibian Conservation Action Plan – ACAP, published in 2007. There are relatively few reports about amphibian population declines taking place in Brazil and only about 2% of Brazilian species have been recognized as threatened with extinction. Unsatisfactory levels of taxonomic knowledge inevitably leads to scarcity of data on geographical distribution and the impossibility of an accurate conservation status assessment. It is therefore not surprising that the most numerous category in the various threatened species lists available (with the exception of “Least Concern – LC”), is “Data Deficient” (DD). Based on these facts, the establishment of a Brazilian Amphibian Conservation Action Plan (BACP) is of the foremost urgency. During the Third Brazilian Congress of Herpetology, in July 2007, the first step towards developing a BACP was presented. Herpetologists, representing all regions of the country discussed the importance of basic studies (taxonomy, systematic and natural history) for population declines assessment and design of conservation strategies. Also stressed was the importance of establishing unified protocols for population monitoring and disease research, among others. From this first meeting, a draft was developed of what will be the action plan, following the ACAP model. This first version of the plan addresses the following main lines of action: documentation of the amphibian diversity, development and implementation of long term conservation programs, research into the causes of decline and extinction, and immediate actions.

Theme: amphibians, anurans, salamanders, caecilians, conservation biology, captive breeding, endangered species, Brazil

Type of Presentation: Oral, Symposium 14: Amphibian conservation.

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Chemical Aspects of Dietary Toxin Sequestration in the Asian Snake *Rhabdophis tigrinus*

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Rhabdophis tigrinus is an Asian natricine snake that possesses unusual defensive glands on the dorsal surface of its neck. These nuchal glands typically contain cardiotoxic steroidal toxins known as bufadienolides, which also are abundant in the skin of toads. Feeding experiments demonstrated that toads consumed as prey are the ultimate sources of the bufadienolides in nuchal glands of *R. tigrinus*. Furthermore, snakes on a toad-free Japanese island (Kinkasan) lack these compounds in their nuchal glands, demonstrating that these snakes are unable to synthesize defensive bufadienolides. However, when snakes from Kinkasan are fed toads in the laboratory, they accumulate bufadienolides in their nuchal glands, indicating that they have not lost the ability to sequester defensive compounds from prey. In contrast, *R. tigrinus* from a toad-rich island (Ishima) possess large quantities of bufadienolides, reflecting the abundance of toads from which these compounds can be sequestered. Feeding experiments involving gravid *R. tigrinus* demonstrated that bufadienolides can be provisioned to offspring so that hatchlings are chemically defended before their first toad meal. Interestingly, provisioning of bufadienolides can take place through two routes: by deposition in yolk and by diffusion across the presumably shelled eggs *in utero* late in gestation. In a separate experiment, we applied bufadienolides to the surface of eggs from Kinkasan and found that the

embryos were able to take up these compounds into their nuchal glands, demonstrating the feasibility of uptake across the eggshell. Female *R. tigrinus* provision bufadienolides to their offspring in direct proportion to their own level of chemical defense. Well-defended dams produce offspring with large quantities of bufadienolides, and dams with smaller quantities of bufadienolides in their own nuchal glands have less well-defended offspring. Although bufadienolides are found in the cutaneous glands of both toads and *R. tigrinus*, some structural differences exist between these two groups of compounds. Toads synthesize bufadienolides from cholesterol and the resultant compounds either lack or possess the suberylarginine side chain of bufotoxins. By feeding chromatographic fractions of toad toxins to undefended *R. tigrinus* hatchlings, we determined that the sequestration of these compounds involves at least three types of modification: ester hydrolysis, hydroxylation, and epimerization. Hydrolysis of the suberylarginine side chain results in the absence of bufotoxins in the nuchal glands of *R. tigrinus*. The hydroxylation and epimerization of sequestered bufadienolides may affect the transport, storage, distastefulness, or toxicity of these defensive compounds.

Theme: amphibians, anurans, reptiles, snakes, ecology, natural history, reproduction, physiology, morphology, predator-prey

Type of Presentation: Oral: Symposium 13

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Broad-shelled turtles (*Chelodina expansa*) in the lower Murray – ecological studies for management of a rare and cryptic carnivore.

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Conservation of threatened species is a priority for the management of highly regulated rivers. Since Europeans invaded Australia, the Lower-Murray River has been subject to dramatic alterations in hydrology including manipulation of the magnitude and timing of flows. With this has come ecosystem changes for both in-stream and water-dependent ecosystems, such as riparian vegetation. Currently South-Eastern Australia is undergoing a period of drought resulting in low water availability and poor water quality. This has increased the imperative for management intervention and highlighted the conflicts that can occur between water demanded to support human populations and water required to maintain healthy riverine ecosystems. The broad-shelled turtle, *Chelodina expansa* is listed as a threatened species in South Australia based on low encounter rates and application of the precautionary principle in the context of a paucity of information. The Broad-shelled turtle is a highly aquatic, large, carnivorous freshwater turtle which co-inhabits the Lower Murray with two other more common turtle species. The Murray River turtle (*Emydura macquarii*), is a habitat and dietary generalist; and the eastern long-necked turtle (*Chelodina longicollis*), inhabits ephemeral backwaters, where it feeds on insects. Broad-shelled turtles are cryptic in the Lower Murray, yet we found substantial populations in both riverine and billabong waters. Aquatic habitat use of the turtles included all available types: the main river channel, shallow backwaters and swampy lagoons. Male turtles can move large distances, up to 40km along the river, whilst females strictly occupy far smaller, discrete home ranges. Our data provides support for management initiatives to restore the quality of riparian vegetation in the Lower Murray and associated wetlands. Movements between off-channel billabongs and the main river channel are common, and predicate against recent management action to isolate many off-stream billabongs for water quantity and quality purposes.

Theme: turtles, ecology, conservation biology, endangered species.

Type of Presentation: Oral, Symposium 15: Development and Implementation of Recovery Programs for Endangered Chelonians.

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Tegus go dormant. Physiological consequences and proximal factors involved with the seasonal metabolic depression in a lizard

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The tegu, *Tupinambis merianae*, is a large South American teiid lizard which is active only during part of the year (hot summer months) spending the winter cold months sheltered in burrows dug in the soil. This pattern of activity is reflected on a suite of seasonal physiological adjustments including changes in thermoregulatory behavior, metabolism, and gas exchange parameters. During the summer months, tegus exhibit a marked circadian pattern of temperature fluctuation with body temperature rising rapidly in the morning with basking, slowly continuing to increase during the day, and then gradually declining once animals re-enter the burrow in the evening. At the onset of the dormancy period, animals retreat into the burrows and stop all external activities. Thus, during this season, the circadian changes in metabolism disappear and body temperature fluctuations merely reflect the ambient thermal profile of the shelter. Metabolic rates are higher in spring and summer than in autumn and winter regardless temperature (from 17 to 30°C) and body size (from 10 g to 3.7 kg). The decrease in oxygen demand during dormancy is accompanied by a change in the pattern of lung ventilation, which becomes episodic. Blood parameters involved with oxygen transport are also known to change seasonally. Thus, while blood oxygen affinity is higher in dormant lizards, hemoglobin content is greater in the active ones. These results indicate a change in the relative importance of oxygen extraction/delivery with seasons and the need of a higher blood oxygen-carrying capacity for summer active animals. The metabolic depression occurring at the cold months may involve, as a final step, the voluntary confinement of the animals inside the burrows and the consequent exposition to a situation of dark and decreased body temperature. Indeed, if these conditions of dark and cold (17°C) are simulated under laboratorial conditions, tegus are able to reduce their metabolism to the low rates seen during winter dormancy at all times of the year. Other proximal factors involved with the triggering of the seasonal physiological adjustments exhibited by tegus remain to be investigated.

Theme: lizards, physiology, thermoregulation, energetics, metabolism, respiration

Type of Presentation: Oral, Symposium 12: Ecophysiology of Reptiles

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Abundance pattern in *Rhinemys rufipes* Spix (1824), Chelidae, on a terra firme forest reserve of 10 km² in Central Amazon

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Rhinemys rufipes (Spix 1824) is a chelid turtle with cryptic and mostly nightly behavior that lives in small streams in terra-firme rainforests in the Western Amazon. A population of this species occurs in the Adolpho Ducke Forest Reserve, near Manaus, Amazonas state, Brazil. In the 1990s a population of this specie that occurs in the Adolpho Ducke Forest Reserve was the object of a series of studies about the biology of this turtle. The reserve has an area about 10000 ha and is located near Manaus,

Amazonas, Brazil. Presently the reserve is still in good conservation state, but is becoming increasingly isolated from continuous forest areas due to the urban expansion of Manaus. The scope of this study was to evaluate the abundance, occupancy patterns and dispersal capacity in the RFAD, once isolated populations of long-lived organisms such as chelonians are particularly more susceptible to adverse effects due to habitat isolation. We also compared our estimates with estimates generated for this population in the 1990s. Throughout 2007 we carried out four mark-recapture sessions in 5km transects of four different streams in the RFAD. We estimate adult abundance for each sampled transect, and extrapolated the abundance estimate for all streams in the RFAD. There were high heterogeneity in capture probability and abundance were estimated in of approximately 52 adult animals in three streams transects and of few lower estimate in the forth stream (42 animals). The number of individuals estimated for the entire reserve varied between 420 and 1100 individuos, well below the abundance estimate of 2500 individuals established in the 1990s.

Theme:turtles, *Rhinemys rufipes*, habitat, abundance, Central Amazon

Type of Presentation: _ oral: _ contributed

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The Introduced American Bullfrog: A Potential Threat for the Endangered Frog *Dendropsophus meridensis* in the Venezuelan Andes

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Dendropsophus meridensis is a frog endemic to the Venezuelan Andes. According to the IUCN, this frog is endangered because its geographic distribution covers less than 5 000 km² and farming activities had modified much of its habitat. The recent introduction of the American bullfrog (*Lithobates catesbeianus*) to this region poses additional threats to *D. meridensis*. Besides being potential competitor and predator to other frog species, this exotic species is a reservoir of the amphibian pathogen *Batrachochytrium dendrobatidis* in the Venezuela Andes. As a first step toward assessing the impact of *L. catesbeianus* on *D. meridensis* we 1) estimated the proportion of the *D. meridensis* distribution invaded by bullfrogs; 2) determined the Bd prevalence of infection and zoospore loads in both frog species, and 3) compared *D. meridensis* densities between ponds with and without bullfrogs. Densities were estimated in twelve ponds by visual counts and Bd was diagnosed in 254 individuals using real time PCR assays. *L. catesbeianus* occupies an area of 42.5 km², which only overlaps with 3% of the *D. meridensis* distribution (1,579.15km²). However, bullfrogs appear to have a significant negative impact on *D. meridensis* where both species overlap. The average density of *D. meridensis* was lower in ponds where it coexists with *L. catesbeianus* (0.033ind/m²) compared to those where it occurs by itself (0.050ind/m²). Also, a significant inverse relationship between the densities of both species suggests a potential displacement between species ($r^2= 0.776$, $F=24.254$, $p=0.0017$). While *L. catesbeianus* appears to be an important reservoir in the area, with high prevalence of infection (79.9%) and zoospore loads (2,299 zoospores-3mg tissue) we cannot conclude that populations that may experience heightened pathogen exposure through a co-existing reservoir. *D. meridensis* has been observed infected in locations outside the bullfrog distribution, but differences in the prevalence of infection between ponds with and without bullfrogs have not been explored yet. *D. meridensis* showed similar zoospore counts (2,749 zoospore-3mg tissue) but lower prevalence of infection (26.7%). However, we did not detect clinical signs of disease in any of the infected hosts. While data are still insufficient to identify the mechanism by which *L. catesbeianus* affects *D. meridensis* (competition, predation, Bd transmission), it highlights the urgency for reducing

bullfrog impact over *D. meridensis*, and for preventing further dispersion of this exotic species into habitats occupied by *D. meridensis*.

Theme: amphibians, anurans, ecology, endangered species, predator-prey

Type of Presentation: Poster

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Taxonomic review of the genus *Placosoma* Tschudi 1847 (LACERTILIA: GYMNOPTHALMIDAE)

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The genus *Placosoma* Tschudi, 1847, is a group of microteids restricted to Brazil. It's identified by the following characteristics: all digits armed with nails, elongate snout, well developed eyelids, hearing pits exposed, head shields without striation, entire and separate nostrils, neck ventral region without widened medium scales, distinct neck, dorsal scales in transversal rows, square ventrals organized in longitudinal and transversal lines and frontonasals shields, single frontal, interparietal, loreal and frenorbital. Currently only three species are known for the genus: *P. cordylinum* Tschudi, 1847, with two subspecies (*P. c. cordylinum* and *P. c. champsonotus*), *P. glabellum* (Peters, 1870) and *P. cipoense* Wedge, 1966. This work comments the existence of one fourth species, still in description process, with exclusive occurrence in two "brejos de altitude" (altitudinal marshes) in Northeast Brazil covered by rainforest (Serra de Baturité and Maranguape, Ceará) that differs from the others in coloration (with a clear vertebral line) and three occipital scales arranged in "butterfly shape", 21-24 femoral pores in males (separated by pre-annals plates) and absent in females, 21-23 ventral transversal scales and 34-38 dorsal scales. The meristics and folidosis data suggest that the subspecies of *P. cordylinum* can be raised to species, being differentiated by: shape of the medium dorsal scales (long or wide), number of scales in the dorsal region between the previus members, number and disposal of pre-femoral pores. About the distribution *P. champsonotus* e *P. cordylinum* occurs in southeast (coastal and altitude of Rio de Janeiro and São Paulo.), *P. cipoense* is endemic of Serra do Cipó (Minas Gerais), *P. glabellum* occurs in southeast and south (costal and altitude of Espírito Santo, Minas Gerais, Rio de Janeiro, São Paulo, Santa Catarina), and *Placosoma* sp.n. is endemic of the mountains of the State of Ceará. The distribution of the genus indicates two points: 1. Possibly occurred a preterit link between the altitudinal marshes located in State of Ceará with rainforests that allowed the arrival of this genus in these mountains and justifies the presence of *Placosoma* sp.n. there; 2. The current distribution of the genus in distant separated areas can be explained by the lack of studies in Atlântica forest of the Northeast Region. Thus, probably will occur new distribution registers and new species will be described for the genus.

Theme: lizards, *Placosoma*, microteiid, taxonomy.

Type of Presentation: poster

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Temporary Pond Availability And Tadpole Species Composition In Central Amazonia.

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Habitat availability for larval development is one of the main factors affecting the distribution of anuran species. However, little is known about the spatial distribution of these habitats, and estimates of the number of available ponds for a given reserve size are not available in Amazonia. The aim of study were show that (1) isolated and streamside forest ponds do maintain a distinct assemblage of frogs, (2) isolated ponds are much more limited spatially in availability, but (3) are, on average, more predictable in time than streamside ponds. In Adolpho Ducke reserve, a system of 18 8-km trails forms a grid covering 64 km². We sampled a 30 m wide strip (15 m on each side) along the trails, which resulted in a total area of 426.2 ha. We considered isolated ponds those further than 150 m from the stream and streamside ponds those that were less than 100 m from the stream. Data on pond availability were collected from March to May (wet season) in 2003, 2004 and 2005. The tadpoles were collected in the streamside ponds between November and May, and in isolated ponds from January to May, with a dip-net to evaluate differences in composition between them. The dimensionality of tadpole community composition was reduced by multivariate analyses. MANOVA was used to test for differences in species composition of tadpoles between the two pond categories. Streamside ponds were found throughout the reserve, although the distribution was much more clumped in 2003 than in 2005. In contrast, the isolated ponds recorded in the surveys were clumped within a limited part of the reserve, and their distribution did not expand much between 2003 and 2005. More than 90% of the ponds were < 150 m from stream, and the tadpole species composition differed between isolated and streamside ponds. Isolated ponds were much more limited spatially in availability, but were, on average, more stable in time than streamside ponds. Despite the limited distribution of isolated forest ponds, species of frogs dependent on them were found throughout the reserve. The presence of both types of ponds is important for the maintenance of the anuran community dependent on water bodies in RFAD. This study shows the importance of regular or, where feasible, random sampling over a large area to monitor Amazonian anuran communities.

Theme: Conservation biology, Anurans, Ecology, Community.

Type of Presentation: Poster

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Communication in a noisy environment: eco-acoustic and visual signalling in *Staurois latopalpmatus*

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Habitat acoustics impose selection on anuran calls, within the phylogenetic and morphological constraints of the vocal apparatus of the sender and the auditory system of the receiver. Visual displays and alerting calls can be used as alternative or additional signal strategies to overcome these problems. In this study, we investigated sound pressure levels and spectral features of calls of the ranid rock-skipper frog *Staurois latopalpmatus*, exclusively found at waterfalls of Bornean streams and report on the predominant visual signal use during male - male agonistic interactions. A total of 176 calls and waterfall recordings were analyzed to characterize acoustic signals and environmental noise. To obtain information on possible signal adaptations, dominant frequency and snout-vent length of 75 ranid species were collected from literature and compared to our findings. Distributions along acoustically characterized rapids and waterfalls within a 1-km long river transect showed that *S. latopalpmatus* exclusively occurs in noisy habitats. Two different call types could be distinguished: a short, single-note call and a long, multi-note call. Both calls had a lower sound pressure than the noise produced by waterfalls. The dominant frequency analyses revealed that the signal-

to-noise-ratio can be maximized within high frequency bands around 5 kHz. Correlations of frequency versus body size in ranids indicated that *S. latopalmatus* has higher call frequencies than predicted by body size, suggesting acoustic adaptation to environmental noise. Acoustic signal efficiency in environments with low-frequency dominated noise can only be attained through high frequency calls. Visual signals are an alternative or complementary communication mode in noisy habitats. Male *S. latopalmatus* perform foot-flagging displays with either one or two legs, to announce the readiness to defend their territory. Quantitative video analyses of visual displays during 14 agonistic interactions showed that foot flagging performed in the direction of the interacting male is the most common display and is performed at a higher rate than advertisement calls. Results of a dyadic transition matrix showed that foot flagging is significantly preceded by foot-flagging displays of interacting males. Timing relationship analyses showed that single-note calls are temporally coupled with foot flaggings and acts as introductory components to direct the receiver's attention to the subsequent visual display. We conclude that foot flagging acts as spacing mechanism and represents the ritualization of agonistic male behavior to minimize physical attacks.

Theme: anura; acoustic signal; Adaptation; foot-flagging displays; *Staurois latopalmatus*; visual communication

Type of Presentation: oral, Symposium 3: Sensory Ecology of Anuran Communication

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Herpetological community characterization in two Cloud Forest of the Nirgua Massif, Venezuelan Costal Range

Douglas Mora

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The Cloud Forest of the Nirgua Massif is located in North Central of the Venezuelan Costal Range. We characterized the amphibians and reptiles faunas inhabiting in Cloud Forest of the Zapatero (ZH) and La Copa Hill (LCH). We sampled on 2007 both dry and rainy seasons using pit falls traps and VES (nocturnal and diurnal transects). Our results -supported on the base of 220 person/hours and 480 hours/tramp- were analyzed with descriptive and multivariate statistical methods. In ZH, we recorded 30 species (22 included for community analysis) which 17 included in Amphibia and 13 in Reptilia Class. LCH showed 20 species (14 included for community analysis); 11 as Amphibia and nine as Reptilia. Although in comparison with of the LCH diversity, ZH had the a high richness assemblages and most abundances, but according to the Shannon-Weaver information diversity index H' showed a low value (0,427) in contrast to LCH (0,897). Elsewhere, suggest to increase the sampling effort in the Zh. The taxonomic affinity test, revealed a sectorized and dispersed distribution in different species group. We not observed a difference obvious in presence of the species during the survey, in contrast to the frequency in accordance with the effects of ecosystem phenology. The habitats surveys in both localities showed significances difference in the communities taxonomic composition both in amphibians and reptiles. Likewise, we observed a spatial and seasonal

distribution that its diversity on the base of ecosystem phenology. In despite of several antropic factors observed in the study site, the amphibian and reptil faunas surveys reveled a highly richness assemblage being ZH the locality with major species richness as well as in terms of the abundance. We compared the complex in the vegetal structural according to species permanence between ZH and LCH obtaining a major richness in the first locality. *Hyalinobatrachium* sp and *Allobates pittieri* (Amphibia), in ZH and LCH respectively; *Norops chrysolepis* (Reptilia) were most common species in both locality. *Engystomops pustulosus* and *Trachycephalus venulosus* are recorded in ZH and LCH, respectively as invasive species due to fragmentation and loss habitat, overexploitation, as well as various combinations of these factors.

Theme:amphibians, anurans, salamanders, reptils, snakes, community

Type of Presentation: Poster

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Amphibians and Lizards From PEC – TO And Surrounding Areas – Species List And Ongoing Research

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The research project here presented aims: to build a checklist of lizards and amphibians from Parque Estadual do Cantão, state of Tocantins and surrounding areas, within an ecotonal region between Cerrado and Amazonia biomes; to assess the potential role of Rio Araguaia as geographic barrier to the gene-flow among populations of the same species distributed on both sides of the river. Until the moment, 15 different points within the study area were sampled, using for each point: one line of 16 pitfalls (30L); one line of 10 pitfalls (60L); one mixed line of 22 Sherman and 10 cage traps distributed by 16 stations of paired traps. Three sampling periods averaging seven nights were carried out for each of the fifteen points, which were distributed through the northern, central and southern regions of the study area. Hand-capture and pipe-traps were also applied to a smaller extent. Species inventory and tissue sampling for DNA typing will continue until November 2008, and for the present year, a similar sampling design will be followed, intensifying sampling in different areas.

Hand-capture and use of pipe-traps will also be intensified. Until now, 29 amphibian (six families) and 17 lizard (seven families) species were identified in the study area (Table 1). One Polychrotidae species, *Anolis ortonii*, with known distribution in Amazonian basin and Atlantic Forest, in Brazil, was found in the study area (however outside conservation units), in the left margin of Rio Araguaia, in the municipality of Santana do Araguaia – PA. This species was not yet sampled in the right margin, in Caseara – TO and Pium – TO municipalities, where other polychrotid (*Anolis chrysolepis*) was however frequently caught and seen. To be confirmed the occurrence of this species only in one margin of Rio Araguaia, one can suspect that the river might act as a geographic barrier for this species. Tissue samples from: the lizards *Ameiva ameiva* (n=36), *Anolis chrysolepis* (n=13), *Kentropix calcarata* (n=15), *Tropidurus oreadicus* (11), *T. torquatus* (n=12) and *Tupinambis teguixin* (n=29); and the amphibians *Elachistocleis ovalis* (n=29), *Hypsiboas raniceps* (n=19), *Leptodactylus leptodactyloides* (n=30), *L. ocellatus* (n=15) and *Trachycephalus venulosus* (n=16) were already collected and will continue to be collected for genetic typing and comparison of populations from both sides of the river. Tissue sampling is being based on a non-destructive method where blood is collected directly to FTA cards (Whatman®) or by taking advantage of caudal autotomy of some lizard species.

Theme:amphibians, anurans, reptiles, lizards, ecology, genetics, conservation biology

Type of Presentation: _Poster_contributed

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Capture Efficiency of Baited and Pitfall Traps for Terrestrial Vertebrates in an Ecotonal Region from Central Brazil

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Efficiency of four different traps was tested for capturing small terrestrial vertebrates in Parque Estadual do Cantão and its surroundings. Study area is located in Central Brazil, in the state of Tocantins, within an ecotonal region between Cerrado and Amazonia biomes. Lines of pitfall (30L and 60L) with drift fences and baited (Sherman and cage) traps were placed in fifteen sampling points, each one at least three kilometres apart from each other. Sampling points were grouped in three separate locations (five sampling points each) in the northern, central and southern regions of the study area. Each sampling point consisted of: 1) one line of 16 pitfalls (30L); 2) one line of 10

pitfalls (60L) and 3) a mixed line of 22 Sherman and 10 cage traps distributed by 16 stations of paired traps. Three sampling periods (end of rain season, dry season and beginning of rain season) averaging seven nights were carried out in each location. Hand-capture and pipe-traps were also used as complementary methods. Only captures from mammals, lizards and amphibians were considered. Individuals were identified to species whenever possible. Captures were grouped by method, family, species and weight class and plotted in diagrams (Figure 1). Odds ratio analysis was performed using STATSDIRECT® version 2.6.6, for assessing significant differences in efficiency between trapping methods. Species not captured by any of the four trap methods, but present in the study area (hand-capture and pipe-traps) are indicated in Table 1. In general, baited traps were more efficient for mammals and large size teiids. Pitfalls were more efficient in capturing greater numbers of species and individuals for lizards and amphibians. With exception of teiids and one polychrotid (*Anolis chrysolepis*), no other lizard or amphibian was caught in baited traps. For global comparisons, 60L pitfalls were significantly more efficient than 30L pitfalls [odds ratio: 1.57 (95%CL: 1.23; 2.17)]. No significant differences, for global comparisons, were found for Sherman/cage and baited/pitfall traps. 60L pitfalls were also more efficient than 30L pitfalls for bufonids [4.96 (1.53;20.89)], leptodactylids [2.41 (1.98;2.98)] and microhylids [1.87 (1.40;2.51)] and for didelphid mammals [6.49 (2.11;26.54)]. Baited traps were significantly more efficient for didelphid [(5.72 (3.61;9.50))], cricetid [1.60 (1.08;2.40)] and echimid mammals [33.35 (6.9;1345.80)], and pitfall traps were significantly more efficient for teiids [0.45 (0.32;0.63)]. Traps were not efficient for hyliids, which were mostly caught in pipe-traps and by hand as well as several amphibian and lizard species.

Theme:amphibians, anurans, reptiles, lizards, ecology, behaviour, conservation biology

Type of Presentation: _Poster_contributed

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The Reptiles, True and Myths: An Environmental Education Strategy to The Caricuao Zoological Park, Caracas, Venezuela

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The aim of this contribution is to apply a brand new strategy of environmental education about the true and myths surrounding the Venezuelan reptile fauna. This initiative intent to promote a changing process on the negative social perception of occasional visitors of The Caricuao Zoological Park. The strategy is based on the use of environmental interpretation as an educational mean. The identification of interpretative features was done through a reconnaissance visit to the zoo, specifically to selected species. A questionnaire on local Venezuelan myths related to reptiles was distributed to a mixed sample of general public and specialists in herpetology, coupled with a documental review on the topic. Therefore, this information on Venezuelan reptiles' myths was the basin to design the environmental education strategy. Later validated by experts in the field of Herpetology, Anthropology and Environmental Education, plus a pilot sample of Zoo user. The strategy is constituted by three key stages: 1) Diagnostic; "Reptile News" journalists (Zoo Guides) made three questions to zoo visitors on the local reptiles' myths that they previously knew, also including their likes and dislikes towards reptiles. Later on, visitors will participate in a game, "Catch your Reptile", in order to drill on features defining the animal group 2) Immersion; visitors took an interpretative guided tour to specific exhibitions of selected reptile species, including hands on demonstration with live and preserved scientific samples, generating a discussion on the main topic. 3) Assessment; researchers documented people perception through a socialized discussion (using motivating questions). Then, by means of the same diagnostic tools, the awareness gained through the information (obtained in the immersion process) was evaluated. The effectiveness and feasibility of

the strategy was evident in seven occasional groups of visitors (family groups). At the diagnostic stage, their perception was a major sense of rejection towards reptiles (48%), in contrast with the acceptance (34%). At the assessment stage the positive awareness (acceptance) increased greatly (96%). The incorporation of the strategy to the standard activities of the environmental education department at The Caricuao Zoo is suggested, including the adaptation of this tool, in order to be use with school children.

Theme:Environmental Education, Environmental Interpretation, Reptiles, Myths, Zoo, Venezuela.

Type of Presentation: poster

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Case Studies of Herpetological Invasion Management: Decision Points for Success

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In recent years there has been increasing recognition of damage associated with alien reptile and amphibian introductions. A paradigm shift is needed in the manner in which alien reptile and amphibian introductions are addressed managerially. There are a series of points during the process of introduction, establishment and expansion of an invasive species where management decisions can be critical for preventing the irremediable long-term establishment of a species in a site. We will review specific management responses to amphibian and reptile introductions in a variety of locations worldwide with the goal of highlighting management decisions that either contributed to or prevented new species establishment. Prevention of the intentional or accidental introduction of new species into a site is the most cost-effective means of control. Australia and New Zealand have model regulatory statutes that serve this purpose and are worthy of broad emulation. If a new species is detected in a site, there is a limited window of opportunity for control to be effective. During this window, decisions regarding distribution, potential impacts, feasibility of eradication and cost of control must be correctly made. This has rarely occurred and, consequently, there are few documented examples of eradication. When control fails, it is still important to document the ecological, economic and human health costs of amphibian and reptile introductions to improve future support. To regularly achieve successful eradication of alien herp populations it will be critical that managers operate within a formal decision-making structure that recognizes critical decision points and the errors prone to be made at each one. This paradigm has been used for a range of non-herpetological alien taxa worldwide and needs to be incorporated in future management responses for alien herps.

Theme:invasive species, alien species, introduced reptiles and amphibians, eradication, conservation biology, reptiles, amphibians, anurans, salamanders, caecilians, turtles, snakes, lizards, crocodilians, ecology, community ecology, natural history, reproduction

Type of Presentation: Oral, Symposium 2: Invasive Reptiles and Amphibians: Global Perspectives and local solutions

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Island Biogeography of Galapagos Lava Lizards (Tropiduridae: Microlophus): Arrival Times and Colonization Within the Archipelago.

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The "lava lizards" (*Microlophus*) are extensively distributed throughout the Galapagos Archipelago, and consist of two asymmetrical radiations that have resulted from two independent colonizations. The "Eastern Radiation" includes only *M. bivittatus* and *M. habeli* endemic to San Cristobal and Marchena Islands, respectively, and the "Western Radiation" includes seven species distributed across almost all of the central and western islands in the archipelago. In this study we combine dense geographic and character sampling (80 localities, 4 mitochondrial and 10 nuclear genes) to estimate a phylogenetic hypothesis for this group, including a recent proposal recognizing a paraphyletic *M. albemarlensis* complex. Our phylogenetic hypothesis statistically rejects both paraphyly for *M. albemarlensis* and two earlier topologies for the Western Radiation, and provides strong support for single colonization events on each island. Molecular divergence times for the two original founding events were estimated with the multidivtime program, using all gene regions, and basing calibration points on Andean orogeny (for the *Microlophus* - *Tropidurus* split) and estimates ages for most of the younger islands. Our estimates are consistent with the two colonization events occurring within the time frame of the oldest existing islands, followed by a relatively recent within-archipelago for subsequent colonization of younger islands by the Western Radiation. The pattern of colonization follows a general east-to-west route (oldest to youngest islands) predicted by the putative age of the islands, and prevailing ocean currents.

Theme: lizards, evolution, phylogeny, divergence times, Galapagos, mitochondrial DNA, nuclear DNA

Type of Presentation: oral

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Small Bodies At High Elevations: Miniaturization In Andean Frogs (Strabomantidae)

Edgar Lehr, Alessandro Catenazzi, Luis A. Coloma

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Diversity among terrestrial breeding frogs (*Bryophryne*, *Noblella*, *Phrynopus*, *Psychrophrynella*, *Pristimantis*) is high in the Andes. Many new species were discovered within the last decade, several of which have remarkable small body sizes (less than 20 mm). One of them is a new species of *Noblella* that has a maximum snout-vent length of 12.4 mm in gravid females obtained from the leaf litter at elevations of 3120–3190 m in southern Peru. We compare these minute frogs with respect to morphology, ecology, and phylogeny, and provide meristic data on the smallest frogs from different continents.

Theme:amphibians, anurans, ecology, taxonomy, morphology

Type of Presentation: _oral:_ contributed

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The Phylogentic Position of a new Species of Nannophryne (Bufonidae) from the high Andes of southern Peru.

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The genus *Nannophryne* is known from the Andes of Peru, Bolivia, Chile, and Argentina. Four species are currently known; all of which lack a tympanum and have extremities which bear large glands. We present a new species from southern Peru at 4720 m above sea level. The new species is morphologically most similar to *N. corynetes* and shares characters with *Rhinella spinulosa*. Based on 12S and 16S mtDNA sequences we discuss the phylogenetic relationship of the new species to other bufonids.

Theme:amphibians, anurans, genetics, taxonomy, morphology

Type of Presentation: _poster_ contributed

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Parasite load, organ masses, and locomotor performance in two species of Brazilian toads

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Parasite infestation affects many aspects of vertebrate life history. In anurans, a large number of parasites can be found in several organs, including lungs and gastro-intestinal tract (GIT). Given the relatively low anuran pulmonary diffusive area when compared to other tetrapods, the presence of large amount of nematodes in their lungs could impair rates of O₂ and CO₂ exchange, mainly during high aerobic demand. Although the presence of parasites in the GIT lumen unlikely affects aerobic performance directly, the level of parasite infestation in the GIT may affect the energy balance of the host and, consequently, long term performance. Among anurans, Bufonids are characterized by relatively higher levels of sustained aerobic locomotion in the field and may be an ideal group to investigate the possible effects of parasite load on aerobic performance. To test the hypothesis that the level of parasite infestation is negatively correlated to aerobic performance, we measured the locomotory distance in a circular track during 60 minutes, the number of parasites in the lungs, stomach, and small intestine, and the dry masses of several organs (lungs, stomach, gut, and kidneys) in adult males of two species of *Rhinella*: *R. icterica* and *R. schneideri*. Analyses were performed with body-length corrected locomotory distances and dry organ masses were included as residuals of dry body mass. Locomotory distances were higher in *R. schneideri* than in *R. icterica* ($t=2.79$, $df=15$,

P=0.014). Parasite infestation in lungs and gut are highly correlated in both species (pearson=0.77, P=0.015 and pearson=0.99, P=0.009 for *R. icterica* and *R. schneideri*, respectively). Individuals of *R. icterica* with larger livers also had larger hearts (pearson=0.73, P=0.025). *R. schneideri* showed negative correlations among masses of liver and lungs (pearson=-1.00, P<0.0001), and stomach and gut (pearson=-0.99, P=0.026). Stomach mass was correlated to number of parasites in both lungs (pearson=0.99, P=0.042) and gut (pearson=-0.99, P=0.033) in *R. schneideri*, suggesting that a higher digestive capacity may be necessary to support a higher parasite load. Although individuals of *R. schneideri* with a higher lung parasite load had smaller hearts (pearson=-0.98, P=0.048), the locomotory performance was not related to parasite levels on any of organs studied. FAPESP: JP-06/54699-1.

Theme:anurans, physiology, ecology

Type of Presentation: poster

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The Amazon River as a barrier to gene flow in a species of *Allobates* (Anura: Aromobatidae) in the Central Amazon

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The *Allobates* (= *Colostethus*) species complex is widely distributed through the Amazon forest and has high species diversity; however, it has been plagued by unstable taxonomy. This can be evidenced by the high rate of description of new species and recent taxonomic revisions proposed for this group. One of the most significant changes was the transfer of *Colostethus* to the newly established family Aromobatidae. Our goal is to understand the evolutionary process associated with the diversification of this group. The present study searches to explain the genetic-population patterns of a yet to be described species of *Allobates*, here named as *Allobates* aff. *marchesianus*. This species lives in riparian habitats of paleovárzea of the Central Amazon with occurrence recorded for the region of Manaus, Brazil. We analyzed 36 individuals of *Allobates* aff. *marchesianus* sampled from 4 localities in central Amazon; two localities from the left side of the Amazon River: Novo Airão (n = 8), Manacapuru (n = 13), and two localities from the right side of the river: Janauacá (n = 5) and a locality on BR319 (Madeira, n = 10). Total genomic DNA was extracted with Phenol/Chloroform and a portion of the 16S ribosomal mtDNA was PCR amplified using conserved primers. The 541 bp PCR product was resolved in automatic sequencer MegaBace 1000. With these sequence data, we conducted distance-based phylogenetic analyses in the program MEGA. We observed two clades representing the left and right sides of the Amazon River. In population analyses conducted in the program ARLEQUIN, AMOVA test indicated very strong population structure with most of the genetic variation distributed among populations ($F_{st} = 0.73406$, $P < 0.001$) with the exception of the pair Novo Airão/Manacapuru that exchange a significant number of migrants per generation ($N_m = 3.28$). The present results indicate that the Amazon River may act as a barrier to gene flow among populations of *Allobates* aff. *marchesianus* sampled on opposite banks of the River. Future studies will examine aspects of acoustics, morphology and behavior of this species with the goal of evaluating the congruence between the patterns of phenotypic and genetic variation of populations on opposite margins of the Amazon River. Additional molecular analyses should provide data for the description of this new taxon and to the understanding of the importance of the Amazon River as a historical factor driving patterns of diversification observed in anurans.

Theme:amphibians, anurans, ecology, genetics, taxonomy

Type of Presentation: Poster

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On the practical experience of the hatching and rearing of *Agrionemys (Testudo) horsfieldii* Gray at the Zoocomplex in Uzbekistan

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Associates of Zoocomplex (Tashkent) have conducted studies on development of conditions for hatching and rearing of tortoises in captivity for more than ten years resulting in the development of a tortoise ranching program in Uzbekistan. Experience of mass incubation of eggs obtained from the broodstock and wild individuals was amassed. At 28-32°C and 80-90% humidity, the incubation of eggs continued 70-80 days. The survival rate of embryos constituted 75%. After hatching, young individuals were placed into growing cages made from wooden shelves 0.75 by 1.5 m, which were divided into two parts with covers and incandescent lamps. The temperature in the daytime was 30-32°C; at night, 24-26°C. We used crushed and carefully prepared mixed feeds consisting of plant fodder, 76%, with protein, 21%, and vitamins and minerals, 3%. The tortoises were fed once a day, for five days a week. To stimulate the feeding activity, the tortoises were washed in warm water from the very first days of their life. This procedure was combined with sunbaths (air temperature should be over 32°C). The rearing of tortoises in these conditions provides an average monthly growth by 3-4 mm and weight gain by 5 g. The individual growth varied from 1 to 6 mm. At an all-the-year-round activity (the tortoises did not hibernate), most of these tortoises reached the size of 3-4-year-old wild individuals in eight months. They grew from 33-53 mm (ca. 44.3 mm) and 20 g in weight to more than 65 mm and 65 g in this period. The mortality during the rearing was below 5%. In 2007, 17.738 tortoises hatched; 0.3% of these were symmetrical and asymmetrical twins; 0.4% had defects of the carapace and 0.03% were teratic showing varying levels of terato-duplications from teratodimy to teratopagy. Owing to the development of the ranching program, the number of tortoises withdrawn from the wild for the export decreases resulting from an increase in those reared on the farm. In 2002, more than 30.000 wild tortoises were collected in the wild. In 2007, this number was only 8600. The number of tortoises ranched in captivity will grow in the near future, thus enabling us to stop the withdrawal tortoises from the wild.

Theme:turtles, ecology, reproduction, conservation biology, captive breeding

Type of Presentation: _Poster

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ANNUAL REPRODUCTIVE ACTIVITY OF A POPULATION OF PTYCHOGLOSSUS BICOLOR (SQUAMATA: GYMNOPHTALMIDAE)

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We studied the reproductive characteristics of a population of *Ptychoglossus bicolor*, which lives in the leaf-litter of an organic coffee plantation located in Santander, Colombia (73°03'W, 06°52'N), in the Western slopes of the Cordillera Oriental at an elevation of 1640 m. The area is characterized by a bimodal rainfall regime, with maximum peaks of rains in February to May and October-November,

and a daily temperature between 8 and 30 ° C. We monthly hand-collected individuals of both sexes and all sizes during a year. Sex ratio was 1:1 and both sexes reached sexual maturity at a similar body size (close to 45.00 mm Snout-Vent Length); however, adults were sexually dimorphic in body size (SVL), mass and head size. Males were larger than females. All adult males showed convoluted epididymides and enlarged testes with active spermatogenesis and presence of sperm in the lumen of testes and ducts. Reproductive, vitellogenic and ovigerous females were found throughout the year and there were not observed significant differences among months in reproductive stages and gonadal morphometry (mass, volume and maximum and minimal diameters). These data, plus the observation of juveniles in most of the months suggest the presence of a pattern of continuous reproductive activity in this population; also, the presence of females simultaneously vitellogenic and ovigerous confirms the production of multiple clutches. Clutch size was constant within the population: two eggs. The mass of abdominal fat bodies did not vary among months in both sexes, neither there were differences in relative mass of abdominal fat bodies between sexes. Despite the bimodal rainfall regime of this area, this lizard population exhibited an aseasonal reproductive pattern, suggesting that there is a continuous availability of resources for reproduction.

Theme: lizards, ecology, reproduction,

Type of Presentation: poster, Symposium 1: Reproduction in reptiles: from genes to ecology

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Teaching transformation: scientific papers about Amazon turtles and their use in the teaching contents for science education.

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The transformation of scientific papers into teaching material for science education is a way of socializing scientific production for the public, following the process of teaching-learning, following the comprehension of transformed concepts as tools for their use in lecturer rooms. This study attempts to transfer scientific papers, producing methods that are within the grasp of teachers and students in the first years of primary education. This study was conducted in a Municipal school in the northern zone of Manaus, Amazonas, Brazil, with students in the sixth grade. The proceeding methods were used: literature search, analysis of documents, and modifying teaching style. We used papers concerning the biology of Amazonian turtles and from this produced contents, methods, and activities that were favorable for teaching. The relevance of this research rests in the work of new ways for teaching, proportioning better access to the students for to obtain relevant scientific data about Amazonian turtles at a level at which they can understand and transform into their everyday lives, resulting that they are able to have access to information which is not readily available to them in the standard teaching texts used in the primary schools today.

Theme: Transformation for teaching, science education, Amazon turtles

Type of Presentation: poster

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Folliculogenesis in two species of Amazonian River Turtles

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Podocnemis expansa and *P. unifilis* are the largest species of Amazonian River Turtles. Both species have a distribution pattern in the largest tributaries in the Amazon Basin. The nesting season is synchronized with the dry period of Amazonian region. The ovaries show during dry season the most significant structural changes, caused mainly by the follicle development. The purpose of this study was to describe the structure of oocyte growth and follicular development in *Podocnemis expansa* and *P. unifilis*. Five ovary samples from females of different sizes were fixed in 10 per cent neutral buffered formalin, and prepared for histological sectioning. The ovarian germinal tissue consists of oogonia (A and B) laid in germinal beds and oocytes involved by follicle components. Oogonia mitosis figures and prefollicle cells were observed in germinal beds. Oogonia A a germinative stem cell, is round with central nucleus and a tiny eosinophilic cytoplasm. Oogonia B, is similar to oogonia A, except that cytoplasm is chromophobe. In addition to the germinal beds follicles containing primary growth oocytes were observed. The main changes of oocytes are the rise of nucleolus numbers (4 in oocyte I to 8 oocyte II), displaced from nucleus to basal region (animal pole) in previtellogenic follicles, and the presence of yolk platelets of different biochemistry nature (protein and lipid yolk). As vitellogenesis advances, the yolk spheres continue to increase in size and number causing follicle enlargement. The stages of follicular development involved changes in follicular cell morphology (one layer of pavement follicle cells in primordial follicle through one layer of cubic cells in vitellogenic follicles); establishment of primary and secondary membranes (named as zona pellucida). Zona pellucida (ZP) appears in previtellogenic follicle as only one acellular membrane of eosinophilic material surrounded by the follicle theca. During vitellogenesis, in *Podocnemis expansa* ZP become thicker with two layers (inner striate layer and external homogenous layer). In *P. unifilis*, ZP is formed by three layers, with the striate layer located in the middle of two homogenous layers. Atretic follicles were observed in all stages of follicular development. The presence of corpora lutea and corpora albicantia were observed in both species.

Theme:reptiles, turtles, reproduction, morphology

Type of Presentation: poster

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Community Management of Freshwater Turtles at SDR (Sustainable Development Reserve) Piagaçu-Purus, Amazonas, Brazil

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Turtles have been an important source of animal protein for Amazon natives. Traditionally these people have been collecting eggs and harvesting adults over the last centuries. Natural populations of turtles have decreased by the illegal exploitation for subsistence and commercial trade, mainly *Podocnemis expansa* (South American river turtle) *Podocnemis unifilis* (Yellow-spotted river turtle) and *Podocnemis sextuberculata* (Six-tubercled river turtle). Currently, the yellow-spotted river turtle is the most intensely consumed turtle in different regions of the Amazon. In the lower Purus River harvesting of eggs and collection of adult turtles has been carried out since the nineteenth century.

Recently, projects are attempting to recover the natural populations and protect turtle nesting sites across the Amazon. In the Sustainable Development Reserve Piagaçu-Purus (SDR-PP) local people of Nossa Senhora do Livramento Community (Uixi) selected for protection two turtle nesting sites located near the community. Four locals were responsible for managing and monitoring these nests. In December of 2007 both Instituto Piagaçu (IPI), co-manager of SDR-PP, and National Research Institute of Amazon (INPA) supported three participatory meeting at Uixi community. Specific management technics successfully applied in other sites of the Amazon were presented, to support the initiative of this community and encourage long-term management practice. Twenty nests of *P. unifilis* were transferred to the nesting sites protection area, where also there occurred 19 natural clutches. The nests were enclosed with a wood box for protection against predators and checked daily by the inhabitants. 465 hatchlings were registered, of which 340 were measured. The mean rectilinear carapace length was 41.8 mm (± 2.9) (33.7 to 48.0 mm), plastron mean length was 39.3 mm ($\pm 2, 4$) (21.0 to 45.5 mm), shell mean height was 19.9 mm (± 1.1) (16.7 to 23.2 mm) and mean weight was 15.0 g (± 2.1) (9.0 to 20.0 g). The hatchlings were kept in plastic boxes for one month, where they were fed and exposed to the sun for a better development. The hatchlings were released in front of nest sites protection area in December 2007 and January 2008 with the active participation of local children. They actively participated and were aware of the environmental issue. The initiative of managing and conserving turtles by these communities offers good perspectives if they are trained on the techniques of management, communities of SDR-PP and other users get involved in the monitoring activity.

Theme: reptiles, turtles, reproduction, conservation biology, endangered species.

Type of Presentation: Poster

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Scute abnormalities frequencies in *Podocnemis sextuberculata* and *Podocnemis erythrocephala* of Amazon.

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The standard (*Podocnemis*) carapace configuration includes five vertebral scutes, four pairs of costals, 24 marginals, and 13 in plastron. Scute abnormalities can be genetic or the result of accidents, injury or other traumas during the embryonic stage. The objective of this study was to quantify the occurrence of scutes abnormalities of two Amazonian species of freshwater turtles: iacá (*Podocnemis sextuberculata*) and irapuca (*Podocnemis erythrocephala*). 531 hatchlings of iacá and 210 of irapuca from Amphibian and Reptile Collection of INPA were observed to find scute abnormalities. The iacá hatchlings were collected from two beaches of Juruá and Solimões rivers. The irapuca's hatchlings were collected in the municipality of Barcelos and in Ayuanã River, municipality of Santa Isabel do Rio Negro. Specimens were collected from 1996 to 2005. Carapace and plastron pictures of 121 adults of irapucas, from Ayuanã River, were also analysed. Scute abnormalities occurred in 5% of iacás and 13% of irapucas. Frequency of abnormalities varied between years. For iacá in 2003 occurred 8% abnormalities 4% in 1999, and 3% in 1996 and 2001. For irapucas abnormality frequency varied from 9% in 2002 to 16% in 1999. Diverse methods employed in management of nests could be responsible for affecting microclimatic conditions for the embryos development.

Theme: scutes, carapace, abnormalities, *Podocnemis sextuberculata* e *P. erythrocephala*

Type of Presentation: Poster

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Osteocranial Development in the Oviparous Snake, *Pantherophis guttatus* (Serpentes: Colubridae).

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Osteocranial development has been studied extensively in fishes, amphibians, birds and mammals but are not common for squamate reptiles. Most previous studies of squamate skeletal development have been based on small sample sizes, have not reported variation, and have utilized embryo or postnatal size to compare specimens. Because size varies considerably among species and with incubation temperature, results of these studies are not easily compared. This study was designed as a baseline study of osteocranial development in the oviparous snake, *Pantherophis guttatus*. Data also are intended to provide for comparison with data on uptake and transport of calcium during development. A total of 76 embryos and neonates were identified to developmental stage (Zehr, 1962); size of Meckel's cartilage (with or without investing bones) was used as a relative measure of growth. Specimens were cleared and double-stained (Hanken & Wassersug, 1981; Taylor & van Dyke, 1985). The first evidence of cranial ossification was the palatine (stage 29—31). During stage 32, ossification of the prearticular, surangular and pterygoid proceed quickly, while the first upper jaw and skull roofing bones show only initial centers of ossification. Ossifications show variation across developmental stages, but a relatively consistent pattern can be identified. By stage 37, just prior to hatching, most bones of the cranium are ossified, except for the parietals, occipital complex, and basisphenoid. The earliest indication of calcium in the embryonic cranium appears as calcium-containing deposits sequestered in endolymphatic fluids present in the earliest developmental stage observed (stage 27), well before ossifications begin. Comparison of our results, based on interpretation of comparable developmental stages, to patterns reported for *Python* and *Naja* indicate that substantial variation in development has been under-represented, but that a generally consistent pattern of ossification can be identified in which palatal and jaw bones ossify early and braincase ossifies late.

Theme:snakes, developmental biology, morphology

Type of Presentation: POSTER

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Ecology and Home Range of the Texas Horned Lizard in Northern and Central Texas

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The Texas horned lizard (*Phrynosoma cornutum*) is considered threatened in the state of Texas and is declining over much of its range. Additional life history data are needed to elucidate possible causes for the decline and help managers slow or reverse this trend. We monitored three populations of horned lizards, two in central and one in northern Texas. No lizards were encountered at the two central Texas in 2006, a drought year. In 2007, an exceptionally wet year, a total of 20 juvenile and adult lizards (8 female, 8 male, 4 unknown sex) were observed and eight were fitted with a radio-

transmitter. At the study area in northern Texas, a total of 307 lizards were encountered between 2005 – 2007; of these, 83 were fitted with radio-transmitters. Home range size in central Texas was small in 2007 (mean=0.8 ha, n=4), with lizards usually remaining within 1-2 m of dirt roads. Overall, home range size was larger in northern Texas: 1.94 ha and 2.09 ha for females and males, respectively, with no significant difference between the sexes. Home ranges in this population were also smaller and road-associated in 2007, perhaps because of dense vegetation resulting from the unusual rainfall. Lizards of the northern population were seen mating during the months of May and June, eggs were laid from late May into the middle of July, and hatchlings were seen beginning in late August. In 2007, 2 females were confirmed to have laid two clutches each, and one may have laid three. The average relative clutch mass (clutch mass:lizard mass) was 54.4%. Lizards were most active at temperatures of 27-37° Celsius. Activity was diurnal in spring and fall and weakly bimodal, with peaks in the morning and evening, in summer. Cloud cover and relative humidity were found to have no effect on lizard activity. Management implications will be discussed.

Theme:reptiles; lizards; horned lizards; ecology; conservation biology

Type of Presentation: poster, contributed

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Overview of the Southern River Terrapin, *Batagur affinis* (Cantor, 1847) Conservation Program in Malaysia

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This paper provides an overview of the conservation programs currently carried out on the Southern River Terrapin, *Batagur affinis* in Malaysia. There are four existing programs with three of them managed by The Department of Wildlife and National Parks (DWNP) and one by the Turtle Research and Rehabilitation Group, University Malaysia Terengganu (UMT). The DWNP programs in the states of Terengganu, Perak and Kedah have been in place since the late 1960s and cover the Terengganu and Dungun Rivers in Terengganu, the Kedah and Muda Rivers in Kedah and the Perak River in Perak. The conservation measures involve procurement of eggs from the wild, ex-situ incubation of eggs and head-starting of hatchlings for varying lengths of time for release. The Perak and Kedah Conservation Centres house breeding terrapins as well. The data and statistics generated from these activities over the years are presented and analysed in an attempt to assess the effectiveness of the DWNP programs in rehabilitating terrapin populations in the various river systems. In Perak and Kedah, persistent and steep declines in nesting density have been registered, whereas nesting along the Terengganu River appear to have been sustained. Harvesting of terrapins for the restaurant business and trade in the west coast of Peninsular Malaysia may be rampant, but not so along the east coast where Terengganu is located. The UMT program was initiated in 2004 and focuses on the terrapin population in the Setiu River. Apart from the purchase of eggs for incubation, head-starting and release programs, research has been conducted to investigate temperature dependant sex determination, effects of different feeds and feeding regimes on growth rates of captive terrapins, and movements of head-started terrapins after release. It is hoped that research inputs will help to fine-tune conservation programs and provide insurance in bringing about population recovery. Finally, conservation of any endangered species must be supported by adequate national legislation. The existing Wildlife Act 1972 which has no provisions to protect *Batagur affinis* is currently under review and it is understood that all endangered turtles will be listed in the updated

Theme:turtles, endangered species, conservation biology, captive breeding

Type of Presentation: Oral, Symposium 15: Development and Implementation of Recovery Programs for Endangered Chelonians.

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Venezuelan Andean Aromobatid frogs: a conservation reappraisal

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Continued monitoring of Venezuelan Andean Aromobatidae frogs (Allobates, Aromobates and Mannophryne) since 2004, concentrating efforts mostly in type localities, have generated data useful to assess their current conservation status. Results suggest that most of the species are experiencing declines, and a record of population depletions supports the claim. According to the GAA, which presented data based on our own previous experiences, 65% of these mountain taxa can be considered Endangered or Critically Endangered, 10% Vulnerable, while 25% are Data Deficient. These data include a new species, and an undescribed taxon from the Andes of Portuguesa and Trujillo states, previously not evaluated. The most affected genus is Aromobates. Originally erected as a mono-specific taxon, Aromobates now encompasses all previous members of Nephelobates, plus some other then unallocated Colostethus. Under this new conception, Aromobates is, by far, the most speciose genus of Venezuelan Andean Aromobatid frogs, with 65% of the species within the family living in that region. Concomitantly, it also has the largest amount of representatives in IUCN higher-risk categories. Mannophryne, with 30% of the species, conforms the second largest Andean component of Aromobatid frogs. This genus shows the lowest number of species in decline, if we place aside Allobates, a taxon represented by a single VU species. Results support our previous findings, but reveal that all taxa currently in the categories of Data Deficient and one VU are in need of placement into higher risk categories. This will mean that 95% of the Venezuelan Andean members of the family are in some category of risk. Although the real causes of declines are largely unknown, some patterns are evident. The highest numbers of declines occur at elevations above 2000 m, the majority in cloud forest environments, albeit a likely extinct frog, Aromobates leopoldalis, occurred in paramo environment as its sole representative. Among the putative causes of declines is a fungus, Batrachochytrium dendrobatidis, which is also present in some Venezuelan Andean Aromobatid populations (like Mannophryne cordilleriana) supposedly not being affected by this pathogen agent. Documented climate alterations may have a more important role than previously acknowledged. Unrespectful of legally protected areas, all the species found in those experience declines and are in CR or EN categories. Nonetheless, National Parks grant some protection; most habitat alteration and destruction, another major cause of amphibian declines in the region, occurs outside of these protected areas.

Theme:amphibians, anurans, Venezuela, Aromobatidae, Conservation biology, endangered species

Type of Presentation: Oral, Symposium 11: Dendrobatoid Frog Biology.

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New species and tadpole diversity: Fast montane sampling and molecular techniques discover spectacular anuran genetic diversity and biogeographic structure in Sumatra

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The islands associated with the Sunda Continental Shelf (SCS) contain remarkable levels of amphibian diversity. For anuran taxa, this regional diversity is particularly striking. While much research occurs on anurans from the SCS, the levels of research on the faunas originating from the island of Sumatra have lagged behind the adjacent islands. One particular area of interest for the poorly known taxa in this region is the elucidation of ecology and natural history. A critical component in this understanding is knowledge of the habits and morphology of frog larval forms. A series of unidentified tadpoles was collected from throughout Sumatra and Java from May to June of 1996. Using mitochondrial DNA sequences from the ribosomal 16S gene we matched approximately 25 unidentified larvae to sequences originating from adult anurans. The resulting phylogenetic relationships among our test sequences place the unidentified larvae in 20 separate clades across 3 families of anurans. While several of the tadpoles included in this study belong to clades which contain relatively well known taxa, 2 belong to recently described parachuting frogs and are the first known reports of any kind for the larvae of these taxa. In addition, several tadpoles are highly dissimilar from the other taxa included in this study indicating tentatively that they are a taxonomic novelty for which no publicly available 16S mitochondrial sequences exist.

Theme: amphibians, anurans, biogeography, diversity, endangered species, genetic, herpetology, Indonesia, larva, montane, Sumatra, tadpole, taxonomy

Type of Presentation: Oral at Symposium 9, Biogeography of the South and South East Asian Herpetofauna

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MICROHABITAT SELECTION BY A NEW SPECIES OF DART-POISON FROG OF THE GENUS *Ranitomeya* (ANURA: DENDROBATIDAE) IN THE ORIENTAL ANDES OF COLOMBIA

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Microhabitat selection in any species involves choosing specific sites, which possess certain characteristics that affect survival and reproductive success of individuals. In many cases, those sites are a limited resource that promotes the development of strategies associated with the defense of territories. In this study, we evaluated possible microhabitat preferences in an apparently relictual population of an undescribed species of *Ranitomeya*, by comparing available and used ground caves in several forest patches located in Colombian East Andes. We measured microclimatic variables (temperature, humidity and luminosity), characteristics of caves (depth of cave, number of entries, and size of entrance), and location of these caves with regard to the forest edge. Furthermore, we tested whether the abundance of males was related to the abundance of bromeliad plants, because these epiphytes play an important role as tadpoles' development site. Males differentially used deeper caves and caves with more than one entrance. This preference could be related to highest humidity in deeper caves and less attenuation of calls when broadcast from caves with several entrances. In addition, density of calling males was positively correlated with abundance of bromeliads, which

might explain why this species appear to be more abundant at the forest edge.

Theme: Microhabitat selection, anurans, males of *Ranitomeya* sp. nov., phytotelmata, caves, forest edge, territoriality.

Type of Presentation: Poster

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Spatial Distribution of the Amphibian Chytrid Fungus: A View From the Temperate Zone

Erin Muths

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The amphibian chytrid fungus (*Batrachochytrium dendrobatidis*, Bd) is extirpating amphibian populations in several world regions. With a few notable exceptions, the emphasis has been primarily on tropical regions of the world. We analyzed the distribution of Bd across an 11 degree latitudinal gradient in the Rocky Mountains, U.S.A., sampling over 1000 amphibians in 202 historic and extant boreal toad (*Bufo boreas*) breeding sites in 97 geographical clusters. We sampled boreal toads or amphibian surrogates. We evaluated potential relationships between landscape (elevation and region), climate (temperature) and the occurrence of Bd. Bd was detected at 64% of the clusters tested in this region; 84% percent in the northern sites and 44% in the southern sites. Paradoxically, the Southern Rocky Mountains have experienced the greatest declines in *Bufo boreas* in spite of the lower occurrence of the pathogen.

Theme: boreal toad, *Anaxyrus boreas*, *Bufo boreas*, *Batrachochytrium dendrobatidis*, amphibian decline

Type of Presentation: Oral, symposium 6: Disease and amphibian declines - where do we go from here?

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The geometric tortoise: conservation status and recovery plan

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The geometric tortoise is the most threatened terrestrial tortoise in South Africa. Following work done in the period 1986-1993 on its distribution, general ecology and conservation status, a period followed during which monitoring work was done on the largest remaining population. In addition, more detailed research into the life history of the species was performed during 1999 to 2004, whereafter systematic conservation planning in the general region during the last three years assisted in identifying potentially new sites where this species can be found. Habitat degradation and habitat loss, invasive alien plants, too frequent fires and severe habitat fragmentation remain the most serious threats to the survival of the geometric tortoise. The process of re-evaluating the distribution and conservation status of the species will start soon, including a formal IUCN Conservation Assessment of its status. Preliminary indications are that its status has deteriorated during the last 10 years, but the drafting of a biodiversity management plan, including the consideration of both in situ and ex situ conservation management measures, is being planned and will be aligned to the IUCN Turtle Survival

Alliance chelonian recovery programme.

Theme: reptiles, turtles, geometric tortoise, endangered species, conservation status

Type of Presentation: Oral symposium 15

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Alien reptiles and amphibians in South Africa – is it too late?

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The introduction of alien reptiles and amphibians into South Africa for the pet trade, and the current inconsistency of measures by conservation and other agencies to control their import into and movement within the country are matters of concern. With only a few alien invaders and extra-limital indigenous invaders, there may still be time to prevent large-scale invasions, however, some warning signs exist and a concerted, focussed intervention is called for by all role-players, that is, government, the pet traders and private keepers. The booming reptile pet trade in South Africa is looking to import more and more snakes and lizards as pets. These species include taxa from climatic zones very similar to that of the different South African ecoregions. Deliberate releases and accidental escapes of these species, as well as the difficulty in controlling invasions of this kind, pose a significant threat to our endemic and indigenous herpetofauna, and conservation and other agencies need to be aware of this and establish risk assessment protocols and effective control measures

Theme: Alien, reptiles, amphibians, invasion, control measures

Type of Presentation: Oral, Symposium 2: Invasive Reptiles and Amphibians: Global Perspectives and local solutions

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Phonotactic approach pattern in the neotropical frog *Allobates femoralis*: A spatial and temporal analysis.

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Phonotactic approaches by 17 male *Allobates femoralis* were videotaped and analysed in terms of spatial and temporal patterns to assess this species' ability to localise sound. Jump angles of consecutive jumps and the straightness of paths were measured to quantify the accuracy of approach. The effect of interbout intervals on phonotactic approach was examined by comparing movement parameters of two tests, using a standard call with interbout intervals, and a continuous call without interbout intervals. Phonotactic approach occurred almost exclusively during calling bouts. Interbout intervals interrupted movement and did not alter the accuracy of approach. Our results suggest that only the calling bouts, but not the silent interbout intervals, play a crucial role for male phonotaxis in this species. Furthermore, anuran phonotactic approach is not strictly axis-alternated and thus not appropriately described by the generally used term "zig zagging".

Theme: *Allobates femoralis*, amphibians, Dendrobatidae, localisation, phonotaxis

Type of Presentation: Oral, Symposium 11: Dendrobatoid Frog Biology.
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Amazonian poison frogs depositing tadpoles with Andean competitors: an ancient ecological trap?

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Reproductive habitat selection in anurans is an important determinant of adult fitness. Although previous studies have shown that anurans select reproductive habitat on the basis of many cues, relatively few have addressed competition risk as a potential cue. We investigate whether a widespread Amazonian frog, *Ameerega trivittata*, selects habitat for tadpole deposition on the basis of intra- or interspecific competition risk. Competition experiments from a previous study allowed us to determine the effects of competition a priori and therefore assess whether habitat selection in response to competitors was adaptive. Our results show that montane populations of *A. trivittata* adaptively select tadpole habitat in response to conspecific competitors. Conversely, their habitat selection in response to a heterospecific competitor (*A. bassleri*) is maladaptive and appears to function as natural ecological trap. We suggest that this ecological trap is maintained by high levels of gene flow from lowland populations that are naïve to the competitor, and the montane population of *A. trivittata* avoids extinction through its connectivity to lowland populations.

Theme:amphibians, anurans, ecology, natural history, reproduction, behaviour
Type of Presentation: Oral, Symposium 11: Dendrobatoid Frog Biology.
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New records of reptiles and amphibians from Quaternary of Serra da Bodoquena (MS, Brazil)

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Fossils of frogs, caimans, lizards, snakes, and turtles are reported from Quaternary deposits associated to the karst of Serra da Bodoquena, state of Mato Grosso do Sul, Brazil. The material was recovered through the exploration of three limestone caves, Nossa Senhora Aparecida, Japonês and Nascente do Formoso, the last two being underwater caves. All specimens are presumably ranging from latest Pleistocene to Holocene. Efforts to date these fossils have been made, but so far no collagen material were successfully extracted. Other vertebrates associated to this herpetofauna are essentially mammals (ground sloths, armadillos, glyptodons, mastodons, horses, tapirs, deer, peccaries, llamas, toxodons, litopterns and carnivores) and a few birds (*Cariama* and *Rhea*). Material referred to *Anura* includes a large tibiofibula, cf. *Chaunus* (*Bufonidae*) and a fragment of ilium. Crocodylians are represented by a fragment of fibula of *Caiman yacare* and two osteoderms belonging to *Caiman* sp. (*Alligatoridae*). Lizards are represented by an articular bone of the mandible, which was attributed to *Tupinambis* sp. (*Teiidae*). A rib was identified as a boiid snake (*Boiidae*). Turtles are represented by one fragment of carapace and three of plastrons. A piece of right hyoplastron is identified as *Podocnemis* sp.; two other pieces of a left and right hyoplastron, which looks like as parts of the same individual, are attributed to cf. *Podocnemis*. A marginal plate from the carapace is identified as *Testudines*. The Quaternary records of reptiles and amphibians from Brazil remain scarce and this is a first glimpse on the past diversity of the late Cenozoic of the state of Mato Grosso do Sul, a region that presently harbors a rich herpetofauna.

Theme: amphibians, anurans, reptiles, turtles, snakes, lizards, crocodylians, palaeontology

Type of Presentation: Poster contributed

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Age Structure, Body Size, and Reproductive Output in *Leptodactylus latinasus* From North-east Argentina

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Skeletochronology has become a widely used tool for age estimates in amphibians, counting the number of lines of arrested growth (LAGs) in cross-sections of phalanges obtained by toe-clipping. We used skeletochronological methods to describe the age structure of a *Leptodactylus latinasus* population from northeast Argentina (Corrientes province, 27°25'51.10"S, 58°44'42.50"W). We also analyzed the body size and age implications for reproductive traits (clutch weight, ovum size and clutch size). We captured a total of 56 *L. latinasus* (Male: $n = 34$, Female: $n = 17$) from spring 2007 to autumn 2008. We were able to assign the age in 12 out of 34 males and 12 out of 17 females captured. Minimum and maximum age found was 1 and 3, respectively. We did not find differences in mean age between sexes ($t = 1.82$, $df = 22$, $P = 0.082$). Mean and SD of LAGs and phalangeal perimeter in microns were: LAG1 = 118 ± 16.3 $n = 8$; LAG2 = 176 ± 31.6 $n = 3$; LAG3 = 182 $n = 1$; PER = 193.6 ± 40.8 $n = 24$. There were no significant effects of sex on body weight, SVL and hind limb right (Wilk's $\lambda = 0.867$, $F_{3,42} = 2.129$, $P = 0.11$), which demonstrated that there were not sexual dimorphism in this specie. Mean and SD of reproductive traits in 10 out of 17 females analyzed were: CW = $0.204 \text{ g} \pm 0.09$, OS = $1.19 \text{ mm} \pm 0.14$, CS = 224.3 ± 51.4 . CW showed a positive relationship with CS ($r^2 = 2.85$, $P < 0.05$, $n = 10$) and ES ($r^2 = 0.787$, $P < 0.001$, $n = 10$). We did not find significant correlations between reproductive traits and, body size and age in *L. latinasus* (minimum P value of all relationship analyzed = 0.201). Partial correlation analyzed, to estimate the relative effects age on reproductive traits, shown that age had no significant effects on reproductive traits.

Theme: Age, body size, reproductive traits, *Leptodactylus latinasus*

Type of Presentation: Poster

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Phylogeographic study of the plantain frogs *Hypsiboas crepitans* and *H. pugnax* (Anura: Hylidae) in western Venezuela

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Hypsiboas crepitans and *Hypsiboas pugnax*, locally known as “ranas plataneras” (= plantain frogs), are two hylid frogs with populations living in western Venezuela. We carried out a study using alloenzymes as molecular genetic markers to examine the level of the genetic structure and its phylogeographic implications among these populations. Both species have populations living on both sides of the Venezuelan Andean Cordillera de Mérida. We studied seven populations of both taxa, through comparisons of their alloenzymatic genetic structure, based on six enzymatic loci. Using as a criterion the presence of fixed allelic differences, we distinguished three electromorphs. The genetic distances registered among the electromorphs were higher than the characteristic values between species of amphibians of the same kind. One of the electromorphs belongs to *H. crepitans*, while the remaining two belongs to populations of *H. pugnax*. A phylogeographic approach based on these findings suggest that *H. crepitans* maintains as a single genetic unit with populations living as high as 2000 m.a.s.l., for which the Andean mountains seem not to act as a barrier limiting their exchange of genes. On the other hand, *H. pugnax* showed up to be composed of two genetically isolated lineages, probably because of the Venezuelan Andes acting as a geographic barrier to these lowland inhabiting forms.

Theme: phylogeography, *Hypsiboas*, Venezuela, genetic structure, alloenzymes

Type of Presentation: poster contributed

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Aspects connected to the nourishment of the young *Podocnemis expansa* in nature and in a commercial farm.

F.N. Armond and Malvasio, A.

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Knowledge about diet, nutritional needs, metabolism and feeding behavior is important for chelonian management and conservation. This research aims to study diet of young *Podocnemis expansa* in nature and in a commercial farm in Tocantins state. For the latter, management practices were also evaluated. Individuals in the wild (n=80) were captured in Javaés/TO river. Captures were divided in two seasons (dry and rain) and two capture periods (20 individuals each) per season. Animals were captured using baited fishing hook, nets or by hand, by diving in shallow waters. We also evaluated 160 captive animals, captured in two dry and two rain season periods, in two different tanks (20 individuals per tank and sampling period) at Praia Alta farm, Lagoa da Confusão/TO. Biometrics

were performed for wild captured individuals and their diet was assessed using stomach content stored in 10% formalin. Stomach content was separated and analyzed by occurrence and gravimetric methods, and protein content was determined by the Kjeldal method. In captivity, regular food offer and relative management practices were recorded. Protein purport was determined according to the Brazilian Table of Food Composition – USP. Food items included four types of vegetables (protein level between 0,51 and 7,81%) and commercial fish food (protein level between 24 and 28%). On severe rain season, at Javaés river, stomach content was significantly greater (13,82g) than moderate rain season (5,55g) and dry season (two periods - 2,48g and 3,14g). Same food items were found in all seasons. During rain season, for both sampling periods, percentages of food items were 64% and 57% (vegetable), 9% and 8% (animal), 24% and 31% (unknown and micro-particulate items) and 2% (mineral). For dry season, percentages were, 26% and 47% (vegetable), 1% and 4% (animal), 37% and 36% (unknown and micro-particulate items), 9% and 13% (mineral). Nematodes and trematodes were found in stomach content from 10% and 7.5% of analyzed dry season individuals and 30% and 27.5% of rain season individuals, respectively. In Nature, diet is predominantly herbivore, but quantity of unknown and decaying items and the lack of knowledge about items digestibility turns analysis of items percentage less precise. We found that season influences on the quality and quantity of individuals' diet. In captivity, wrong feeding management practices have shown to have negative impact the growth of body mass, with individuals aging from five to seven years old failing to reach 1,5Kg (minimum weight for trading purposes).

Theme:Reptiles, turtles, ecology,behaviour,captive breeding

Type of Presentation: Poster

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Notes about the herpetofauna found in seasonal beaches from two Brazilian Amazon rives

Fabiano Waldez

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Some species of amphibians and reptiles occur associated the Amazonian fluvial beaches. This seasonal landscape is utilized by these species as environment of forrageio, reproduction and thermoregulation. These species also interact with others groups of vertebrates, as prey for birds, alligators and fishes; and as predators of eggs and cubs of birds and quelonians. In this work I offer information about the natural history and the use of the habitat, for species of amphibians and reptiles observed in areas of seasonal beaches in the down basin of Purus river and medium basin Juruá river, in the Brazilian Amazon.

Theme:herpetofauna, fluvial beaches, Amazon, Purus river, Juruá river

Type of Presentation: Poster

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Herpetofauna in forest/savanna complexes from two different interfluves of the Madeira River in the Brazilian Amazon

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The landscape diversity of Amazon region includes savannas ecosystems inserted in the matrix-forest. These not-forest systems can be seasonally submitted to flood cycles. The isolation of savanna enclaves provided an endemic biodiversity. However, in Brazil the Amazon savannas are environments strongly threatened by expansion of the agricultural border and mineral exploitation in south of Amazonas State. These savannas island region represent environments with different structures and formation, known as grassland, campina and cerrado. In these areas the amphibian and reptilian diversity are poorly studied. The Madeira river interfluvies have large complexes of forests assorted with savannas seasonally flooded. We studied two complexes in the different Madeira interfluvies, in southwest State (AMAZONAS: Canutama, Puciri/Humaita complex 08°39'S and 64°21'W) and in southeast (AMAZONAS: Aripuana/Bararati complex 07°45'S and 58°48'W). Both complexes are under the influence area of highways, BR-319 (Porto-Velho/Manaus) in the southwest and BR-230 (Trans-Amazonica) in southwest. This is threatening for environments conservation due to the quickly region colonization, that usually promote deforestation. To identify important areas for conservation and evaluate the status of protect areas, we carried preliminary studies with the herpetofauna in these two complexes, during the dry season in June/July 2006 (Aripuana/Bararati) and the rainy season in April 2007 (Puciri/Humaita). The amphibians and reptiles were collected by two persons in the different environments along transects of 5 km and we used pitfalls only in the Puciri/Humaita. The sampled environments were: savannas (grassland and campina) and forests (campinarana, igapo and terra-firme) (Figure 1). For all sampled areas we recorded a total of 44 reptiles and 40 amphibians (Table 1). Assemblies of reptiles had low similarity of species composition between interfluvies, indicated by the low value of Biogeography Resemblance Coefficient/BRC=0.37. We recorded 28 species in the Puciri/Humaita and 26 in the Aripuana/Bararati, and 18 species were observed only in Puciri/Humaita and 16 only in Aripuana/Bararati. Only few lizards and snakes (10 species) occurred in both interfluvies. The species similarity for amphibians species composition was also low between interfluvies (BRC=0.33), with 28 species recorded for Aripuana/Bararati and 20 for Puciri/Humaita. And 20 species were observed only in Aripuana/Bararati and 12 only in Puciri/Humaita. Only eight frogs occurred in both interfluvies. Comparing species records in different environments the occupation pattern showed major local diversity (α) in forests environments and there was a representative contribution of not-forest environments for regional diversity (β) with new reports of species distributions for these Amazon regions.

Theme: Amazon savannas, Herpetofauna, checklist, conservation, distribution

Type of Presentation: Poster

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BEHAVIORAL AND THERMAL SENSITIVITY IN TUPINAMBIS MERIANAE (SAURIA: TEIIDAE): A ONTOGENETIC VIEW.

Fabio Cury de Barros, Tiana Kohlsdorf

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Lizards regulate their body temperature through heat exchanges with the environment, and an effective thermoregulation using appropriate sources of solar radiation and (or) a warm substrate grants suitable performance of biological activities in a given habitat. Therefore, it may be expected that both behaviour and physiological pathways related to the thermal sensitivity are under constant action of natural selection in these organisms. In this scenario, the present study investigates two hypotheses: 1) juveniles of the lizards *Tupinambis merianae* exhibit often a flight antipredator behavior while adults are more aggressive; 2) the activities of anaerobic glycolytic and oxidative enzymes differ between juveniles and adults at low temperatures. Behavioural tests were performed at five distinct temperatures. The thermal sensitivities of the enzymes Citrate synthase (CS), which is

related with aerobic metabolism, and Lactate dehydrogenase (LDH), which is central to anaerobic metabolism, were analyzed. The results corroborated the hypothesis tested. Adults became more aggressive when the temperature decreased while the juveniles always exhibited a flight behavior. Metabolic differences were observed mainly in the activity of LDH enzyme in adductor externus superficialis (jaw muscle) and CS thermal sensitivity in iliofibularis (hindlimbs muscle), between juveniles and adults of *Tupinambis merianae*.

Theme:temperature, Tupinambis, ontogeny, anti-predator behavior, enzyme activity

Type of Presentation: Poster

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Aspects connected to the nourishment of the young *Podocnemis expansa* in nature and on commercial captivity

Fatima do Nascimento Armond

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Knowledge about nutritional needs, metabolism and feeding behavior is important for chelonian management and conservation. This research aims to study diet of young *Podocnemis expansa* in nature and in a commercial captivity in Tocantins state. For the latter, management practices were also evaluated. Individuals in the wild (n=80) were captured in Rio Javaés/TO. Captures were divided in two seasons (dry and rain season) and two capture periods (20 individuals each) per season. Animals were captured using baited fishing hook, nets or by hand, by diving in shallow waters. We also evaluated 160 captive animals, captured in two dry and two rain season periods, in two different tanks at Fazenda Praia Alta, Lagoa da Confusão/TO. Wild captured individuals and their diet was assessed using stomach content stored in 10% formalin. Stomach content was separated and analyzed by occurrence and gravimetric methods, and protein content was determined by the Kjeldal method. In captivity, regular food offer and relative management practices were recorded. Protein purport was determined according to the Brazilian Table of Food Composition. Food items included vegetables (protein level between 0,51 and 7,81%) and commercial fish food (protein level between 24 and 28%). On severe rain season, at Rio Javaés, stomach content was significantly greater (13,82g) than moderate rain season (5,55g) and dry season (two periods - 2,48g and 3,14g). Same food items were found in all seasons. During rain season, for both sampling periods, percentages of food items were 64% and 57% (vegetable), 9% and 8% (animal), 24% and 31% (unknown and micro-particulate items) and 2% (mineral). For dry season, percentages were, 26% and 47% (vegetable), 1% and 4% (animal), 37% and 36% (unknown and micro-particulate items), 9% and 13% (mineral). Nematodes and trematodes were found in stomach content from 10% and 7.5% of analyzed dry season individuals and 30% and 27.5% of rain season individuals, respectively. The quantity of unknown and decaying items and the lack of knowledge about items digestibility turns analysis of items percentage less precise. We found that season influences on the quality and quantity of individuals' diet. In captivity, wrong feeding management practices have shown to have negative impact the growth of body mass, with individuals aging from five to seven years old failing to reach 1,5Kg (minimum weight for trading purposes).

Theme:turtles, conservation biology, behaviour, captive breeding

Type of Presentation: poster

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Parasitism on *Podocnemis expansa*

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Information about parasite diversity, life cycles and ecological relation or effects on host metabolism is almost absent in chelonians. This study aims to evaluate ecto and endoparasite occurrence and intensity on *Podocnemis expansa* nestlings and youngs. At Rio Javaés/TO, young individuals (shell length between 15 and 30cm) were captured using fishing hook, nets or by hand, diving in shallow waters. Twenty individuals were captured for each sampling period (two sampling periods for both dry and rain season). Newborns (n=100) from the same nest were captured and later placed on captivity on commercial farm "Praia Alta", in the municipality of Lagoa da Confusão/TO. Eighty young individuals from two different tanks from the previously referred farm were included in this study. Twenty individuals were collected during each sampling period. Ectoparasites were collected using a scalpel, placed in distilled water and ice for two hours and then transferred for microscope glass slides and kept in 70% alcohol. For identification, specimens were dehydrated clarified and assembled on Canada balsam. Protozoans were observed by counting 200 erythrocyte in blood smears, colored using "fast Panopticum" method. Helminthes were separated from food content, which was collected by stomach washing. Data were converted to percentages, and analyzed using the test of U at 5% significance and linear correlation. During rain season, higher infestation levels of *Klossinemella conciliatus* were found, against low infestation levels of *Atractis cruciata*, *Atractis* sp.,. During dry season there was detected a higher level of the Trematodea, *Halltrema avitellina*. For wild chelonians, there were 99% of blood parasites, gametocytes of *Haemogregarina* sp. and unknown cytoplasmatic inclusions. Statistically higher gametocyte levels were found during dry season. Inclusions were different for dry and rain season, with higher parasitic infestation during rain season. In captive individuals, infestation levels were of 3% (gametocyte) and 9% (inclusions) in one tank and 18% (gametocyte) and 36% (inclusions) on the other tank. Blood parasites were found only during high dry season, with higher level for the tank with lower leach infestation (20%), which differed significantly from the other tank with (46%). During rain season peak, three microfilaria were found in extra-cellular matrix. At Javaés River, during rain season, intensity of ectoparasites varied from 1 to 17 per individual, all from the species *Unoculobranhiobdella expansa*. Correlation between ectoparasite levels (higher in captivity) and blood parasite levels (higher in the wild) was negative for all environments. Analyzed newborns were never infected.

Theme: Turtles, community ecology, captive breeding,

Type of Presentation: Poster

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Thermoregulation of the *Sceloporus torquatus* group: consequences on distribution and life history traits

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Sceloporus torquatus is a group composed by viviparous lizards that inhabits different altitudinal ranges (0 – 3400 m). Viviparity influences several of their life history traits as winter pregnancy and thermal preferences that are present in the entire group with the following consequences: a) winter pregnancy seems to be favored because the mountains show a lower thermal quality during the summer which limiting the embryonic development, b) winter pregnancy limiting the distribution toward the north due to low temperatures at latitudes higher than 35° N, c) species that occurs in tropical climates show prefer temperatures similar to the ones that occurs in temperate environments

but shows differences in basking times, d) minimum pregnancy period is of four months even with operative temperatures higher to preferred temperatures, e) minimum pregnancy period seems to be limiting the geographic distribution as species that inhabits latitudes higher than 35° N shows pregnancy periods maximum of 3 months.

Theme: Thermoregulation, *Sceloporus torquatus*, Winter gestation, Distribution

Type of Presentation: Oral, Symposium 1: Reproduction in reptiles: from genes to ecology

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Costa Rican Amphibian Conservation Strategy

Federico Bolaños* and Yolanda Matamoros

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In 2002, ten Costa Rican amphibian experts met to analyze the population status of all 180 native amphibian species and develop a Conservation Assessment and Management Plan (CAMP). This was the Costa Rican contribution to the Global Amphibian Assessment (GAA). In response to the pressures on native amphibians, four years later we produced a National Conservation Strategy. CBSG Mesoamerica, the University of Costa Rica and Amphibian Ark (AArk) organized a workshop for this assessment in 2006. Fifty eight Costa Rican nationals and residents together with 11 international representatives met to discuss the actions required for in-situ and ex-situ research and conservation to promote a better understanding and the conservation of Costa Rican amphibians. The need for participation of all the people in an education group was also considered. As a result three subsequent meetings were convened: a revision of the status of Costa Rican amphibians was conducted during a second CAMP in 2007 together with GAA representatives; a Species Prioritization Workshop for ex-situ conservation in 2007 together with AArk, and this year, a seminar to promote the participation of veterinarians in amphibian conservation activities. An impressive outcome is the way in which a growing interdisciplinary group of professionals have generated a better understanding of Costa Rican amphibians. With the information now available, we have changed the population status of 40 out of 188 amphibian species. The most significant and negative changes are the identification of two out of four endemic species as extinct and another eight species highlighted as possibly extinct. We now have less data deficient (DD) species and, excluding these DD species, a total of 18 species were downlisted to a less severe conservation status and nine were uplisted to a more severe conservation category. A list-serve has been established, now with 78 participants, and we are organizing a course for captive amphibian management and a workshop to establish the Regional Amphibian Conservation Strategy directed to the Mesoamerican and Caribbean Zoos and Aquariums Association. An Amphibian Reproduction and Research Center has been designed and will be constructed at Santa Ana Conservation Center, one of the national zoos. Several educational activities for the country school system in both Costa Rican national zoos has been organized, and we have designed an itinerant exhibition about amphibians that will travel throughout country to commemorate the Year of the Frog.

Theme: amphibians, captive breeding, Costa Rica, Endangered Species

Type of Presentation: Oral, Symposium 14: Amphibian conservation.

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Evolution of Sexual Dimorphism in Tropidurinae Lizards: Relationships with Habitat Use

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Sexual selection is directly related to the reproductive success of a given individual and favor changes that improve its ability to attract mates and increase offspring. This type of selection is based both on males dispute for females (intrasexual selection) and on females choice for males (intersexual selection). These kinds of behavior are possibly mediated by complex visual signalling. The sexual dimorphism in shape or in coloration patterns facilitates the perception of these visual signals, and both signalling emission and perception may be influenced by the density of vegetation and the presence of physical barriers in a given environment. For example, in environments with less dense vegetation the area for transmission of visual signalling is increased. Thus, one could expect that in Brazilian open habitats (e.g. Cerrados and Caatingas) the evolution of morphometric sexual dimorphism would be favoured, in comparison with forested habitats (e.g. Amazonian and Atlantic forests). The present study tested this hypothesis by quantifying seven morphometric variables in males and females belonging to twenty one species of Tropicurinae lizards: Snout-vent length (SVL), tail length, height, width and length of the head, and two semi-axes of the femoral right spot (which were used to calculate the femoral spot area, FSA). Rates of sexual dimorphism were calculated for each species based on the measured variables, and because a significant phylogenetic signal was detected in most traits, statistical analyses were performed both using a conventional and a phylogenetic approach. Ancestral state reconstructions of the variables were mapped on the Tropicurinae phylogeny. Conventional t tests detected significant differences between open and forest species only for SVL dimorphism rate, but this result was not confirmed by the phylogenetic analysis, suggesting that the difference in sexual dimorphism of body size between open and closed habitats is probably mostly due to phylogenetic relationships among species

Theme: lizards, morphology, sexual dimorphism, evolution

Type of Presentation: Poster

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Phylogeography of *Phyllorhynchus pollicaris* (Squamata: Gekkonidae): coalescent tests of palaeodistribution modeling hypotheses of the evolution of South American dry biomes

Fernanda P Werneck

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Despite the advances of phylogeography, the field traditionally disregards the 'geographical' component compared to the 'phylo'. In such a context, recent efforts to use species distribution modeling in conjunction with phylogeography have great potential to generate (through GIS approaches) testable hypotheses of historical relationships (through genetic approaches). The final test of alternative hypotheses can be done within a coalescent framework, in which genealogies and sequence data are simulated under a neutral coalescent model and tested against empirical molecular data. Here we used palaeodistribution niche modeling (using Maxent) to generate phylogeographical hypothesis of relationships among populations of the lizard *Phyllorhynchus pollicaris* (Squamata: Gekkonidae) in the South American dry biomes of Seasonally Dry Tropical Forests (SDTFs), Cerrado, and Chaco, and test them using empirical sequence data of mitochondrial (16S) and nuclear (RAG-1) genes into a coalescent simulation framework (using Mesquite). The alternative

populational hypotheses tested were: Pleistocenic Arc hypothesis, in which we expected that divergence of SDTFs populations of *Phyllopezus pollicaris* began after the Last Glacial Maximum (LGM; 21,000 YBP) and that they share a more recent history than populations from Cerrado and Chaco; and the Pleistocenic Refugia of dry vegetations hypothesis based on palaeodistribution modeling, in which we expected that SDTFs' populations had already diverged from each other and were isolated by an inhabitable barrier during the LGM (Figure 1). In general, during the LGM areas were less suitable for *P. pollicaris* occurrence and the past distribution were more restrict than the present projected distribution. The observed and simulated number of deep coalescences calculated under each population hypothesis was significantly different under both tested hypotheses for both genes. In other words, the observed patterns were significantly different from what should be expected if the data fitted a given hypotheses in both cases. We argued that the populational history of *Phyllopezus pollicaris* could not be predicted by a single model of evolution for the dry biomes of South America and instead complex multiple biogeographical histories took place. Factors that might determine this pattern are: high levels of gene flow sufficient to homogenize geographically separated populations; fragmentation of populations in geographical areas followed by secondary contact in a constantly changing landscape, and occurrence of finer geographical scale genetic structure instead of large scale patterns. Finally, our results indicates complex biogeographical histories that should be considered in conservation efforts for South American dry biomes, not justifying their consideration under single efforts of conservation.

Theme: Cerrado, SDTFs, Chaco, coalescent, phylogeography, palaeodistribution, species modeling, lizards.

Type of Presentation: Poster

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Phylogeny, biogeography and evolution of clutch size in South American lizards of the genus *Kentropyx* (Squamata: Teiidae)

Fernanda P Werneck

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The lizard genus *Kentropyx* (Squamata: Teiidae) comprises nine species: *Kentropyx calcarata*, *K. altamazonica*, and *K. pelviceps* (*calcarata* group – associated to forests); *K. paulensis*, *K. vanzoi*, *K. viridistriga* and *Kentropyx* sp., an undescribed species (*paulensis* group – associated to open ecosystems); *K. striata* and *K. borckiana* (*striata* group - associated to open ecosystems). We reconstructed phylogenetic relationships of *Kentropyx* based on morphology (pholidosis and coloration) and mitochondrial DNA data (12S and 16S), using maximum parsimony and Bayesian methods, and evaluated biogeographic scenarios based on ancestral areas analyses and molecular dating by Bayesian methods. Additionally, we tested the life history hypothesis that species of *Kentropyx* inhabiting open ecosystems (often seasonal) produce larger clutches with smaller eggs and that species inhabiting forest ecosystems (often aseasonal) produce clutches with fewer and larger eggs, using Stearns Phylogenetic-Subtraction Method and Canonical Phylogenetic Ordination to consider the effects of phylogeny. Our results showed that *Kentropyx* comprises three monophyletic groups, with *K. striata* occupying a basal position in opposition to previous suggestions of relationships (Fig. 1). Additionally, Bayesian analysis of divergence time indicated an early diversification of *Kentropyx* species mostly during the Miocene and the only diversification that took place during the Quaternary was among populations within species (Fig. 1). The “Pleistocenic Refuge

Hypothesis” has only limited importance for the diversification of *Kentropyx* species, being able to explain only recent diversification of populations. DIVA analysis found two equally most parsimonious reconstructions, with four dispersal events each during the evolution of *Kentropyx*. Both reconstructions require one dispersal event of *K. calcarata* into the Atlantic Forest and one of the common ancestor of *K. viridistriga*, *K. paulensis*, and *Kentropyx* sp. into the Chaco-Paraná Basin. The other dispersal events will depend on whether the common ancestor of all living *Kentropyx* species was restricted to the Guianan and Brazilian Shields or if it also inhabited the Amazon Basin. Savannas were likely the center of origin of the genus, instead of Amazonian forest as previously suggested. Historical events during the Tertiary of South America promoted the differentiation of the genus, coupled with recent Quaternary events, important as dispersion routes and for populational diversification. Clutch size and egg volume were not significantly different between major clades and habitat, irrespective of phylogenetic structure. Variation in reproductive parameters was not determined by the major habitat type where species occur, but may reflect phylogenetic constraints and phylogenetic inertia, essential aspects of life history evolution for *Kentropyx*.

Theme: lizards, *Kentropyx*, phylogeny, biogeography, life history evolution, reproduction

Type of Presentation: Poster

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EFFICIENCY OF SAMPLING AND AMPHIBIAN DIVERSITY ON A BRAZILIAN CERRADO AREA

Fernanda Werneck

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The Cerrado is a Neotropical savanna known for its elevated species richness, being one of the greatest global hotspots of biodiversity. However, the continuous anthropic use of this biome is endangering its associate fauna. In this context, diversity studies can generate essential technical information to define conservation strategies. The herpetofauna has characteristics clearly important for these studies, such as specificity in habitat use and relatively ease of sampling. Particularly amphibians, which depend on water and vegetation quality to complete their life cycle, can serve as model organisms for conservation studies. Our aim was to determine the efficiency of amphibian sampling, and estimate their diversity on a Cerrado area in central Brazil. We carried out this work in 2006, on a farm located in Novo Gama-GO with weekly sampling between April 2006 and March 2007 in seven different habitats: cerrado stricto sensu, campo sujo, gallery forest, permanent pond, intermittent pond, streams, and dry forest. We used three sampling methods: active search, conducted weekly (70 days of work), pitfall traps (175 traps installed), and traps of temporary shelter, distributed on the margins of ponds and streams. We estimated species richness using a rarefaction curve, with 10,000 randomizations. Over 35 weeks of sampling, we collected 802 individuals, corresponding to 29 anuran species, distributed into five families, and one *Gymnophiona* species. The families with higher species richness were Leptodactylidae and Hylidae, with 12 and nine species, respectively, following the patterns of distribution for the Neotropics. The three most abundant species were *Hypsiboas albopunctatus* (n = 126), *Dendropsophus minutus* (110) and *Physalaemus cuvieri* (107). Of the 30 sampled species, six are endemic to the Cerrado: *Barycholos ternetzi*, *Bokermanohyla pseudopseudis*, *Epipedobates flavopictus*, *Hypsiboas lundii*, *Phyllomedusa azurea* and *Proceratophrys goyana*, which represent approximately 18.75% of the endemic

amphibians known for this biome. Although the rarefaction curve showed that the amphibian richness might be even greater, the local richness (30 species) account for approximately 26% of species known to the all Cerrado biome. A more specific analysis on species richness patterns revealed that this area contains about 50% of the reported regional amphibian richness for the Federal District, one of the best-sampled Cerrado regions. These results, together with the strategic location of the studied area, strongly suggest that its maintenance as a conservation unit might be important for protection of endemic amphibian species, serving as source for migration and gene flow to other areas of preservation.

Theme:amphibians, community ecology, diversity, conservation biology

Type of Presentation: poster

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Abiotic noise, call frequency and the composition of stream-breeding anuran communities

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Environmental noise can be an important selective force modulating the evolution of call traits in species with acoustic communication. Many anuran species breed alongside streams and, hence, the sound produced by the flowing water is the most important noise source that they face for communication. Since calling is physiologically very expensive in anurans, and communication is essential for reproduction, we expected adaptations that reduce environmental masking effects and allow communication in streamside breeders. This basic assumption of bioacoustics has not been yet evaluated in anurans. We tested whether anuran species that breed alongside streams call at higher frequencies than species that breed away from streams, controlling biases generated by the body size (SVL) and phylogenetic affinity of species. We compiled primary and secondary data on phylogeny, SVL, breeding place, and dominant frequency (DF) of advertisement calls for 54 species of Brachycephalidae, 22 of Bufonidae, 31 of Dendrobatidae, 64 of Hylidae, and 13 of Ranidae. Later, we compared the DF of species that breed alongside streams and those that breed away, both before and after statistically controlling the effect of SVL (analysis of residuals between SVL and DF of call) and phylogeny (independent contrasts). DF of call tends to be higher on average and lower in variance in streamside breeding species. In addition, SVL of streamside species was concomitantly lower. After controlling by SVL and phylogeny, only differences in SVL persisted. Our data suggest that acoustic signals of large species (characterized by lower DF) may suffer from higher levels of acoustic interference than acoustic signals of small species, because noise produced by flowing water is higher at lower frequencies. Consequently, larger species will have more difficulties than smaller species for communicate in those noisy microhabitats, which implies a reduction in their possibilities for establishing viable breeding populations alongside streams. This fact alone would explain SVL (and call frequency) bias in anurans establishments alongside streams.

Theme:amphibians, anurans, reproduction, behavior, communication, advertisement calls, abiotic noise, stream breeders.

Type of Presentation: Oral

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Human Activities Alter Biogeographical Patterns of Reptiles on Mediterranean Islands

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The theory of island biogeography predicts species richness based on geographical factors that influence the extinction-colonization balance, such as area and isolation. However, human influence is the major cause of present biotic changes and may, therefore, modify biogeographical patterns by increasing extinctions and colonizations. Our aim was evaluating the effect of human activities on the species richness of reptiles in islands. Using the literature, we built a dataset reporting the distribution of reptiles in 212 islands from six countries in the Mediterranean sea and Macaronesia. We built spatial regression models (Spatial Eigenvector Mapping), to compare the effect of geographical (area, isolation, topography) and human factors (human population, presence of airports) on the richness of native and alien species. We also used piecewise regression to evaluate whether human activities cause deviation of the species-area relationship from the expected linear pattern. The richness of both native and alien species was best explained by models combining geographical and human factors. The spatial regression model showed that the overall species richness related positively to island area and elevation, and negatively to isolation, human population and presence of airports (Table 1a). This pattern occurred because native species related negatively to human influence (Table 1b). The presence of airports, a proxy of trading intensity, was positively related to the number of alien species of reptiles. Overall, human influence increased the number of alien species (Table 1c), but this increase did not compensate the loss of native species. In models that did not take into account human factors, the relationship between $\log(\text{island area})$ and $\log(\text{species richness})$ was not linear (Fig. 1). Large islands (area > 150 ha) hosted fewer native species than expected from a linear species-area relationship, because they were affected more strongly by human influence than were small islands. Anthropogenic factors can strongly modify the biogeographical pattern of reptiles in islands, probably because they are major drivers of present-day extinctions and colonizations and can displace island biodiversity from the equilibrium points expected by theory on the basis of geographical features. Since human influence is now a major driver of global scale processes, it should be better integrated in biogeographical analyses, for a more complete understanding of large-scale patterns and processes.

Theme: reptiles, turtles, snakes, lizards, community ecology, conservation biology, biogeography

Type of Presentation: oral; contributed

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Census size, polygyny and effective population size of small populations of the threatened frog, *Rana latastei*

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Effective population size (N_e) is a key determinant of genetic diversity of populations. In amphibians, the ratio effective population size / census size (N_e / N) is often very low, raising concerns for the long time persistence of genetic diversity in isolated populations. It has been proposed that the

phenomenon of 'genetic compensation' increases the ratio N_e / N in small populations, but the underlying mechanisms are poorly understood. Polygyny is a major factor decreasing N_e / N due to the negative relationship between polygyny and effective population size. We used microsatellites to evaluate the relationship between census size and polygyny in populations of the threatened Italian agile frog, *Rana latastei*. We reconstructed parentage in tadpoles from nine populations with 8-35 breeding females, using a likelihood based method. The level of polygyny strongly differed among populations (average number of mates per breeding male: 2-6.4). Polygyny was greater in populations with large census size. Moreover, variance among males in mating success was larger in large populations. In polygynous species, increasing levels of polygyny in large populations may explain low N_e / N values, and has important implications for the conservation of genetic diversity.

Theme: amphibians, reproduction, behaviour, genetics, conservation biology, endangered species

Type of Presentation: oral, Symposium 10: Conservation Genetics of Amphibians and Reptiles in the 21st Century

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Eleutherodactylus coqui morphological response to the introduction in the Hawaiian Islands.

Francheska Ruiz-Canino and Richard Thomas

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Eleutherodactylus coqui is an amphibian species native to Puerto Rico that has been introduced to Saint Thomas; Saint Croix; South of Florida; Louisiana; Santo Domingo, Dominican Republic and Hawaii. Out of all places of introduction, Hawaii has been the most affected by the introduction of the coquí, mainly because the islands of Hawaii do not possess any native amphibians, meaning that coquíes have no natural predators and no competition (empty niche). Currently there are over 250 known populations on the islands of Hawaii and Maui. The coquí was accidentally introduced to Hawaii in the late 1980s likely from infested plant shipments from the northeastern part of Puerto Rico. Invasion events have been known to cause adaptations in morphology (phenotypic plasticity of the species), and some species have been shown to increase in biomass. We do not know if this is the case for the coquíes in Hawaii. The purpose of our study is to determine if the introduction of the coquíes to Hawaii has resulted in any morphological changes on the invasive populations. We envision that since Hawaii has no native amphibians and the predators array is different from that of Puerto Rico that the coquíes will experience a quite different selective regime, possibly affecting their morphology and their coloration. To examine this we took 17 standard morphological measurements of 15 *Eleutherodactylus coqui* individuals from Puerto Rico and compared them with 15 individuals found in three of the eight main islands of Hawaii (Maui (6), Hawaii (6), and Oahu (3)). We then conducted a student t-test to determine if there were statistical differences between averages of any of the 17 measurements for the two groups (Puerto Rico and Hawaii). Out of the 17 measurements 8 were statically significant between both groups and in all cases Hawaiian coquíes showed average differences. The biggest differences were found in measurements of leg bones and third finger width. We did not find Hawaiian coquíes to be larger (Snout Vent Length) but there seems to be a tendency for increasing size. These conclusions are very preliminary and we intend to expand our sampling both of Puerto Rican and Hawaiian coquíes and to include variation in color and pattern

Theme: Invasive Species, Phenotypic Plasticity, Morphological Differences, Hawaii, *Eleutherodactylus coqui*

Type of Presentation: _Poster_
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Improving Tree Plantings as Habitat for Reptiles

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We surveyed differing sized planted areas and remnants in southeastern Australia to determine the value of plantations to herpetofauna. We used time-constrained surveys to count the reptiles present in small and large plantings compared to small and large remnants. Reptiles were present in all four types of habitat, but remnants have relatively more individuals present relative to plantings. However, there was a significant scattering of results due to relatively low count numbers. Reptile numbers in plantings with significant levels of retained cover appear to be significantly greater than in plantings with no retained ground cover. Ground cover is typically removed during the seedling establishment process, which appears to inhibit the broader use of these sites by reptiles. We recommend that landholders deliberately retain cover objects within planted areas to improve its habitat quality. Attempts to introduce artificial cover as compensation are underway.

Theme: Reptile, habitat restoration, plantations, conservation

Type of Presentation: Poster contributed

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The relationships between habitat and pond use by frogs in NSW

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The features of ponds or the surrounding forest environment has the potential to influence the anurans likely to use the ponds, but this is not well understood in Australia. We undertook a study of ponds in central and northern coastal NSW to assess the possible links between habitat and the presence and abundance of frogs. 93 ponds were surveyed to record frog populations and information taken on attributes of the ponds themselves, the surrounding vegetation and the level of human disturbance. We compared the frog counts and the habitat attributes using various multivariate tests. Overall frog species richness and total frog abundance does not have strong obvious relationships with the measured habitat features. There was an apparent strong effect of region for some species (eg *Mixophyes fasciolatus*), reflecting gradients in abundance across the study area. Models for individual species showed a greater ability to explain the variation in presences and abundances, but the overall explanatory power again remained relatively small. Frog numbers showed little obvious relationship with human disturbances. We believe that frog communities may be relatively random in their establishment and that the frogs prevalent in the forest today are not greatly influenced by the current levels of human disturbance.

Theme: anurans, ponds, habitat relationships, conservation

Type of Presentation: Oral, Symposium 8: Herpetological Conservation & Biology

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Morphological variation in the allantoplacenta within the Mabuya lineage

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The genus *Mabuya* is highly placental due to the greatest placental morphological complexity known among squamates. The type IV allantoplacenta proper of this genus has been studied in few species; however, some morphological variations of this placental morphotype have been found. We studied the morphological variations of the allantoplacenta of twelve populations of *Mabuya* distributed in different geographic areas in North of South America. All the populations conserve a general placental morphotype and a similar pattern of morphological specializations already found in other species of *Mabuya*. In the embryonic hemisphere are encountered specialized structures for the transport of nutrients (placentome, paraplacentome and chorionic areolas), and in the abembryonic hemisphere there are structures related to the histotrophic transfer (absorptive plaques) and for the respiratory exchange (respiratory segments). However, the placentalome of some populations shows characteristics related to a localized endotheliochorial placenta, such as invasive cells in the uterine syncytium, which probably arise from chorionic cells that features apical projections deeply toward the uterine syncytium. Variations in the morphology of the absorptive plaques and respiratory segments were also observed, we found for some of the populations the occurrence of folded and delimited absorptive plaques, and highly folded regions (folded respiratory segments integrated with folded absorptive plaques), which are regionalized, the latter at the abembryonic pole. These variations confer a greater morphological complexity and an increased nutrient transfer area to the placenta. The replication and the regionalized differentiation of the absorptive plaques can be the possible mechanisms that underlie the evolution of this placental complexity within the genus. Absorptive plaques are instrumental in the emergence of specialized structures for nutrient transport such as the placentalome in the embryonic region and the different types of absorptive plaques in the abembryonic region. Therefore, these placental specializations can be regarded as serial homologous structures, which constitute repetitive structures with a similar morphology and a common ontogeny. The regionalization of the embryonic chamber perhaps could be the product of regionalized inductive signals affecting absorptive plaques. Consequently, there is an interesting variability of specialized structures within a common morphological pattern shared by the species of *Mabuya*.

Theme: lizards, reproduction, developmental biology, morphology

Type of Presentation: Oral, Symposium 1: Reproduction in reptiles: from genes to ecology

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Evaluation of the populational status of *Atelopus eusebianus* and *Atelopus ebenoides* in San Rafael's Natural National Park sector Puracé Department of the Cauca and Evaluation of the populational Status of *Atelopus eusebianus* and *Colostethus pinguis* in the

Francisco José López-López, Dorado-Santa Eyder Alexander, Arboleda-Simmonds Alejandro,
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The work one carries out during one year, in San Rafael's Natural National Park sector Puracé Municipality of Puracé and in the region of Malvaza, corregimiento of Gabriel López Municipality of Totoró in the Department of the Cauca, trying to cover the different winter seasons and summer or veranillo, you employment the methodology of inspection transectos for visual encounter IEV, by means of the realization of transectos day different longitudes keeping in mind the characteristics of the land and the size of the visited vegetable communities, they were reported a total of nine copies of *Atelopus eusebianus* inside San Rafael's sector in the PNN Puracé and a copy of *Atelopus ebenoides ebenoides*, in a very far away town and outside of our study areas, For the malvaza town eight copies of *Atelopus eusebianus* are reported, registrations of *Atelopus ebenoides ebenoides* and 160 copies of *Colostethus pinguis* don't exist. You uses the method of free search or inspection transectos for visual encounter and the cut of phalanges like marcaje method, recapturas was not presented.

Theme: *Atelopus eusebianus*, *Atelopus ebenoides ebenoides*, *Colostethus pinguis*, Natural National Park Puracé, Lagoon of San Rafael, Malvaza

Type of Presentation: Poster

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Evaluation of the populational status of the *Atelopus eusebianus* in the region of Malvaza Municipality of Totoró Department of the Cauca-Colombia

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The work one carries out during one year, in the sector of Malvaza, municipality of Totoró, Department of the Cauca, intended to determine the current state of the populations of *Atelopus eusebianus* in him study area and to identify the main threats that are affecting to the species, to be able to implement conservation measures. By means of the employment of the following methodologies like the inspection transectos for visual encounter (IEV), you parcel or samplings for quadrants and the realization of day transectos of different longitudes keeping in mind the characteristics and the size of the visited vegetable communities, trying to cover the different seasons of the year like winter and summer or veranillo, the populational status of *Atelopus eusebianus* was evaluated where were reported a total of six copies of the species inside an area of but of 50 hectares.

Theme: *Atelopus eusebianus*, Moor of Gabriel López, Valley of Malvaza, Anuros, Totoró, Cauca, Colombia.

Type of Presentation: Poster

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ANALYSIS OF THE VOCALIZATIONS OF FOUR SPECIES OF DENDROBATIDS (AMPHIBIAN-ANURANS) OF THE I COLLIDE BIOGEOGRAPHIC ZONE

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The anurans, frogs and toads, are a group of quite attractive animals for their vocalization, their songs or calls, which carry out most of the species during the hours of the night. These calls are quite diverse and they vary among the different species, even within a species variations exist in the vocalizations, used in different occasions. In general it is considered that only the males who vocalize and that the females choose them to mate. Apart from the call of Warning, the anurans have other types of calls. For example, the liberation call or of detachment, which is produced by males or for females non willing to mate when they are amplexed by other males. Not all these characteristics are equally important for the intraespecific communication, but invariably it has been that the females prefer the calls of their own species. Presently work is being done to establish the differences of the calls among the four species., to compare the calls of the species in the wild and in captivity, by means of the realization of recordings in field and laboratory that later will be analyzed using a software of analysis of sounds.

Theme:amphibians, anurans, acoustic calls, dendrobatidae

Type of Presentation: Poster

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Black caiman (*Melanosuchus niger*) nesting ecology in a protected Varzea Forest from Central Amazon, Brazil

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The Brazilian populations of black caiman (*Melanosuchus niger*) were recently down listed on CITES Appendix II as populations have increased in the central Amazon during the last decades. Sustainable management programs are being planned, yet black caiman nesting ecology still needs to be understood throughout its range. We studied black caiman nesting in the Jaraua sector of the Mamirauá Sustainable Development Reserve (MDSR), a protected Varzea forest (floodplains of silt-laden waters) located at the confluence of the Japurá and Solimões rivers, in the Central Amazon, Brazil. All nests located were georeferenced and visited twice during the incubation period to determine hatching success and causes of egg mortality by observing the remains of the nests. We collected data of clutch and egg size on about one-third of all nests found. We related the occurrence of nesting sites with hydrology and habitat availability in interior water bodies. With the aid of Landsat satellite images, we are trying to identify suitable nesting habitats in the southern-most part of the reserve (the focal area). Black caiman nesting occurs during annual low-water levels (September-December). We found 148 nests with average clutch size of 30.8 eggs, mean egg length of 80.0mm and mean egg width of 50.2mm. We found low hatching success (15% of all nests studied). The main causes of egg mortality were predation (70%) and flooding (13%). Most of the eggs predated were taken by Tegu lizards (*Tupinambis* sp) and local people. Humans collected eggs in lakes both close and far away from their community. This collection appears to be for consumption and associated with fishing excursions. Black Caiman females prefer to nest in lakes with relatively stable water levels during annual low-water period. Low Varzea forest was the most used habitat for nesting and the occurrence of aquatic macrophytes in the lake margins was frequently associated with nesting sites. Lakes where water levels are highly variable during low-water period present shores with exposed soil, this habitat was avoided for nesting. Some of the features mentioned above are identifiable on satellite images and might be potentially good predictors of nesting sites. Black caiman sustainable management programs should take into account information on habitat preferences for nesting and avoid management activities near nesting sites.

Theme: Melanosuchus niger, nesting sites, hydrology, habitat availability

Type of Presentation: Oral, Symposium 7: The biology and management of crocodilians.

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From the Global Scale to a Conservation Strategy for the Amphibians of Madagascar: An Example of an Action Plan for a Highly Diverse Frog Fauna

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The highly diverse amphibian fauna of Madagascar is currently represented by around 240 species of frogs. According to the Global Amphibian Assessment (GAA), Madagascar ranks as the country with the 12th highest amphibian species richness, but this is likely an underestimate as an additional 182 candidate species have been identified. This makes of Madagascar a real focus for frog diversity, especially if we take into consideration that all the autochthonous species are also endemic and only one species is present elsewhere as an introduced species. The amphibians of Madagascar also represent an ideal fauna upon which developing the global amphibian actions and the Amphibian Conservation Action Plan (ACAP) at a regional scale. This is due to a series of reasons. Extinctions of Malagasy amphibians have not yet been detected: in fact, all historically described species have been observed during the past 15 years. Furthermore, Batrachochytrium dendrobatidis has not yet been detected and there are reasons to believe that it is not yet reached Madagascar. Nevertheless, the conservation status of Malagasy amphibians is reason for concern. Ongoing habitat destruction has already led to destruction of 90% of the original vegetation and threatens most species. To address these threats, we have developed a specific action plan, entitled Sahonagasy Action Plan. In addition, we held the workshop "A Conservation Strategy for the Amphibians of Madagascar" (ACSAM) in Antananarivo in September 2006. It was attended by more than one hundred biologists and major conservation and governmental agencies. To provide a scientific basis for conservation actions, a proceedings volume is being published in 2008, summarizing the conservation-relevant scientific results of the workshop in 26 articles by 56 authors. A volume summarising the steps of the action plan is being sponsored by the Malagasy government. The conservation actions summarised in the action plan focus on (1) the coordination of research and conservation; (2) monitoring of amphibians; (3) managing the emerging diseases; (4) effects of climate change; (5) management of focal areas; (6) harvesting and trade; (7) captive breeding and zoo actions; (8) natural history collections. The actions, projected in a 5-years timeframe, have been estimated to cost around 2 000 000 EUR. Madagascar may be the only worldwide amphibian diversity hotspot still in a pre-decline phase where intensive pro-active conservation measures are feasible, and where the impacts of climate change can be measured without the confounding influences of emergent diseases such as chytrid fungus.

Theme: amphibians, anurans, conservation biology, captive breeding, endangered species, Madagascar

Type of Presentation: Oral, Symposium 14: Amphibian conservation.

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Assisted Breeding of Skinks or How to Teach a Lizard Old Tricks!

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The introduction of predatory mammals has dramatically reduced the abundance and distribution of endemic New Zealand reptiles and over 50% are now threatened. Consequently little is known about the reproductive patterns of many of these species. Reproductive technologies are invaluable tools for understanding how different species reproduce. Contemporary techniques like artificial insemination established long ago in livestock have been used to assist the breeding of threatened species *ex situ*, even restoring them to nature. This has been most successful through initial testing and application of procedures in a taxonomically related model species. McCann's skink (*Oligosoma maccanni*) is a viviparous lizard that is still relatively abundant and its reproductive cycle in the subalpine area of Macraes Flat in southern New Zealand has recently been described. Assisted breeding techniques are being developed in this skink as a model for threatened lizard species such as the grand skink (*Oligosoma grande*) and Otago skink (*Oligosoma ottagense*). So far in male McCann's skinks, a non-destructive technique of semen collection has been established (see Figure), along with methods to assess sperm quality and specialist media developed to support short-term (liquid) storage of sperm. Long-term (frozen) storage of sperm is also in development to safeguard species level genetic variation of threatened species. Female McCann's skinks were artificially inseminated in March 2008 and most were confirmed to be cycling due to the detection of at least one vitellogenic follicle per female after palpation in May 2008. If artificial insemination is successful, females should be pregnant by October 2008 (mid-Spring), with the birth of live young anticipated January-February 2009 (late-Summer). These techniques will need refinement to be effectively adapted to threatened lizards but will significantly increase our knowledge of their unique reproductive mechanisms. In the longer term they are expected to substantially improve captive breeding success and will be vital tools to aid genetic management of animals bred for release to restored ecosystems and secure genetic repositories for future restoration needs.

Theme: reptiles, lizards, reproduction, genetics, physiology, conservation biology, captive breeding, endangered species

Type of Presentation: contributed oral presentation

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Identification of hotspots of frog endemism in the Western Ghats, India

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The topological discontinuities of the Western Ghats of India with other mountain ranges probably played an important role in controlling faunal exchange with adjacent areas, and in developing an endemic fauna. Our initial molecular screening of frog diversity in this area revealed a high number of undescribed species that are mostly found on a single mountain range. Here we further analyzed molecular data to identify regions of high phylogenetic diversity in the Western Ghats, and to quantify the intensity and direction of dispersal events in and out of the Western Ghats. Our analyses reveal that endemism goes beyond the species level for multiple families on several hilltops. Moreover, clade-level endemism was located on the same mountain ranges for all families studied. This shows that each of these isolated areas served as a center of frog diversification, and that dispersal between these ranges and other areas within or outside the Western Ghats was limited. The discontinuities of the Western Ghats mountain range thus played an important role as barriers for gene flow, and formed a substantial contribution to present-day higher-level endemism. Nevertheless, our analyses also identify a number of distinct dispersal routes that allowed faunal exchange with adjacent areas at multiple occasions.

Theme:Anura - India –Western Ghats – endemism

Type of Presentation: Oral, Symposium 9: Biogeography of the South and South East Asian Herpetofauna.

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Developing Risk-Assessment Screening Systems For Alien Herpetofauna Using Pathway-Analysis Information

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A globally comprehensive analysis of >5700 introductions of alien reptiles and amphibians shows that herpetofaunal introductions are growing exponentially, with a doubling time of just over 27 years. Six pathways account for the large majority of introductions: accidental introductions occur via cargo and the nursery trade, and intentional introductions occur for biocontrol, food use, the pet trade, and aesthetic purposes. Pathway importance varies taxonomically, temporally, and geographically, providing data potentially useful for risk assessment. Unlike most other major taxa, for which most introductions have involved either accidental pathways alone or intentional pathways alone, reptile and amphibian introductions involve a mix of both. Consequently, predicting invasiveness and preventing introduction of these organisms must involve a two-pronged approach: (1) risk assessment and treatment of pathways for taxa introduced accidentally, and (2) pre-import screening of taxa proposed for intentional introduction. Pathway risk may be liable to prediction using information on how taxonomic, temporal, and geographic variables co-vary with economic and social data. In contrast, predictive assessment of taxon risk may be had using an additive metric involving climate-matching, phylogenetic risk, and prior history of successful taxon establishment. I will discuss recent advances in meeting these predictive goals and identify additional research needed to produce a robust risk-assessment system for alien herpetofauna.

Theme:amphibians, reptiles

Type of Presentation: Oral, Symposium 2: Invasive Reptiles and Amphibians: Global Perspectives and local solutions

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Worldwide Herpetological Species Movements from 1850: Accidental, Purposeful, and Costly Ecological Change

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The purposeful or accidental introduction of new species to an environment often has unintended consequences to the productive capacity of economies and the ecosystems upon which they depend. Herpetological species have been introduced purposefully for the pet trade, as biological control agents, and food for other species. They have also been introduced accidentally as hitchhikers with general cargo and through the nursery and aquaculture trade in particular. Long term consequences of these hundreds of introductions have been little studied, but just three prominent cases with mounting costs include the brown treesnake in Guam, the cane toad in Australia, and the coqui frog in Hawaii. We investigate all known introductions of herpetological species worldwide since 1850 to determine what economic factors influence the probability of new species introductions along these various purposeful and accidental pathways. Preliminary results indicate that earlier introductions were more likely intentional and for defined gain to the introducers, that higher income, as well as looser regulatory restrictions not just for trade but for all business practices increase the probability that an introduction's provenance is known and intentional, and that the stronger a location's property rights, the less likely introductions came via known, intentional pathways or the nursery trade. These results suggest that species introductions are not simply a function of the magnitude of trade but rather broader economic incentives. The ability to identify these co-factors of introductions by pathway should improve current efforts to reduce these trade externalities.

Theme:conservation biology, economics, amphibians, reptiles

Type of Presentation: Oral, Symposium 2: Invasive Reptiles and Amphibians: Global Perspectives and local solutions

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Genetic effects of habitat fragmentation

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Habitat fragmentation is an important cause of species decline. Habitat fragmentation will both decrease population size and decrease the amount of genetic exchange among local populations. Both of these effects will reduce the local genetic effective population size and bring about inbreeding effects, which can decrease population viability. Amphibians and reptiles have been particularly affected by habitat fragmentation and therefore are especially vulnerable to these effects. Many amphibian species exist as an interconnected series of populations. Metapopulation models predict

that isolated populations are more likely to go extinct than populations that are connected. Over time, habitat fragmentation can lead to the loss of genetic diversity which can affect a population's ability to respond to environmental changes, confounding the effects of climate change, contaminants, and introduced species. I will consider these issues using examples from my own research.

Theme: amphibians, reptiles, genetics, conservation biology, captive breeding

Type of Presentation: Plenary

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Demographic effects of temperature-dependent sex determination: can tuatara survive global warming?

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Temperature-dependent sex determination (TSD) is widespread in reptiles. Global warming will adversely affect small, isolated populations of reptiles with TSD because loss of genetic variation may constrain adaptive shifts in pivotal temperatures and result in skewed sex ratios. The surviving populations of tuatara (*Sphenodontia*) from New Zealand are mostly small and isolated on offshore islands, thus neither adaptation nor migration are likely to compensate for skewed sex ratios. We explore the demographic consequences of skewed sex ratios using population viability analysis (PVA). We focus on the North Brother Island tuatara (*Sphenodon guntheri*, a population of around 1000 individuals characterised by low levels of genetic variation). Despite the low fecundity of *S. guntheri* females (with only 10.8% breeding each year) the population is viable at hatchling sex ratio of 65% male, but simulated populations with 85% male hatchlings are extinct within 1000 years (approximately 25 generations). Incorporation of inbreeding depression slightly increased the probability of extinction under male biased sex ratios, with no simulated populations surviving at a sex ratio of 80% males. We simulated an increasingly male biased sex ratio predicted under maximum climate change, where 100% male are produced by 2085. The population became entirely male by 2115 and extinction occurred around 2152-2156 (range depending on incorporation of inbreeding). Finally, we use PVA to examine various management options that would allow the *S. guntheri* to survive extreme warming, including translocation of subsets of the population to cooler sites, and periodic shading of rookeries to produce balanced sex ratios.

Theme: reptiles, sphenodonts, reproduction, genetics, conservation biology, endangered species,

Type of Presentation: oral, Symposium 10: Conservation Genetics of Amphibians and Reptiles in the 21st Century

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Evolutionary Origin and Development of Snake Fangs

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Many advanced snakes use fangs — specialised teeth associated with a venom gland— to introduce venom into prey or attacker. Various front- and rearfanged groups are recognised, according to whether fangs are positioned anterior (e.g. cobras and vipers) or posterior (e.g. grass snakes) in the upper jaw. A fundamental controversy in snake evolution is whether or not front and rear fangs share the same evolutionary and developmental origin. Solving this controversy could identify a major evolutionary transition underlying the massive radiation of advanced snakes, and the associated developmental events. We examine this issue by visualising the tooth-forming epithelium in the upper jaw of 96 snake embryos, covering eight species. We use the sonic hedgehog (shh) gene as a marker, and reconstruct the development in 3D in 41 of these. Here we show that front fangs develop from the posterior end of the upper jaw, and are strikingly similar in morphogenesis with rear fangs. This is consistent with their being homologous. In front-fanged snakes, the anterior part of the upper jaw lacks shh expression, and ontogenetic allometry displaces the fang from its posterior developmental origin to its adult front position — consistent with an ancestral posterior position of the front fang. In rear-fanged snakes, the fangs develop from an independent posterior dental lamina and retain their posterior position. In light of our findings, we suggest a possible new model for the evolution of snake fangs; a posterior subregion of the tooth-forming epithelium became developmentally uncoupled from the remaining dentition. This would have allowed the posterior teeth to evolve independently and in close association with the venom gland, becoming highly modified in different lineages. This developmental event could have facilitated the massive radiation of advanced snakes in the Cenozoic era, resulting in the spectacular diversity of snakes seen today.

Theme:snakes, fangs, developmental biology,

Type of Presentation: oral

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Ontogeny of the spitting behaviour in cobras

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The ability of some African and Asiatic cobras to “spit” venom at the eyes/face of a predator is one of the most specialized defensive behaviours among vertebrates. Few previous studies have described either the ontogeny of this behaviour or the ecological significance of venom spitting for newborn cobras. Spitting cobras are capable of spitting venom immediately after being born or even before the entire body of the cobra has emerged from the egg. Two aspects of venom spitting — the planar distribution of the spat venom and the kinematic movements of the head during spitting — are very similar in hatchling and adult cobras suggesting that a similar functional mechanism is being used throughout the ontogeny of this behaviour. The amount of venom spat by hatchling *Naja pallida* (mean of 14.6 mg), while less than that reported from adults of this species, is surprisingly high suggesting that either the hatchlings have less control over the amount of venom expelled or are physiologically compensating for their relatively greater fragility. The hatchling *N. pallida* spat at targets that were nearly 2 meters away (mean distance = 196 cm) even though their spat venom only covered a mean distance of 54.8 cm. Post-ecdysis the hatchlings only spat at closer targets and their

venom covered a greater distance, but the target distance was still roughly 3x the distance covered by the spat venom. A general behavioural model is offered to account for the ontogenetic and interspecific differences in spitting performance among the cobras.

Theme: reptiles, snakes, behaviour, ecology

Type of Presentation: poster

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The role of pesticides in the decline of amphibians in the Sierra Nevada, California, and implications for tropical amphibian declines

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Contaminants appear to be playing a significant role in the decline of amphibians in California, especially in areas downwind of the Central Valley where application rates exceed 500,000 kg (active ingredient) per year for the four most commonly used compounds. Organophosphorus pesticides are now ubiquitous in the environment and highly toxic to amphibians. We examined the toxicity of chlorpyrifos, malathion, diazinon, and their oxons on *Rana boylei*. Median lethal concentrations of the parent forms during a 96 hr exposure were 3.00 mg/L (24 hr) for chlorpyrifos, 2.14 mg/L for malathion, and 7.49 mg/L for diazinon. Corresponding oxons were 10 or 100 times more toxic than their parental forms. We conclude that environmental concentrations of these pesticides can be harmful to *R. boylei*. We also looked at chronic toxicity of two commonly used insecticides (chlorpyrifos and endosulfan) on larval *Pseudacris regilla* and *R. boylei*. Chlorpyrifos was three times as toxic to *R. boylei*. For endosulfan, *R. boylei* were > 40 times as sensitive; all *R. boylei* exposed to concentrations > 0.8 µg/L died before they metamorphosed. Each of the most commonly used compounds can be found in air, snow, or amphibian tissue. Parent compounds of the most commonly used pesticides are present in the Sierra Nevada in sufficient concentration to cause significant amphibian mortality. Our work adds to the increasing evidence that pesticides are harmful to amphibians that live in areas up to 100 km from pesticide application. Our findings are relevant for many tropical areas as well. In Central America, agriculture is chemically intensive and frequently occurs in close proximity to biologically diverse ecosystems. In Costa Rica, significant accumulations of current-use pesticides have been documented in montane forests (Daly et al., 2007). Pesticides include endosulfan and its breakdown products, some of which are highly toxic to amphibians. Brazil is the fourth largest world market for agrochemicals, and intensive agriculture has greatly increased, especially in the Pantanal Basin which is the world's largest wetland and one of the most biologically diverse regions of Brazil. In this area, endosulfan and its breakdown products are the most frequently detected compounds (Laabs et al., 2002), raising concerns about impacts on amphibians.

Theme: amphibians, conservation biology, ecology

Type of Presentation: Oral, Symposium 8: Herpetological Conservation & Biology

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Two Decades of Western Swamp Turtle *Pseudemys umbrina* Recovery through Captive Breeding and Re-introduction

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The critically endangered Western Swamp Turtle *Pseudemydura umbrina* is only known from seasonal clay swamps in the outskirts of Perth in Western Australia. Two small nature reserves were set aside for the species in the early 1960s and then harbored more than 220 individuals, but by the late 1980s the turtles had nearly disappeared from Twin Swamps Nature Reserve. Only about 30 wild individuals survived at the smaller Ellen Brook Nature Reserve, the last self-sustaining wild population. With 17 captive individuals that were not breeding the world population in 1987 counted less than 50 individuals. A successful captive breeding operation for *P. umbrina* at Perth Zoo started in 1988, the Recovery Team was formed in 1991 and a recovery plan was first published in 1994. Conservation actions include predator control like the construction of fox-proof fences to exclude foxes and dogs from turtle habitat; supplementing bore water into swamps during dry winters and springs to extend the duration of swamp live; changes of the drainage patterns of several swamps to increase flooding; fire management; captive breeding; and since 1994 re-introduction and introduction of captive bred juveniles into two nature reserves. Today the population at Ellen Brook Nature Reserve increased to about 70 individuals. About 160 juveniles were re-introduced at Twin Swamps Nature Reserve between 1994 and 2005, and about the same number to an introduction site, Mogumber Nature Reserve, since 2000. A trial introduction of 10 juveniles started in 2007 at a third site, Moore River Nature Reserve. However, after 14 years of re-introduction and introduction, climate change now poses a new difficult hurdle for the recovery of the species. Drier winters make the seasonal swamp habitat in the two main release sites increasingly marginal. Today the population at Twin Swamps Nature Reserve may count about 40 individuals and virtually no successful recruitment has yet been recorded despite demonstrated egg production by re-introduced females. At Mogumber Nature Reserve about half of the then released turtles died in a wildfire in late 2002 and the majority of turtles have not yet reached maturity. Thus, although the captive population counts today about 200 and the number of wild *P. umbrina* is again over 200, long-term success (self-sustenance) of the re-introduced and introduced populations still could not be demonstrated.

Theme:turtles, conservation biology, captive breeding, endangered species

Type of Presentation: Oral, Symposium 15: Development and Implementation of Recovery Programs for Endangered Chelonians.

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Effect of the Captive Environment on the Behavior of Released Western Swamp Turtles, *Pseudemydura umbrina*, and Suitability of Captive-bred Versus Wild Turtles for Translocation

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The critically endangered Western Swamp Turtle *Pseudemydura umbrina* inhabits shallow, ephemeral, winter-wet swamps on clay or sand over clay soils in a Mediterranean climate in south-western Australia. When the swamps dry out in late spring *P. umbrina* moves from the swamp areas into slightly elevated bush land and aestivates in naturally occurring holes or under leaf litter. Since 1988 a successful captive breeding project operates at Perth Zoo and since 1994 about 20-40 captive-bred, head-started, two to four year old juveniles with >100g body mass are released per year into two nature reserves. A change in aestivation management at Perth Zoo (holes + leaf litter provided in aestivation pens 1989-1998, no holes only leaf litter 1998-2003, holes + leaf litter again since 2003) was gradually reflected in the aestivation site choices of freshly released turtles after a lag time of 2-4 years. This demonstrates that the aestivation environment and aestivation experience

of captive tortoises influence their choice of aestivation sites (holes versus leaf litter) after their release into the wild. This choice directly effects the survival prospects of released turtles during wild fires. When wild *P. umbrina* found outside a nature reserve are moved and released inside the reserve, they return home to the outside even if they have to climb over 2.2m high fences. For that reason some wild *P. umbrina* were maintained for several years in captivity at Perth Zoo until their previous home area had been incorporated into the fenced area of Ellen Brook Nature Reserve. When 15 wild *P. umbrina* that had been kept in captivity for between 5 and 14 years were translocated back to Ellen Brook Nature Reserve in 2006, all adult turtles returned to their former home range during the first three months after their release. Males returned home faster than females and the time needed to return home increased in proportion to the length of time the turtles had spent in captivity. Only wild juveniles which had spent most of their life in captivity did not show homing behavior. For these reasons it is not a good strategy to move wild *P. umbrina* found outside nature reserves into the reserves. Captive-bred juveniles establish new home ranges in nature reserves more readily than wild translocated turtles.

Theme:turtles, behaviour, conservation biology,captive breeding, endangered species

Type of Presentation: Oral, Symposium 15: Development and Implementation of Recovery Programs for Endangered Chelonians.

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Evaluating Impacts of Temperature Dependent Sex Determination in Headstarting and Captive Breeding Projects of Critically Endangered Turtles

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Temperature dependent sex determination has important implications for tortoise and turtle conservation programs involving captive breeding or nest translocation and head-starting. The standard scientific method to establish sex ratios of hatchlings is to sacrifice them for histological examination of their gonads. The dilemma is that this technique is generally not permissible in conservation programs of critically endangered species, for which however the assessment of sex ratios is particularly imperative. Many tortoise and turtle species take many years or decades to mature. External sexual dimorphism may take as long to develop. Thus, conservation programs often operate for a long time without knowing the sex ratio they produce and the sex ratio of juveniles released into the wild. Unfortunately no non-invasive technique presently allows the accurate sexing of juvenile chelonians. I used endoscopy to sex juvenile *Geochelone yniphora* and *Erymnochelys madagascariensis* in the breeding and head-starting programme of the Durrell Wildlife Conservation Trust in Madagascar; to sex juvenile *Dipsochelys dussumieri* at the breeding program of the La Vanille Crocodile and Tortoise Park in Mauritius; and to sex juvenile *Batagur affinis* and *Batagur borneoensis* for the Malaysian Fisheries Department and the University of Malaysia Terengganu. I successfully sexed turtles as small as 60g, but found that gonads and reproductive tracts are better differentiated and the sex is easier to determine in larger juveniles. Intersex conditions do occur in small tortoises and turtles, but three “intersex” *D. dussumieri* which I re-examined four years later had all turned into females. The conservation programs for *G. yniphora*, *E. madagascariensis* and *D. dussumieri* generally produced female biased sex ratios, those for *B. affinis* either male or female biased sex ratios, and those of *B. borneoensis* only females. A captive breeding project for *Chitra chitra* in Kanchanaburi produced a heavily male biased sex ratio based on dissection of dead juveniles, even though softshell turtles are generally believed to have genetic sex determination. Biased sex ratios from nests constructed by captive mothers demonstrate that the limited nest site choice in captivity does not guarantee that this “natural” incubation provides balanced sex ratios.

Theme:turtles, developmental biology, conservation biology,captive breeding, endangered species
Type of Presentation: Oral, Symposium 15: Development and Implementation of Recovery Programs for Endangered Chelonians.
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Captive Breeding and Chytridiomycosis

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Captive breeding and reintroduction form two of the 11 themes presented within the Amphibian Conservation Action Plan. Nevertheless, captive breeding remains a controversial conservation tool, and the emergence of chytridiomycosis has presented new challenges for amphibian conservation programmes that integrate in-situ and ex-situ population management. At least 13 species of amphibians have established self-sustaining populations following reintroduction, seven of which had a captive breeding component. Several other reintroduced species have shown evidence of breeding in the wild. Although reintroduction is frequently viewed as the ultimate goal of captive breeding programmes, ex-situ projects also have the potential to make significant contributions to both conservation research and conservation education. Indeed, research – rather than reintroduction – is the most frequent justification for captive breeding programmes of amphibians. Nevertheless, despite a general upsurge in publications on amphibian conservation and disease in recent years, so far there has been relatively little published research relevant to conservation management emerging from amphibian captive breeding programmes. Equally, there has been little evaluation of the effectiveness of education and awareness-raising initiatives. Comparative research on chytrid infection rates and the efficacy of different fungicides in controlling the disease has the potential to make significant contributions to the management of wild populations. Chytridiomycosis also raises several dilemmas for managers of captive populations. Should collection-based institutions focus on those species suffering from conventional threats that are potentially reversible, or those species threatened by disease that are likely to go extinct in the wild? How can zoos and aquaria reconcile the need for high biosecurity facilities for single-species with the demand for imaginative displays of attractive species that immerse and educate the visitor? Are different types of biosecurity required for species with different life histories? AArk has developed a prioritization process to enable conservation managers make objective decisions about which species should – and which species should not – be included in captive breeding programmes.

Theme:amphibians, ecology, captive breeding, conservation biology

Type of Presentation: Oral, symposium 6: Disease and amphibian declines - where do we go from here?

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Conflicts and solutions between quilombolas, conservation units and freshwater turtles

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The Reserva of Rio Trombetas was created in 1979 to protect the large reproductive colony of tartaruga-da-amazônia (*Podocnemis expansa*). The large land holders were paid for their property, whose principal activity was harvesting Brazil nuts (*Bertholletia excelsa*). The harvesting was done primarily by the descendents of the negro quilombos. However the lands were occupied by the nut gatherers. Many of these families were transferred to the right margin of the Rio Trombetas, outside of the Reserve, however the main areas used for gathering nuts, turtle eggs, hunting and fishing remained within the Reserve. This situation persists today as an open conflict between the communities and the Conservation Unit. The clandestine fishing and collection of turtles and their eggs persists, which has caused the population of nesting turtles to crash to a critical point in 2003 to about 5% of the number of females nesting in relation to the decades of 1970 and 1980. One of the strategies used to minimize the conflict is to contract some of the people from the communities as conservation wardens to help lower the capture and traffic in wild animals. We are also working with schools to involve children in the release of hatchling turtles with the idea of sensitizing them to the conservation problem. We had them collect turtle eggs from the nesting beaches and transfer them to protected beaches to prevent poaching, which is nearly 100% if the eggs are not moved or physically protected. The constitution in 1988 recognizes the legitimacy of the property of the descendents of the quilombos. The regularization of this article was made in the Decree of 4.887 in 2003, when they began the process of recognizing these Territories. In 1997 Terra Trombetas took part of the Reserve where there was a large concentration of nesting tracajás (*Podocnemis unifilis*). Now there is proposal to give the entire nesting beach areas of tartaruga-da-amazônia (*Podocnemis expansa*) to Terra Jamari / Último Quilombo which includes nesting areas of tracaja and feeding areas of tartarugas. In summary the essence of the Reserve used to justify its creation are being destroyed. If the titles for future territories are granted within the Reserve extreme conservation measures will have to be taken to insure that these turtle populations do not disappear completely.

Theme:turtles, conservation biology, reproduction, quilombos

Type of Presentation: poster

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Reptiles of Venezuela: an update

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Here we present an updated list of Venezuelan reptiles. Extensive literature was reviewed, and several Venezuelan and foreign museum collections were consulted for this paper. To date, Venezuela is known to be home of 347 species, 117 genera, 28 families and 3 orders of reptiles. The order Squamata contains 92% of the taxa, followed by Testudines (7%) and Crocodilia (1%). The most diverse families within Squamata are Colubridae (40%), followed by Gymnophthalmidae (14%), Polychrotidae (7%), Sphaerodactylidae (6%) and Teiidae (3%), whereas the most speciose genera are *Atractus* (8%), *Liophis*, *Anolis* and *Gonatodes* (4%), *Micrurus* and *Anadia* (3%) and *Chironius* (2%). Among the 12 bioregions covering the country, the highest reptile diversity is found in Venezuelan Guayana (52%), followed by Cordillera de la Costa Central (27%), los Andes (24%), Región Deltaica del Orinoco (20%), los Llanos (19%), Depresión del Lago de Maracaibo (17%) and Cordillera de la

Costa Oriental (15%), Sistema de colinas Lara-Falcón, Perijá and Insular (12%), Costera Continental (5 %), and Marine habitat (2%). It must be emphasized that the low values exhibited by the region of Perijá are likely due to deficient sampling as a result of local dangerous political situation. Other regions are also inadequately surveyed and future work is seriously needed to assess the real diversity of reptiles. The majority of the Venezuelan endemic species are associated with middle and highland areas from the Venezuelan Guayana, Andes and Cordillera de la Costa. In terms of conservation, all species of sea turtles, some freshwater turtles, the two species of *Crocodylus* and seven lizards are listed under different endangered categories proposed by IUCN. Furthermore, some turtles and crocodilians are under conservation programs that have been implemented by governmental and non-governmental agencies to recover some populations of these groups in order to reintroduce these populations inside their historical distributions.

Theme:reptiles, community ecology, conservation biology, taxonomy, endangered species

Type of Presentation: Poster

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Conservation and Management of *Phrynops hoguei* in Carangola River, Minas Gerais Brazil

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The Brazilian Official Fauna Red List indicates that there are six species of threatened chelonians in Brazil and *Phrynops hoguei*, a freshwater turtle, is one of them. Up to date data show that this specie geographic distribution is very restricted and the Carangola river, in Minas Gerais State, is one of rare locals where it can still be found. Considering the construction of a hydroelectric plant in this river, the Government of Minas Gerais decided that the studies about biology, ecology and distribution of *P. hoguei* must be more detailed. These results will be used for a long term conservation plan for *P. hoguei*. The project will begin in the second semester of 2008 and developed over 12 months. The main goals of the studies are: estimate the population size, identify breeding sites, determine the genetic intra population variability, map the soil use and characterize the fragments of forest along the river, evaluate the situation of legal reserves in proprieties close to Carangola river, and suggest an area to create a conservation unit to protect *P. hoguei*. The private sector is responsible to finance the studies and the other partners of this project are two non-profit conservation institutions, CECO – Center of Ecologic Studies and Environmental Education and Biodiversitas Foundation, the Laboratory of Biodiversity and Molecular Evolution of Federal University of Minas Gerais, the Center for Conservation and Management of Brazilian Reptiles and Amphibians (RAN/ICMBio), and IEF – Instituto Estadual de Florestas. The multiple actors engaged with this project shows that the solutions for biodiversity conservation are associated with many social sectors and that the scientific research is one essential tool for public politics and economic sustainability of the private sector.

Theme:turtles, conservation biology, reproduction,

Type of Presentation: Poster, symposium 15
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Conservation and Management of Phrynops hoguei in Carangola River in Minas Gerais State

Gláucia Moreira Drummond¹ Richard C. Vogt² Braz Antônio Pereira Cosenza³ Fabrício Rodrigues dos Santos⁴ Marcos Eduardo Coutinho⁵ Yeda Soares de Lucena Bataus⁶
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The Brazilian Official Fauna Red List indicates that there are six species of threatened chelonians in Brazil and *Phrynops hoguei*, a freshwater turtle, is one of them. Up to date data show that this specie geographic distribution is very restricted and the Carangola river, in Minas Gerais State, is one of rare locals where it can still be found. Considering the construction of a hydroelectric plant in this river, the Government of Minas Gerais decided that the studies about biology, ecology and distribution of *P. hoguei* must be more detailed. These results will be used for a long term conservation plan for *P. hoguei*. The project will begin in the second semester of 2008 and developed over 12 months. The main goals of the studies are: estimate the population size, identify breeding sites, determine the genetic intra- population variability, map the soil use and characterize the fragments of forest along the river, evaluate the situation of legal reserves in proprieties close to Carangola river, and suggest an area to create a conservation unit to protect *P. hoguei*. The private sector, Carangola Energia S/A, is responsible to finance the studies and the other partners of this project are two non-profit conservation institutions, CECO – Center of Ecologic Studies and Environmental Education and Biodiversitas Foundation, the University of Minas Gerais State, the Laboratory of Biodiversity and Molecular Evolution of Federal University of Minas Gerais, the Center for Conservation and Management of Brazilian Reptiles and Amphibians (RAN/ICMBio), and IEF – Instituto Estadual de Florestas. The multiple actors engaged with this project shows that the solutions for biodiversity conservation are associated with many social sectors and that the scientific research is one essential tool for public politics and economic sustainability of the private sector.

Theme:turtles, conservation biology, endangered species

Type of Presentation: poster

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Translocation and headstarting programs for West Indian rock iguanas: bringing species back from the brink

Glenn Gerber

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Due to introduced mammalian predators and habitat loss, West Indian rock iguanas (genus *Cyclura*) are among the world's most endangered lizards. Of the nine species presently recognized by the IUCN Red List, five are considered critically endangered, one endangered, and three vulnerable. Several species exist as single populations with less than two hundred estimated individuals. One species, the Jamaican iguana (*C. collei*), was believed extinct for approximately 40 years until its rediscovery in 1990. This event catalyzed a surge in research and conservation of rock iguanas that continues today. Recovery programs utilizing headstarting and (or) translocation have now been implemented for seven of the nine rock iguana species. Headstarting of wild-hatched juveniles is being used to bolster recruitment of large-bodied *Cyclura* species incurring high juvenile mortality from introduced mammalian predators in Jamaica (*C. collei*), Mona Island (*C. cornuta*), and Anegada Island (*C. pinguis*). Similarly, in Grand Cayman, captive breeding combined with headstarting of captive-hatched juveniles is being used to bolster the wild population of *C. lewisi*. Combined, nearly 700 headstarted iguanas of adult or near adult size have been returned to the wild over the last decade in Jamaica (100), Mona (135), Anegada (120), and Grand Cayman (320). Monitoring of released iguanas, using radiotelemetry and (or) mark-recapture techniques, conservatively estimate survival rates one year after release at 40-85%, depending upon species. Thus, headstarting has significantly increased the wild adult population for many of these species, providing a critical short-term hedge against extinction. For species inhabiting archipelagos, translocation is being used to reduce extinction risk by establishing additional island populations. Translocations have been conducted for *C. cychlura* (3) and *C. rileyi* (2) in the Bahamas, *C. pinguis* (3) in the British Virgin Islands, and *C. carinata* (6) in the Turks and Caicos Islands. Of these 14 documented translocations, some involving only a handful of founders, all have been successful in establishing breeding populations, demonstrating *Cyclura* have a tremendous capacity for population recovery given favorable conditions. Nevertheless, translocation and headstarting alone cannot ensure the long-term survival of West Indian rock iguanas. For that, significant increases are needed in the protection of habitat and the control of invasive mammals.

Theme: reptiles, lizards, conservation biology, endangered species

Type of Presentation: Oral, Symposium 5: Herpetofaunal Reintroductions, Translocations, and Supplementations

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Assessing costs and precision of thermoregulation in reptiles

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The metabolic costs of behavioural thermoregulation of lizards are primarily those associated with locomotion. Thus, a low cost environment is that in which availability of basking spots is high and the distance between them is small. It has been proposed that lizards will thermoregulate less precisely when the costs associated with it are high. Such a strategy enhances overall fitness by allowing lizards to be more flexible to environmental conditions while maximizing the benefits of maintaining a relatively high body temperature and minimizing energy expenditure. In situations where oxygen is low, the costs of thermoregulation are relatively high (i.e. in relation to the amount of oxygen available for metabolic functions). As a result, it is likely that exposure to hypoxic conditions induce a decrease in the precision of thermoregulation. Although it has been shown that lizards significantly lower their preferred body temperature in response to low oxygen concentrations as a way of protecting vital organs from oxygen depletion, the effects of hypoxia on the precision of thermoregulation have not been studied. We have evaluated the effect of different levels of hypoxia and of environmental thermal quality on the precision and level of thermoregulation of the bearded dragon, *Pogona vitticeps*, in laboratory conditions. Environmental thermal quality was manipulated

by varying the rate of temperature change in an electronic operantly controlled temperature-choice shuttle box, with higher rates of temperature change translating into more thermally challenging environments. Additionally, lizards were tested in “extreme temperatures” conditions during which air temperatures of the compartments of the shuttle box were maintained at a constant 50 and 15 °C, respectively. The thermoregulatory response was similar under both low oxygen (4% O₂) concentrations and lower thermal quality environments, each inducing a decrease in preferred Tb of ~2 °C. A decrease in the precision of thermoregulation was also observed with exposure to lower oxygen concentrations and lower levels of environmental thermal quality. Thus, during profound hypoxia or in poor thermal quality environments, the bearded dragon reduces energy expenditure by both lowering its preferred Tb and minimizing locomotion at the expense of precise behavioural thermoregulation. These data will provide important implications for the procedural assessment of preferred Tb and a better understanding of thermal set-points in reptiles in general.

Theme:reptile, lizards, temperature, behaviour, thermoregulation

Type of Presentation: Oral, Symposium 12: Ecophysiology of Reptiles

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Acoustic structure and attraction of female frog-biting midges to calls of terrestrial and arboreal frogs, *Bufo cf. typhonius* and *Scinax ruber*

Godfrey R. Bourne, Debbie Boege Tobin & George M. Lynch

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Animals produce signals targeting conspecific receivers. However, in a network environment heterospecifics within signaling range can act as unintended receivers. We studied the acoustic preferences of female frog-biting midges of the genus *Corethrella* spp. (Diptera: Corethrellidae) that eavesdropped on the advertisement calls of terrestrial and arboreal frogs, *Bufo typhonius* and *Scinax ruber*. Midges exhibited phonotaxis to recorded and natural calls of both species, but not to silent CDC Miniature Traps used in sampling. Although there was no preference for either of the taped calls, midges preferred living *B. typhonius* to *S. ruber*. Multiple regressions of number of midges on temporal and sonic call variables of *B. typhonius* indicated a linear relationship with fundamental frequency, and for *S. ruber* with temporal features, note and intercall durations. The effects of stimulus amplitude on phonotaxis was also evaluated, and suggested that response strength increased with amplitude from 60 dB to 90 dB sound pressure level (SPL). Midges never associated with non-calling males, and most landed directly on calling frogs to feed. This mating and eavesdropping predatory relationship between an invertebrate predator and its vertebrate prey indicated that intended and unintended receivers with very different hearing organs exhibited similar preferences for specific frog calls, and that midges can use either temporal or sonic characteristics of frog calls to locate prey species. Furthermore, selective phonotaxis in *Corethrella* spp. is adapted for long-distance detection and is similar to evidence provided by studies of other acoustic insects.

Theme:Anurans, natural history, reproduction, behaviour, predator-prey

Type of Presentation: Oral

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Resolving a rapid radiation of newts: a boost from multiple nuclear markers

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The phylogenetic history of an evolutionary radiation is hard to resolve because little information accumulated between branching events. The crested newts of the genus *Triturus* are a group of parapatric species distributed across Europe and adjacent Asia that may represent such a rapid radiation. Neither allozymes nor mtDNA were able to resolve their phylogenetic history, which lead to the hypothesis that they separated (near-)simultaneously around 10-11 Ma. We here aim to see if multiple nuclear markers can break the polytomy. Forty-one samples from localities covering the range of the group were sequenced for five nuclear and two mitochondrial genes. Gene trees were built using MrBayes. Two methods were used to reconstruct the phylogenetic history: a phylogenetic network with 'Splitstree' and a hierarchical method that from the alignment builds gene trees and from these, the species tree with 'BEST'. The two mitochondrial genes were combined since they had similar trees. All nuclear genes produced incompatible topologies. The phylogenetic network defines six distinct groups. Each of these groups corresponds to a different species, except *T. karelinii*, that is split into three geographically defined groups. The centre of the network is unresolved. The hierarchical model inferred a species tree with the eastern *T. karelinii* splitting off first, followed by the western *T. karelinii*. The final branching events were not resolved. The phylogenetic network was based on a concatenated dataset and the signal it presents is mostly due to the higher variability of mtDNA. The hierarchical model is more balanced, because it uses gene trees to create the species tree. However, it cannot deal with introgression, and some samples had to be eliminated from the analysis because of this. *T. karelinii* is paraphyletic and might be split into two or three taxa. Multiple nuclear markers can help in deciphering radiations. It is possible that a larger set of genes would resolve the *T. cristatus* - *T. carnifex* - *T. dobrogicus* polytomy.

Theme:amphibians, salamanders, genetics, taxonomy

Type of Presentation: poster

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Seven Visions For Vertebrate Recovery On Snake-infested Guam; Under What Conditions Is Permanent Snake Control Practical At The Landscape Scale?

Gordon H. Rodda* and Earl W. Campbell

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The Brown Treesnake (*Boiga irregularis*) introduction is credited with having eliminated most native forest vertebrates of Guam. Recovery of many extirpated species is theoretically possible, as most are still alive elsewhere (zoos or nearby islands). In ascending order of recovery area size, seven visions to address this dilemma have been implemented to some degree: 1) Recover species on offshore islets; 2) Hyper-local control, of nest trees or roosts; 3) Mainland island creation, combining snake barriers and local eradication; 4) Continuous trapping of large landscapes; 5) Continuous toxicant application to large landscapes; 6) Periodic decimation of the snake population islandwide, using toxicants; and 7) Coexistence of predator and prey following post-irruption decline in snake numbers (i.e., no action to reduce snake numbers). Feasibility decreases, and the cost of control increases, with the size of area managed. Each approach has its champions and advantages, but none has yet progressed to the establishment of a repatriated population of a native vertebrate. Costs are relatively high for most approaches, and the technology is not mature. We will evaluate the feasibility and probable cost of the seven approaches. From this evaluation of the prospects on 540 km² Guam

we will consider the implications of these results for control of invasive *Boa constrictor* and *Python molurus* populations in continental areas such as Florida. Costs for management of snakes on Guam are presented in the Table. The Brown Treesnake program benefits from limited external opportunities for recolonization, favorable access to most habitats, few vulnerable non-targets, robust funding sources, and a large corpus of applicable research. For conservation actions that may not have resources available on this scale, and perhaps for those that do, there may not be a practical control method for well-established reptile invaders in large areas. The area of Florida colonized by *Python molurus* (roughly 10,000 km²) is an example of a widespread population that would be exceedingly expensive to eradicate or depress in perpetuity. Conversely, the eradication of *Boa constrictor* from Florida may be feasible, as the population now extends over only a few square kilometers. Prevention of reptile introductions offers many favorable contrasts with control or eradication of established populations.

Theme:snakes, conservation biology, endangered species

Type of Presentation: Oral, Symposium 2: Invasive Reptiles and Amphibians: Global Perspectives and local solutions

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Placentation in the Viviparous Lizard *Sceloporus jarrovi* is Unusually Specialized

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Viviparous *Sceloporus* commonly are assumed to have simple placentas that mainly function in gas exchange. Our studies using light and electron microscopy reveal that *Sceloporus jarrovi* has placental structures that are highly specialized, with features not found in typical viviparous lizards. Two distinct placentas persist until birth, a chorioallantoic placenta and a yolk sac (omphalallantoic) placenta. Both show specializations for maternal - fetal exchange. The eggshell membrane deteriorates, allowing direct contact of uterine and fetal tissues. Epithelia of the uterus and chorion are greatly thinned, enhancing gas exchange between maternal and fetal capillaries. The yolk sac placenta shows striking specializations for maternal secretion and fetal absorption. The omphalopleure shows peculiar absorptive pits, and develops elongate papillae that protrude deeply into a mass of cellular debris and accumulated shell membrane. The associated uterus exhibits epithelial hyperplasia, protruding folds, and persistent glands. The yolk sac placenta of *S. jarrovi* is one of the most unusual ever discovered in reptiles, and reflects unusual functional attributes. Such specializations are unexpected in a species in which the yolk provides the main source of nutrients for embryonic development. The presence of a yolk sac placenta is easy to overlook in squamates without appropriate histological techniques. Future research should take account of both placental types, given their divergent specializations and persistence until the end of gestation.

Theme:lizards, reproduction, developmental biology, reptiles, morphology, viviparity

Type of Presentation: poster, Symposium 1:Reproduction in reptiles: from genes to ecology

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A New Type of Infrared Sensitive Organ in the Python *Aspidites* sp.

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Pythons are well known to possess an infrared sense enabling them to perceive infrared radiation. It is believed that the infrared sense is mainly used to localise their warm blooded prey. The infrared sensitive organs are comprised of infrared sensitive thermoreceptors, which are embedded within specialised pits of the labial scales. Infrared signals are detected by these pits lined with thermoreceptors, which project to the CNS via the trigeminal nerve and a specialised nucleus within the hindbrain (nucleus of the lateral descending trigeminal tract: nLTTD) to be relayed towards the midbrain and forebrain. The nLTTD is only found in infrared sensitive snakes. *Aspidites* sp. are the only members of the Pythoninae that do not possess labial pits. The lack of labial pits and thus the obvious lack of the infrared sense in *Aspidites* have been interpreted in the past either as a primitive character of this genus or as a secondarily loss due to the fact that these pythons feed on-cold blooded prey. We investigated a conspicuous U-shaped single pit located in the rostralia of *Aspidites* sp. which points downward in a resting specimen but clearly faces forward if the python raises its head. The rostral position and the overall shape of the pit allow frontal object localisation to be mediated by shadowing, where certain regions of the pit are differentially stimulated with regard to the position of objects in front of the animal. Scanning electron microscopy (SEM) has confirmed that the ultrastructure of the fundus of the pit resembles the fundus of labial pits in other pythons i.e. it possesses enlarged shingle like cells with micropits. Transmission electron microscopy (TEM) also reveals the presence of typical infrared thermoreceptors within the pit that are not found in other scales. Furthermore, the brain of *Aspidites melanocephalus* reveals a structure that can be regarded as a nLTTD. We propose that *Aspidites* clearly possesses an infrared sense and the unusual position of the single, downwardly-directed pit in the rostralia has evolved in response to its fossorial lifestyle i.e. to avoid damage to the pit from soil and debris. This arrangement is clearly different to the open labial pits of other pythons, which are directed laterally from the head. This work was partly supported by the Feodor-Lynen program of the Alexander von Humboldt Foundation.

Theme:reptiles, snakes, morphology

Type of Presentation: oral contribution

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Diversity of anurans in the region of beaches of Ilha Solteira- SP

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The objective of the project was to investigate the composition of community of anurans, of beaches Marina and Catarina located in the City of Ilha Solteira-São Paulo that areas have a intense human activity. Determining the abundance of species, verifying the reproductive strategies to supply environmental indicators of these areas. The area of beaches was divided in 5 places of collections,

having considered local geography, vegetal fisionomy, and the areas of greater and minor human activity. We registered 12 species allocated in 9 genus in five families : Bufonidae (1), Hylidae (5), Microhylidae (1), Leptodactylidae (2) e Leiuperidae (1). The reproduction of these species initiated in October of 2007 and extended until June of 2008. The species that presented greater period of vocalization was *L. fuscus* of October 2007 until March 2008. In the four areas of beaches we found five species, the fifth area that is a temporary puddle located in a bush near of beaches we found ten species. Among of species found in beaches areas, are *Rhinella schneideri* (Werner, 1894), *Leptodactylus fuscus* (Schneider, 1799), *Dendropsophus minutus* (Peters, 1872), *Leptodactylus ocellatus* (Linnaeus, 1758) known by possessing great tolerance of environmental alterations indicating that these places are very degraded.

Theme: anurans, reproduction, community ecology

Type of Presentation: _Poster _ contributed or __symposium, number of symposium __

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Evolution of complex acoustic signals

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Although there are widespread examples of acoustic signals made up of multiple elements with different properties, the most common signals consist of a single kind of element that is monotonously repeated. I will show that in several species of treefrogs (Family Hylidae), females may prefer novel two-element signals to the established call alone. The relative attractiveness of such novel signals depends less on the acoustic qualities (spectrum, fine-scale temporal properties) of a novel appendage than on its order (leading or following the established element), relative duration and amplitude, and the duration of a silent interval between the established signal and the novel appendage. I will discuss psychophysical factors that contribute to some of the general constraints ("rules") governing the production of an effective novel complex call as well as differences in the properties of existing calls that may lead to some species-specific rules.

Theme: acoustic communication complex signals frogs

Type of Presentation: oral

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An action plan for turtle conservation in China and a brief introduction on our conservation and research efforts of turtles in China

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China has a rich turtle fauna with approximately 35 native species. However, turtles have been exploited in China as food and for Traditional Chinese Medicine for thousands of years. This exploitation has become unsustainable. There is a lack of distributional, taxonomic, and ecological data. Basic ecological data are available for only 10% of Chinese species. All native turtle species are endangered, but less than 25% are listed as 'State Major Protected Wildlife'. Today, most turtles in Chinese markets are imported. The Chinese turtle trade is impacting other populations. Effective legislation and enforcement for trade control is difficult due to insufficient survey data and the lack of a practical identification manual. The captive breeding turtles in China has been growing rapidly with a potentially negative impact on turtle conservation. Conservation education is seriously inadequate, as most Chinese people are unaware of the critical status of turtles. As a result, turtle conservation is given a very low priority. Consequently there is a desperate need for an integrated and specifically targeted approach to turtle conservation in China. Our Action Plan incorporates eight areas. 1. Capacity building will develop and support the Chinese scientific community and encourage programs for research, training and collaboration. 2. Research plans will be formulated, and a network of turtle researchers will be developed while encouraging young scientists to become involved. 3. Trade monitoring will involve documenting the extent of the turtle trade and the adoption of relevant measures to enhance enforcement and monitor changes in the trade. The development of a practical identification manual for Chinese officials and biologists is essential. 4. Legislation efforts will include the lobbying of relevant government officials. Existing laws need to be modified and new regulations must be proposed to minimize current conflicts among different laws. 5. Captive breeding efforts will be investigated to understand their influence on wild populations, enhance effective management and provide guidance. 6. Rescue centers, 2-3 in South China, will be established. 7. It is essential to establish 3-5 nature reserves in areas of high turtle diversity in southern China. 8. Education: we will design an education plan including a set of effective education materials and initiate an extensive education campaign across a wide sector of the public and wildlife and government officials. Our efforts in this action plan will be reviewed.

Theme: reptiles, turtles, conservation biology,

Type of Presentation: symposium 8

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Seasonality and habitat structure in abundance and habitat use of *Sceloporus utiformis* (Sauria: Phrynosomatidae) tropical deciduous forest.

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In lizards, the abundance of a particular species is closely linked to habitat characteristics, which responds to environmental seasonality. Given that few works address the effect of seasonality and structure of vegetation in the use of habitat and abundance of lizards in tropical deciduous forest (BTC), a study was conducted to find such an effect on the species *Sceloporus utiformis*, comparing rates BTC vegetation and stream vegetation (VA), and between two nearby BTC but with a different degree of seasonality: Biosphere Reserve Chamela-Cuixmala (Jalisco) and BTC in the biosphere reserve Sierra de Manantlán (Colima). We found that *S. utiformis* presents greater abundance in the BTC than the VA (54 ind / Ha and 39 ind / Ha respectively) and therefore live longer in the BTC. There was a greater abundance of Manantlán in the BTC (29 ind / Ha) than the BTC of Chamela (24 ind / Ha), the first locality in the best combination of conditions is reflected in the abundance of the species. When it concluded that the seasonal nature and structure of habitat has a greater impact on the abundance and habitat use of *S. utiformis*, on the site that features less favourable.

Theme: lizards, ecology
Type of Presentation: Poster
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Contrasting Variation In Calls And Colours In The Strawberry Poison Frog *Oophaga pumilia*

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The purpose of this study was to relate divergence in calls with divergence in colours and genetic distance in the dendrobatid frog *Oophaga pumilio*, an abundant and conspicuous frog in the Caribbean lowland of Central America (Nicaragua, Costa Rica, Panama). We sequenced three mitochondrial genes (Cyt B, COI, 16S rRNA), recorded advertisement calls and documented body colour patterns in 20 populations along a transect from NW Costa Rica to the Bocas del Toro Archipelago in Panama. Phylogeographic analyses detected two different genetic lineages, one in North Costa Rica and the second in South Costa Rica/Panama. Costa Rican frogs showed little colour variation while colouration of Panamanian frogs varied between populations (Figure 1). However, frogs in Panama were less genetically diverged than Costa Rican frogs. Also, several parameters of the advertisement calls varied along a geographic cline, but call differentiation did not correlate with genetic distance. Call parameter variation was higher in Costa Rican populations than in Panamanian populations. Thus call, colour and genetic variation did not coincide in this species. We assume that selection pressures (ecological, sexual or both) on calls and colours vary geographically leading to different levels of divergence.

Theme: geographic variation, bioacoustics, colour patterns, genetic distance, *Oophaga pumilia*

Type of Presentation: Oral, Symposium 11: Dendrobatoid Frog Biology.

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EDGE-ing Towards Amphibian Conservation

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Conservation priority setting based on phylogenetic diversity has been frequently proposed but rarely implemented. We have defined a simple index that measures the contribution made by different species to phylogenetic diversity and use this index to define species-based conservation priorities. The approach has been applied to a near-complete species-level phylogeny of the Mammalia to generate a global priority list incorporating both phylogenetic diversity and extinction risk. It was subsequently used to define a priority list for the Amphibia based on the most complete phylogenetic information available. The 100 highest-ranking amphibian species represent a high proportion of total amphibian diversity and include many species not usually recognised as conservation priorities. A large proportion of species that are both evolutionarily distinct and globally endangered (EDGE species) do not benefit from existing conservation projects or protected areas. The results suggest that global conservation priorities may need to be reassessed in order to prevent a disproportionately large amount of amphibian evolutionary history becoming extinct in the near future. Now in its second year, the EDGE Programme (www.edgeofexistence.org) at the Zoological Society of London (ZSL)

is forging ahead with conservation projects for focal amphibian species, including *Andrias davidianus*, *Nasikabatrachus sahyadrensis* and *Boulengerula niedeni*. The conservation projects under development focus on three major areas: local capacity building; scientific information collection to aid the production of Conservation Action Plans; and local and global awareness-raising of the amphibian extinction crisis. ZSL coordinates some 45 conservation projects in more than 30 countries worldwide, collaborating with a vast network of international partners. Furthermore, we participate in conservation breeding programmes coordinated by the Amphibian Ark (www.amphibianark.org) and the EDGE Programme utilises the ZSL Institute of Zoology's expertise in amphibian disease surveillance wherever relevant.

Theme:amphibians, anurans, salamanders, caecilians, conservation biology, captive breeding, endangered species. **ADDITIONAL:** phylogeny

Type of Presentation: Oral, Symposium 8: Herpetological Conservation & Biology

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Morphological shifts in populations of a generalist and a specialist leaf-litter amphibian in a fragmented landscape of the Brazilian Atlantic forest

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Changes of morphological traits, such as body size, body condition, and leg length are important indicators of fundamental changes in life history or habitat quality. Changes in environmental parameters, e.g. following habitat fragmentation, are main drivers of adaptational shifts in morphology. We tested the hypothesis that anthropogenic habitat fragmentation can result in significant intraspecific changes of body size, body mass, body condition, and tibia length to a smaller size or lower condition in fragmented habitats, respectively. Furthermore, we examined, whether generalists and specialists show different degrees of shifts in body size. We therefore collected data of a generalist (*Rhinella ornata*) and a specialist (*Ischnocnema guentheri*) leaf-litter amphibian species from three sites in the fragmented landscape and one site in an unfragmented part of the Brazilian Atlantic forest of Southeast Brazil. We measured 54 and 376 individuals respectively. Results show significant differences between fragmented and unfragmented study sites for the generalist species *Rhinella ornata*. Individuals of this species showed a decrease in body length, tibia length, and body mass in isolated fragments compared to the unfragmented control. The specialist species *Ischnocnema guentheri* showed no significant shifts. The results show that generalist species using the original forest habitat as well as the matrix, surrounding their original habitat, can be more affected by habitat fragmentation than specialist species with high matrix aversion.

Theme:amphibians, anurans, morphology, conservation biology, ecology

Type of Presentation: oral: contributed

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Does Embryo Stage At Oviposition Differ Between Snakes And Lizards? A Study of Egg Retention In Tropical Snakes

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Current models for the evolution of viviparity in squamate reptiles suggest that it arises via a gradual increase in the duration of intrauterine embryonic development. It is largely widespread that in oviparous squamates oviposition typically occurs when embryos are at developmental stage 30 and the majority of species oviposit at stages 26-33. Few species oviposit soon after ovulation or retain eggs to later stages. However, these observations are based mostly on data about egg retention in lizards. This work focuses on the need for additional data in snakes, mainly tropical species, about the level of intrauterine embryonic development. We examined stages of embryonic development at oviposition from 68 eggs of 16 species from São Paulo State, Brazil. For comparison with lizards and thus providing insights into squamates in general, we staged embryos following criteria of Dufaure and Hubert for the lizard *Lacerta vivipara*. Gravid snakes kept at the same captive conditions laid eggs with embryos at the modal stage 30 (27-34) what represents a considerable degree of intrauterine embryonic development. Therefore, in the species studied, we found that the range of egg retention in snakes, though with more restricted ranges, resembles to distribution of egg retention in lizards. Some species showed wider amplitude in the level of intrauterine development than others. For example, the false-coral snake, *Oxyrhopus guibei*, oviposits with embryos ranging from stages 27-33, whereas the green snake *Philodryas olfersii* with embryos ranging from 30-33. Only 25% of the species oviposit with embryos beyond stage 30, but 50% had ability to prolong retention of eggs beyond this stage. The elapid *Micrurus corallinus* holds retention of eggs beyond the usual range, ovipositing at stage 34. Nevertheless, whether prolonged retention in these species has any influence on hatching success or hatchling phenotypes remains unknown. Our results enlarge available data on egg retention and provide more support to the fact of oviposition in squamates occurs more frequently at some stages than at others. This similarity between groups may reflect similar constraints on the evolution of egg retention. This is the first extensive work on egg retention comprising different groups of tropical snakes. Further studies will focus on embryonic responses to extended egg retention and incubation conditions to provide important insights into the evolution of egg retention and viviparity.

Theme: Reptiles, snakes, reproduction, developmental biology.

Type of Presentation: Poster

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Reptiles long term translocations and monitoring in Bahia, Brazil

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Habitat changes and fragmentation are two of the key factors threatening the conservation of reptiles biodiversity worldwide. These, can have multi-faceted impacts on the biota, ranging from: species loss and extinction, re-ordered community composition, altered patterns of species behavior, and loss of genetic variability. These factors often interact leading to cumulative effects which can, in turn, make it extremely difficult to accurately predict and mitigate the impacts of landscape change. Reptiles are fundamental components in open environmental ecosystems, such as the coastal sand

dune (Restinga) habitats on the Atlantic forest. Large-scale studies are required to better understand and, in turn, predict the impacts of habitat loss on herpetofaunal biodiversity. On this basis, the Reserva Imbassaí long term management and monitoring program was established, in addition to IBAMA licensing, in the northeastern coast of Bahia, Brazil to fulfill the needs for better understanding the influence of habitat fragmentation and landscape conditions on a range of species. This project leads to a broader question understanding fauna persistence before and after habitat changes. It aimed to quantify the translocated herpetofaunal biodiversity before habitat loss into patches of remaining native Restinga ecosystems surrounded by extensive stands of exotic and modified habitats. Here we present a range of herpetofauna species covered during extensive surveys completed, so far, from 2005 to 2008 as part of the access, translocation and monitoring. The program applied the transect methodology. Each transect (46), measured 200 m and used 20 pitfall traps with drifting fences. Traps were kept open daily four five weekdays all year long, except for holidays, on both translocation sites. A total of 18 lizards (2,865 individuals) and 28 snakes (987 individuals) species were covered by translocation actions. Animals were translocated to similar habitat, after an environmental characterization, using 16 structural and climate parameters. After three years of monitoring program all the 46 reptile species were detected on the area, where 96 % are occupying the open shrubby vegetation remnants. These results show that translocation techniques may serve as an important tool to maintain herpetofaunal diversity within the boundaries of a changed habitat, even after a long period of interventions. Despite of all the controversy, translocation techniques when properly associated to monitoring can guarantee the maintenance of reptiles in regions suffering from severe development environmental impact.

Theme: reptiles, snakes, lizards, conservation biology, endangered species

Type of Presentation: poster, symposium 5: Herpetofaunal Reintroductions, Translocations, and Supplementations.

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Sound attenuation in the Amazonian dart-poison frog *Allobates femoralis*: comparison of two Brazilian populations

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Anurans predominantly use acoustic signals for communication over long distances. Because signals degrade in amplitude and structure as they propagate through the environment, signal degradation may reduce receiver's ability to detect and decode signals and therefore evolve under strong selective pressures. The sound pressure level (SPL) at which calls are perceived by the receivers is known to influence both females' phonotactical responses as well as males' antiphonal reactions. Furthermore, SPL is crucial for spacing patterns of males in chorusing anurans. At the beginning of the rainy season, males of the Pan-Amazonian dart-poison frog *Allobates femoralis* establish territories on the forest floor announced by calling from slightly elevated perches. Distance between territories varies at two Brazilian sites, which might be explained by concomitant differences in attenuation effects caused by dense vegetation. We investigated the degree of sound attenuation in this ground-dwelling species by measuring the peak SPL of spontaneously calling males ($n = 47$) at two heights (20 + 50 cm) and at two distances (2 + 5 m) for 3 times, respectively. As expected, call SPL attenuated with distance and higher perches were associated with higher SPL values at a given distance. Against our expectations, differences in distances between territories are not explained by SPL attenuation patterns alone. Our results support the importance of perches for acoustic communication but suggest that other ecological factors are responsible for observed among-

population differences in spacing patterns among males.

Theme:amphibians, anurans, ecology, behaviour, community ecology, natural history

Type of Presentation: oral

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Current Research and Conservation of Sea Turtles in China

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Five species of sea turtles, including green, hawksbill, olive ridley, leatherback, and loggerhead turtles are found in China waters from northeast to Bohai Sea and south to South of China Sea. Sea turtle populations have been precipitous decline due to human predation in the early 20th century. Many nesting sites and foraging grounds have been degraded or disappeared resulting from human activities and coastal development. Nowadays, incidental capture has till been the major influence of sea turtle mortality in recent years. More endeavors for sea turtles research and conservation in China have primarily been carrying out at Sea Turtle Bay, and Penghu, Lanyu and Nanya island. Here, we summarize research works and conservation measures for sea turtles in China. Most research has been restricted to nesting sites in the last 20 years, with focusing on the nesting ecology to analyze various environmental and biological fators affecting hatchling rate and hatchlings' health status, and satellite telemetry has been utilized to track sea turtles migration since 2000. Education activities and community participation have been launched for sea turtles conservation. In recent years, several education projects : public education including summer camp for kids and ecotourism for public, special training and education to local fishermen, community participate and workshop have been developed to improve public awareness. This presentation is to provide a comprehensive overview on the current population, research and conservation status, as well as recommendations for the effective management of sea turtles in our future work in China.

Theme:Turtle, Conservation biology

Type of Presentation: Poster

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Status of Alien Reptiles and Amphibians in Japan and Prospects for Their Management

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Japan consists of many continental islands and a few oceanic islets in East Asia. Owing to the complicated paleogeography, crossing of broad climatic range (from subarctic to subtropical), and highly variable geomorphology (including both steep mountain ranges exceeding 3,000 m asl and flat plains close to the sea level), indigenous terrestrial fauna of Japan enjoys substantial species diversity and remarkable endemism. On the other hand, Japan now has a number of feral animal populations including those of various alien reptiles and amphibians. In this presentation I first review those reptiles and amphibians that are now established as nonnative breeding colonies within Japan with reference to possible mechanisms of their impacts on the native biodiversity. I then introduce

management measures taken by the Japanese Government to control those alien species and to prevent further colonization from abroad. From Japan, at least eight species of alien reptiles and four species of alien amphibians are currently known to occur as established populations. Of these, five exotic reptiles (62.5%) and two exotic amphibians (50%) are confined to subtropical small islands of the Ryukyus and the Ogasawara (Bonin), although these island assemblages collectively account for no more than 1% of the whole Japan in area. Also, there are numerous cases of artificial transportation of some Japanese species within this country, which have also lead to establishment of feral populations. Negative impacts of the nonnative reptiles and amphibians on native biodiversity are known or predicted to occur through alterations of food-web structure, genetic contamination, and deliveries of exotic infectious diseases and parasites. Of these, impacts through the food-web restructuring are particularly prominent or concerned for alien species established on some small subtropical islands, such as *Anolis carolinensis* of the Ogasawara, *Elaphe taeniura schmackeri* of Okinawajima, *Bufo marinus* of Ishigakijima, and *Rana catesbeiana* of a few islets of the Central Ryukyus. In contrast, occurrences of hybrids between native and nonnative taxa in the field, which may possibly lead to loss of original genetic properties in the former through introgression, are mostly attributable to artificial transportation of some Japanese taxa to outside their original ranges. The Japanese Government recently established a law regulation for both further import from abroad and transportation within Japan of some exotic species that are considered to be particularly invasive. However, no regulation has yet been devised at all to control further transportation of Japanese taxa to extralimital regions within the country.

Theme:amphibians, anurans, reptiles, turtles, snakes, lizards, ecology, genetics, conservation biology, predator-prey

Type of Presentation: Oral, Symposium 2: Invasive Reptiles and Amphibians: Global Perspectives and local solutions

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Evolution of viviparity in cold-climate lizards: testing the maternal manipulation hypothesis

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We used a cold-climate viviparous lacertid lizard (*Eremias przewalskii*) as a model system to test the maternal manipulation hypothesis. Twenty-four gravid females collected from a population in Inner Mongolia (northern China) were maintained in the laboratory for the whole gestation length, with 12 allowed to bask for 14-h daily and the other 12 for 10-h daily. Females selected lower body temperatures but did not thermoregulate more precisely when gravid. The mean gestation length was shorter in females provided with longer basking opportunity. Neonates in the two treatments differed in tail length and the number of ventral scales but not in other examined morphological traits, with offspring born in the 14-h treatment having longer tails but fewer ventral scales. Offspring were sexually dimorphic at birth, with females being smaller in tail length, head length and fore-limb length but having more ventral scales than males of the same size. Offspring born in the 14-h treatment were not only faster runners but also grew faster than did offspring born in the 10-h treatment. Our data validate the main predictions of the maternal manipulation hypothesis that females should shift selected body temperatures during gestation to provide optimal thermal conditions for developing embryos and that phenotypic traits determined by maternal thermoregulation should enhance offspring fitness. Our study is the first to demonstrate that the maternal manipulation hypothesis applies to cold-climate viviparous reptiles.

Theme:*Eremias przewalskii*; Lacertidae; Maternal basking; Viviparity; Morphology; Locomotor

performance; Growth; Cold-climate

Type of Presentation: Poster

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The variance of incubation temperatures does not affect the phenotype of hatchlings in a colubrid snake, *Xenochrophis piscator*

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It has been documented in some reptiles that fluctuating incubation temperatures influence hatchling traits differently than constant temperatures even when the means are the same between treatments, yet whether the observed effects result from the thermal variance, temperature extremes, or both is largely unknown. We incubated eggs of the checkered keelback snake *Xenochrophis piscator* under one fluctuating (Ft) and three constant (24, 27 and 30 C) temperatures to examine whether the variance of incubation temperatures plays an important role in influencing the phenotype of hatchlings. The thermal conditions under which eggs were incubated affected a number of hatchling traits (wet mass, SVL, tail length, carcass dry mass, fatbody dry mass and residual yolk dry mass) but not hatching success and sex ratio of hatchlings. Body sizes were larger in hatchlings from incubation temperatures of 24 C and 27 C compared with the other two treatments. Hatchlings from the four treatments could be divided into two groups: one included hatchlings from the 24 C and 27 C treatments, and the other included hatchlings from the 30 C and Ft treatments. In the Ft treatment, the thermal variance was not a significant predictor of all examined hatchling traits, and incubation length was not correlated with the thermal variance when holding the thermal mean constant. The results of this study show that the mean rather than the variance of incubation temperatures affects the phenotype of hatchlings.

Theme: snake; incubation temperature; hatchling phenotype

Type of Presentation: Poster

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Embryonic growth and mobilization of energy and material during incubation in the checkered keelback snake, *Xenochrophis piscator*

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We used the checkered keelback snake (*Xenochrophis piscator*) as a model animal to study embryonic growth and mobilization of energy and material during incubation. Females (N = 20) laid eggs between late May and late June. Eggs were incubated at 27 C. One egg from each clutch was dissected at five-day intervals starting at oviposition. The mean incubation length at 27 C was 48.9 days. We identified three phases of embryonic growth or yolk depletion in *X. piscator*. The first phase, between oviposition and Day 20, was one of minimal transfer of energy and material from yolk to embryo. The second phase, between Day 20 and Day 39-40, was characterized by increasingly rapid embryonic growth or yolk depletion. The third phase, between Day 39-40 and hatching, was characterized by that embryonic growth or yolk depletion gradually slows down. Approximately 71.4% of dry mass, 53.0% of non-polar lipids and 66.0% of energy were transferred from egg contents to hatchling during incubation. Our data confirm once again that oviposition is not timed to correspond to the onset of rapid embryonic growth in oviparous squamate reptiles that are positioned midway between the two endpoints of the oviparity-viviparity continuum, and that the greater conversion efficiencies of energy and material from egg to hatchling in snakes can be

attributed to their lower energetic costs of embryonic development and greater residual yolk sizes.

Theme: Reptilia; Colubridae; *Xenochrophis piscator*; Egg; Incubation; Hatchling; Embryonic growth; Conversion efficiency

Type of Presentation: Poster

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Biogeography of the Solomon Islands – Colonization History and Systematics of the Prehensile-Tailed Skink (*Corucia zebrata*) Across the Archipelago

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The Solomon archipelago emerged from the ocean when the Indian and Pacific Plates collided and as such has never been connected to any neighboring continent. Comprising over 900 islands with different ages and geological histories, the Solomon archipelago represents an ideal system for studying island colonization patterns. Our study has focused on a large terrestrial reptile that is endemic to and widely distributed across the archipelago: the prehensile-tailed skink (*Corucia zebrata*). Due to its large size and unusual ecology, *C. zebrata* is regarded as one of the most iconic reptiles world wide. We aimed to determine the genetic relationships among *Corucia* from across the archipelago to infer coalescent based estimates of the timing of population splitting. Combined with the detailed geological information available for the Solomon archipelago, specifically the timing of island formation and land bridges, we will be able to identify the geological events most important in shaping the biogeographic history of this large reptile. *Corucia* is considered monotypic with two sub-species, however, assessments of the species level diversity have to date been based on morphology alone and limited geographic sampling. We sampled *Corucia* from 14 locations across the Solomon archipelago and obtained nucleotide sequences from each individual at five mitochondrial and nuclear genes. Results from our phylogenetic analyses of these sequence data show that *Corucia* separates into five strongly supported clades whose individual distributions are restricted to single islands or groups of adjacent islands. Morphological variation, as well as the evolutionary antiquity of the deepest split in the tree, suggest that two species are present among these samples, which are referred currently to just one of the two named sub-species. This indicates the need for a taxonomic revision of *Corucia*.

Theme: Reptiles, lizards, genetics, taxonomy

Type of Presentation: Oral, Symposium 9: Biogeography of the South and South East Asian Herpetofauna.

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Biogeography patterns and the distribution of anurans density and biomass within and among islands and mainland.

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High densities of individuals are usually associated with insular environments (excess density compensation), due to the lack of competitors and niche expansion. Original explanations rely on island size and total species richness to explain island density and biomass. A group of seven land bridge islands were studied in a reservoir lake in Minas Gerais state, Brazil, regarding amphibian community density and biomass. Among the studied islands, size and total amphibian species richness seem to have no relationship with islands' density and biomass. Significant variations between islands and continent and among habitat types were recorded, showing that density variation can be related to factors other than islands' size and species richness, such as quality of marginal habitat types. Both in islands and continent, high densities were recorded in habitats with mud and vegetation. This habitat type seems to favor amphibian reproduction, providing protection to adults and juveniles. Marginal habitats with no vegetation had low densities recorded. Most islands had low values of total mean density when compared to the continent. Only three islands presented the condition of excess density compensation, which can be explained by specific characteristics of these islands such as temporality, isolation, habitat quality and availability. Even though the quality of habitat types present in islands' margins seems to be an important factor favoring islands' occupation, other factors can not be excluded. For islands and continent of a reservoir lake, a variety of marginal habitat types must be preserved and the quality of these habitats must be warranted. The preservation of the original vegetation near water is needed, so it is necessary to prevent human use of marginal habitats in order to avoid degradation of resources used by the amphibian community.

Theme:Anurans, density compensation, biomass, continental islands, island biogeography

Type of Presentation: Poster

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**Anuran species richness and community composition of islands from a dam flooding in Brazil:
the influence of island size, isolation, habitat diversity and mainland characteristics**

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The species-area relationship has long been a well known pattern in studies of species richness and distribution, and it was incorporated in the Theory of Island Biogeography, which also includes distance from the mainland as a determinant of species richness. Area, isolation and habitat diversity have been pointed out as the main factors determining species richness in an island. Anuran communities were studied in a reservoir in Southeast Brazil, using the quadrat sampling method, from November 2006 to October 2007. Species richness was related to island size, isolation and habitat diversity. The same variables were analyzed to investigate their influence in community composition. The species richness of seven islands in the reservoir was positively correlated with their area. This relationship was probably masked by the effect of sample size. Estimated species richness, free of the effect of sample size, was weakly correlated with habitat diversity. The hypotheses that best apply to explain variation in species richness of these islands are related to the small island effect, time of equilibrium and habitat diversity. Probably the species richness has not reached equilibrium at islands in the reservoir, and extinctions can still happen. *Ameerega flavopicta* and *Rhinella* gr. *granulosa* could be pointed as species prone to extinction, due to their low abundance and their occurrence restricted to a single island. Connectivity between islands and mainland may play an important role in shaping community composition. Anuran species richness and abundance in the mainland are important factors in determining species richness and community composition at islands. The preservation of a vegetation belt at the edge of properties in mainland is recommended to prevent the degradation of marginal environments occupied by the anuran species.

Theme:Anurans, species richness, community composition, continental islands, island biogeography theory

Type of Presentation: Poster

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Amphibian assemblage in two rice field managements from coastal planice in South Brazil.

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Wetlands sustain high levels of productivity and biological diversity, therefore being important ecosystems from a conservation standpoint. Despite their importance, wetlands are among the most affected and degraded of all ecological systems. The agricultural expansion and urban development are the main human activities responsible by the decline of natural wetlands throughout the world. Worldwide, rice agriculture has been recognized as having considerable potential value for many species of aquatic organisms. The majority of amphibians depend on wetlands in some stages during its development, been vulnerable to habitat lost and fragmentation. In Brazil the rice field function as refuge to biodiversity it's unknown, in this sense the objectives of this study were: Identify the anuran assemblage in rice fields, and verify differences through cycle plantations and differences in management. We study the rice farm cycles through a year in six farms, in three farms after harvest the rice fields remained with water and other three rice fields was drained located in Mostardas, RS, Brazil. We survey anuran assemblage after sunset, where we cover each area with six transects of 15 minutes visually and four minutes acoustically. In this study we register 13 species of amphibians, being 12 anurans and one gymnophiona, where shows in flooded rice (7-0~3.09) and drained (6-0~3). The anuran composition did not vary in flooded or drained rice field (Mrpp: $A=0.0095$, $p=0.898$), but vary significantly between rice cycles (Mrpp: $A=0.168$, $p=0.000$), differing mainly on the initial stages to after harvest. The richness vary through rice cycle ($F_{4,31}=4.545$; $p=0.005$) in each farm, but did not vary significantly with management process ($p>0.05$). The conflict between irrigated agriculture and wildlife conservation has reached a critical point on a global scale. Conservation units are the most important and used tool in protection for biodiversity. However, protected areas represented by undisturbed natural habitats cover only a small proportion of the world land area. Given that agricultural wetlands, such as rice crop, grows at the expense of natural wetlands, the important question from the point of view of biodiversity conservation is the adequacy of these agricultural wetlands as an integrated managed landscape that contributes to maintain a rich biodiversity.

Theme:amphibians, anurans, conservation biology

Type of Presentation: _Poster _ contributed or __symposium, number of symposium__

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Differential Evolution of Colour Pattern Elements in the Aposematic Frog *Oophaga histrionica*

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Colouration pattern affects the ecological performance of anuran amphibians due to its implications in thermoregulation, communication, and predator-prey relationships. Dart-poison frogs (Anura: Dendrobatidae) have evolved bright colouration, used as a warning signal of unpalatability addressed towards potential predators. For this mechanism to work, predators should learn to associate colouration and distastefulness. Theoretical background and empirical evidence indicate that predators learn faster when aposematic signals are relatively invariable. Interestingly, the dart-poison frog *Oophaga histrionica* is aposematic but exhibits striking within- and among-populations variation in colouration and pattern. We hypothesise that this contradiction is only apparent: colouration elements did not evolve as a whole and at least some elements are relatively invariable and, therefore, readable by predators as aposematic signals. In this study, we aimed at (1) testing for differential evolution among colour and pattern elements, (2) identifying relatively invariable coloration elements that might subserve communication between frogs and their potential predators, and (3) testing whether divergence in strongly variable elements is explained by neutral processes such as isolation by distance. We measured 14 colour and pattern variables on digital photographs of six individuals from each of nine populations. We found that colour pattern in *O. histrionica* is a multicomponent system with both highly variable and very conserved traits. At the extremes, the colour contrast between bright and dark dorsal areas was invariable, whereas reddish tones were highly variable among populations. Genetic distances, as calculated from two neutral genetic markers (COI), were correlated only with variation in reddish tones once differences between two major genetic clusters were taken into account. Summing up, our results evidence differential evolution in colouration elements of *O. histrionica*. Predators' learning should then be based on non-variable elements such as contrast. Because the divergence in variable traits is poorly explained by neutral processes, we further suggest that it might be attributed to sexual selection and associative mating, but this hypothesis remains to be tested.

Theme: anurans, ecology, behaviour, genetics, predator-prey

Type of Presentation: Poster

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Evolutionary relationships between Indian and South East Asian frogs

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The longtime isolation of the Indian subcontinent during its northward movement across the Tethys Ocean provided exclusive surroundings to develop endemic lineages. Remnants of this ancient endemism are still apparent in several plant and animal lineages. However, the accretion of Greater India to the Eurasian mainland in the Tertiary created opportunities for faunal interchange between both regions. As a consequence, India lost part of its endemism through out-of-India dispersal of Gondwanan elements (e.g. frogs, lizards, caecilians). Conversely, the accretion created potential for biota of Laurasian origin to enter the subcontinent. It remains unclear how the interplay between the fauna of both areas has influenced present evolutionary patterns of anuran diversity. Here we review evolutionary relationships between frogs of the Indian subcontinent and South East Asia and look at the patterns of diversity and endemism shaped by Tertiary dispersal events. Using molecular phylogenies and dating estimates, we examine colonization of India in multiple anuran groups. Our results indicate that there is a substantial taxonomic level of endemism on the Indian subcontinent that resulted from a few waves of independent dispersal events followed by in situ radiations. This demonstrates that the Indian subcontinent did not only obtain its biotic uniqueness during Cretaceous

isolation, but acquired a second form of endemism after accretion to the Eurasian mainland.

Theme:Anura - India –South East Asia – radiations

Type of Presentation: Oral, Symposium 9: Biogeography of the South and South East Asian Herpetofauna.

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Reproduction In Three Direct-Developing Frogs Of The Genus Eleutherodactylus (Anura: Eleutherodactylidae) From Cuba

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Detailed information on the ecology, especially reproduction, of Cuban frogs are scarce, particularly those direct-developing species. For the first time, the reproductive characteristics of three endemics species (*Eleutherodactylus cuneatus*, *E. dimidiatus* and *E. gundlachi*) are assessed in Cuba. We studied a sample of 168 specimens collected from March 2003 to April 2004 on La Gran Piedra, eastern Cuba. Individuals were measured snout-to-vent and dissected to determine reproductive condition. Frogs were classified as adult female (oviducts wide and convoluted, ovaries containing large eggs or yolking follicles), adult male (developed testes), or juvenile. Reproductive characteristics of the three species were similar, especially those referred to morphology of gonads and eggs. Sexual size dimorphism was detected in the three species, with females being larger than males. The number of ovarian eggs and size of the eggs were positively correlated with the female body size. Reproductive males and females were captured throughout the year suggesting continuous reproduction, but appearance of juveniles and females with mature eggs indicated some seasonality in reproduction of these frogs. This coincided with a rise in the males calling activity in May to July, at the onset of the rainy season. Additional information on reproduction of other *Eleutherodactylus* species is needed to confirm if this nearly continuous reproduction is common for every species in Cuba or a wider range of breeding periodicities exists, such as those described for other Neotropical sites.

Theme:amphibians, anurans, reproduction

Type of Presentation: Poster

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Distribution of *Leptodactylus ocellatus* (Anura: Leptodactylidae) through Marginal Habitats under the Influence of a Dam at São Francisco River, Brazil

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Dams have many impacts on local communities and possibly disturb amphibians' populations as they fragment the environment and transform natural streams of water into a permanent lentic water reservoir. The margins of these dams, used by amphibians to reproduce, present little structural heterogeneity but constitute very variable places in time for anurans, since the volume of the reservoir determines the width of the margins and changes their configurations. Seven land bridge islands and adjacent continent areas were chosen to study the distribution of the *Leptodactylus*

ocellatus population, considering the habitat types, the influence of closeness to water and possible ontogenetic changes. Marginal habitats were classified into four types according to the possible combinations of their kinds of substrate (rocky or muddy) and presence or absence of vegetation. The quadrature sampling method was used, and each available type of habitat at each island was sampled at three different distances from the water. All individuals of *L. ocellatus* found at the quadrates were counted and had their weight and length measures taken. A total of 875 individuals of the species were sampled throughout the study period, comprehended between November 2006 and October 2007 including, thus, one reproductive event. Even if considered as a generalist species, *L. ocellatus* showed clear preference for muddy habitats with vegetation, which probably provide more suitable conditions to reproductive activities and protection for froglets and young individuals. Within the same habitat, the most representative number of animals was found near the water, at a moister microhabitat and with the possibility of using water as an escape path. The place and month of the sampling, as well as the distance from the water and the habitat type are variables that, all together, create a model which best explains the variation related to the weight of the individuals. Therefore, the growing of a new cohort is evidentiated through the year; those habitats with rocks, and also those without vegetation, present low densities but relatively great amounts of biomass because are specially occupied by large animals; and the places close to the water, just as the habitats with mud and vegetation, are occupied by individuals of all sizes of *L. ocellatus*.

Theme: amphibians, anurans, ecology, natural history, behaviour

Type of Presentation: Poster

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The Amazon Chelonia Project: Conserving The Amazon Turtles

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Turtles are a resource of great importance to the human communities that inhabit the Amazon, a region where the uncontrolled hunting of turtles, tortoises and other animals, is an ancient predatory action. During the Seventies, it was registered a great decline in *Podocnemis expansa* (giant amazon river turtle) populations, and, as an outcome, it was proposed the first governmental policies towards the conservation of this species. Since the creation of the Amazon Chelonia Project, in 1979, by the Brazilian Institute for the Environment and Renewable Natural Resources (IBAMA), the *P. expansa* nesting sites became a target of protecting and managing activities. This Project, which is coordinated by the Brazilian National Center for Conservation and Management of Reptiles and Amphibians (RAN), nowadays a part of the Chico Mendes Institute for the Biodiversity Conservation, is executed at the northern and mid-western regions of Brazil, at 115 Chelonia spawning areas (sandy river beaches), which are located in the main rivers that compose the Amazonas River Basin. Out of the Amazon turtles, *P. expansa* is the species of the most economic importance and it is used as a species-symbol for the protection of other ones of equal ecological value, such as *P. unifilis* (yellow-spotted amazon river turtle), *P. sextuberculata* (six-turbercled river turtle), *P. erythrocephala* (red-headed river turtle), and *Peltecephalus dumerilianus* (big-headed amazon river turtle). The management methodology consists, basically, of: i) monitoring the spawning beaches and the hatching of the hatchlings, under the form of data collecting in a field card; ii) marking the clutches by using numbered wooden sticks; iii) encompassing the nesting beaches where the majority of the clutches are laid by the females; iv) controlling the hatching process; vi) after the hatching process, the clutches are opened and the hatchlings are removed, counted, sorted and transferred to nurseries, where they stay for a period of approximately 15 days while they lose their characteristic smell (the

one that attracts predators); vi) the hatchlings are released in their natural habitat; vii) carrying out Environmental Education activities towards river-bank communities that inhabit the Amazon, showing them the importance of conserving the Turtles from the Amazon, as well as the importance of conserving the ecosystems where they live in. As a result, more than 57 million of hatchlings had already been returned to nature, thanks to the efforts of the Amazon Chelonia Project.

Theme:the Amazon Chelonia Project, turtles, giant amazon river turtle, conservation, management of turtle populations

Type of Presentation: Oral, Symposium 15: Development and Implementation of Recovery Programs for Endangered Chelonians.

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The Natural History of the Nocturnal Arboreal Gecko, a *Blaesodactylus antongilensis*-like Species in Ankarafantsika National Park, a Dry Deciduous Forest of Madagascar

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The natural history of a *Blaesodactylus antongilensis*-like species of Madagascar was investigated for future geo-phylogenetic analysis with ecological comparisons among *Blaesodactylus* species, all of which are endemic to Madagascar. Hatchlings were observed at the beginning of the rainy season, and reached adult size in the next dry season. Females stopped their oogenesis during the rainy season and recrudesced at the beginning of the dry season. They probably lay eggs in the middle of the dry season. This reproductive cycle is seasonally different to other Madagascan lizards. The reproductive activity of this gecko might have shift into the dry season because of high predation pressure on females digging nesting holes, and on buried eggs in the rainy season. At night the geckos perched on tree trunks and were active at a wide-range of environmental temperatures (15-30 C°). Although these geckos were thermally passive to environmental temperatures, they selected relatively higher ST at low AT for thermoregulation. This gecko is a sit-and-wait forager. During the day they retreated to refuges, mainly crevices between buttress roots, which seemed adequate to avoid predators. Because these geckos stayed at a large tree shared with other individuals, the home ranges of these geckos presumably overlapped. The complete absence of male-biased sexual dimorphism in this gecko also supported the possibility of overlapping home range, which suggests little male-male competition for mating. Under strong predator pressure from diurnal birds in this study area, localized distribution of diurnal retreat sites on large trees might cause overlapping home ranges. This nocturnal gecko also presumably has difficulty surveying and defending a large area at night, which may be another reason for their overlapping home ranges.

Theme:lizards, size composition, female reproductive cycle, thermal usage, perch sites, home range, foraging mode

Type of Presentation: oral: contributed, natural history

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Holoaden luederwaldti Miranda-Ribeiro, 1920: Rediscovery and population biology

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Holoaden luederwaldti is described from Campos de Jordão, São Paulo State, Brazil. The species has not been registered in the region since the 1970s. *Holoaden luederwaldti* is included in the Data Deficient (DD) category due to the uncertainties on its geographic distribution, status and ecological requirements. In this work we present the rediscovery of a population of *Holoaden luederwaldti* in the State Park of Campos de Jordão. Information on sexual dimorphism, reproductive biology, habitat and vocalization are provided. The samplings were carried out from August 2005 to April of 2008. The specimens were collected using pit-fall traps with drift-fences. The pitfalls were installed in different altitude gradients: Area I - 2000m; area II - 1780 m; and area III - 1540m of elevation (Atlantic forest). During the study, we collected 49 individuals of *H. luederwaldti*: 38 males and 11 females. The mean size (SVL) of males was 36.12 ± 2.6 mm (31.02 - 40.48 mm, $n = 33$) and of females was 41.9 ± 2.5 mm (39.48 - 46.53 mm, $n = 11$). Five juveniles had a mean size of 25.9 ± 1.6 mm (23.97 - 28.55 mm). The period of occurrence of the species was associated to the hot and rainy months from September to April. Higher abundance occurred in October 2005 ($n=11$), 2006 ($n=10$) and 2007 ($n = 13$). Females with oocytes were recorded in October, February and April. Females presented between 36 and 41 oocytes with a mean diameter of 4.23 ± 0.23 mm ($n = 21$). *Holoaden luederwaldti* was found between 1500 to 2000m of elevation, being collected in the three areas sampled. In October 2005 and April 2008, vocalizations of specimens recently collected and maintained in plastic bags yet in the field were recorded. The advertisement call of *H. luederwaldti* had three harmonics with frequency bands of the first harmonic between 936 - 1377 Hz, dominant frequency around 1186 ± 31 Hz. The second harmonic presented a mean frequency band between 3247 - 3804 Hz; FD 3557 ± 62 Hz. The third harmonic exhibited a mean frequency between 5626 - 6244 Hz, FD 5988 ± 83 Hz. The duration of the note was on average 32.6 ± 1.9 ms with a mean repetition rate of 252 ± 38 notes per minute. The last record of the species was in 1969 (Campos do Jordão) and this rediscovery, at about 200 km from the big city of São Paulo, suggests that tropical forests are poorly surveyed.

Theme: Anurans, *Holoaden luederwaldti*, Natural history, vocalization, Rediscovery.

Type of Presentation: Poster

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Reciprocal Call and Agonistic Call in *Hypsiboas albopunctatus* (Anura, Hylidae) in the Cerrado Biome, State of Goiás, Brazil

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In most of the Anura species, only males call. According to BOISTEL & SUEUR (2002), between 1997 and 2002, was reported 58 species of female frogs who made some kind of call. In South America, recently was reported distress call by *Leptodactylus chaquensis* females, in Bolivia (2006), and reciprocal call in *L. siphax*, in Brazil (2008). On March 28 and 31, 2008, at night, at Goiânia's Zoological Garden (S16°40'59.2"; W49°16'14.2"), was recorded two females' calls, similar to birds' whistles. The females called while they were handled. On April 17, 2008, at Carapina Farm, agricultural area, thereby Ecological Park Altamira de Moura Pacheco (PEAMP), Goiânia (S16°32'43.4"; W49°06'34.1"), was recorded a whistle with the tone of a distress call during the intervals of advertisement calls given by males in a large chorus. So the assumption that females of *Hypsiboas albopunctatus*, in the Photo 1, give reciprocal calls was supposed. At the same place, on April 24, 2008, this assumption was confirmed when recording a female calling in duet with a male, answering its calls. Due to the difficulty to handle that specific female, this record was done at 1m

from it. In this situation, was acknowledged that the female was giving calls without the vocal sac's distension. The records were made with a Marantz PMD 660 digital recorder, coupled to a Sennheiser ME66 microphone. Avisoft SASLab Light was used to obtain quantitative information and Sound Ruler was used to generate audiospectograms and sonograms on a PC computer and the Microsoft Excel was used to obtain means and standard deviations. The specimens collected were deposited in the ZUFG (Zoological Collection of the Federal University of Goiás). The distress call and reciprocal call are described in Table 1 and the audiospectograms and sonograms are in the Figure 1. These differences are easy to be noted by human hearing. Since the male and the female calls of *H. albopunctatus* are so differenced, couldn't that be the reason why they weren't noticed by researchers? Or are these calls a recent phenomena provoked by chemicals pollutants introduced by humans into the environment that have an androgenic effect on anuran females, as proposed by Hand (2001)?

Theme: Anura, behaviour, *Hypsiboas albopunctatus*, female call

Type of Presentation: Poster

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Environmental Gradients in Traits influencing the Egg Stage in Water Dragons, *Physignathus lesueurii*

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Embryonic fitness and fitness-related traits of neonates have been routinely linked to incubation conditions in reptiles. Although data are limited, three major traits influence those conditions: nest site choice, seasonal timing of nesting, and pivotal temperatures in species with environmental sex determination. Demonstrated adjustments in nest site choice include openness and aspect of the nest site, but nest depth has been particularly under-studied, both within and among species. Yet nest depth has been implicated in the evolution of viviparity in reptiles, and theoretically reptiles could respond to imminent climate warming by digging deeper nests. We tested the hypothesis that nest depth would decrease with increasing elevation among cold climate populations of the water dragon, *Physignathus lesueurii*, in southeastern Australia. The hypothesis was strongly supported, and has implications for among-generation compensation to differing climates manifested in offspring sex and/or embryonic survival. Implications for climate warming responses are discussed.

Theme: reptiles, lizards, ecology, reproduction, behaviour

Type of Presentation: Oral, Symposium 1: Reproduction in reptiles: from genes to ecology

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Molecular genetic testing of landscape ecological hypotheses: a case study on dispersal in the crested newt

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Habitat fragmentation is widely recognized as a major threat to the persistence of populations, in particular for species such as amphibians that have low dispersal capability. Amphibians have deme-structured populations, with reproduction in ponds and feeding and survival in the surrounding terrestrial habitat. Hence, gene flow between local populations is dictated by i) reproductive success that determines the number of new recruits available for dispersal, and ii) the connectivity of demes in terms of distance and habitat quality that determines the actual dispersal success. I studied the crested newt (*Triturus cristatus*) at the edge of its range in western France. Historical data indicate that the species has been enlarging its range at the cost of a sister species. I constructed a hypothesis on the actual range expansion by a GIS-based analysis of landscape ecological parameters, which hypothesis was then tested with the help of genetic markers (nine microsatellite loci in 2300 individuals over 45 ponds). In particular, I aimed to distinguish isolation by distance from isolation by habitat. Isolation by habitat does operate, but the signal may be overridden by fluctuating breeding success. Consistent results on the effect of the environment on dispersal are obtained with analysis over larger spatial and temporal windows.

Theme:amphibians, salamanders, genetics, ecology, conservation biology

Type of Presentation: oral, Symposium 10: Conservation Genetics of Amphibians and Reptiles in the 21st Century

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National Strategy for the Conservation of Amphibians in Venezuela

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Given the importance of amphibians and their widely threatened status globally, the Ministry of Environment of Venezuela and the herpetological scientific community in Venezuela have shown concern for the evidence which demonstrates population decline of certain anuran species in the Andes and Coastal Range of Venezuela. For this reason the Ministry of Environment and Conservation International Venezuela, with the participation of Fundación La Salle de Ciencias Naturales and the Instituto Venezolano de Investigaciones Científicas, have written the National Strategy for the Amphibian Conservation in Venezuela. This preliminary document has been discussed and consulted with national specialists in five national workshops which were open to the public. It includes twelve chapters detailing the current knowledge of threats to amphibians in Venezuela. The proposed action plan is organized along seven strategic lines.

Theme:amphibians, anurans, salamanders, caecilians, conservation biology, captive breeding, endangered species

Type of Presentation: oral_symposium_amphibian conservation (moderator-Don Church)

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Evolution of Placental Calcium Transport: Pattern of Embryonic Calcium Uptake in a Placentotrophic Lizard

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The reptilian egg is enclosed in a mineralized shell that provides protection and is a significant source of calcium for the embryo. Oviparous squamates have lightly calcified eggshells and embryos acquire most calcium from yolk. Eggs of viviparous squamates lack calcareous shells and embryos are nourished by placental transport of calcium. Placental calcium uptake by embryos of highly placentotrophic species exceeds the quantity recovered from the eggshell of oviparous species. The higher level of calcium provision might result from maternal secretion of calcium for a longer interval of embryonic development, or alternatively, the evolution of specializations that enhance the rate of calcium transport. We tested these alternative hypotheses by comparing the pattern of calcium mobilization to embryos in a highly placentotrophic scincid lizard, *Pseudemoia pagenstecheri* to that of a closely related oviparous species, *Saproscincus mustelinus*. Yolks of recently ovulated eggs of *P. pagenstecheri* are considerably smaller (18.0 mg) and contain less calcium (0.16 mg) than those of *S. mustelinus* (44.9 mg, 0.33 mg), yet neonatal *P. pagenstecheri* are larger and contain more calcium. Yolk contributes 14% of the calcium in neonatal *P. pagenstecheri* and 54% in hatchling *S. mustelinus*, with the remainder contributed by placental transfer and eggshell recovery respectively. Timing of calcium uptake by embryos of the two species is similar. Calcium levels remain low until embryonic stage 36 and then increase dramatically. However, neonatal *P. pagenstecheri* are larger and contain more calcium than hatchling *S. mustelinus* reflecting a greater rate of increase in dry mass and total calcium by *P. pagenstecheri* embryos late in development. The lower calcium content of hatchling *S. mustelinus* does not reflect depletion of egg calcium reserves because the eggshell of *S. mustelinus* at hatching contains 0.95 mg of calcium. The difference in embryonic calcium acquisition in these two species supports the hypothesis that the timing of embryonic uptake of calcium is similar but the rate of placental calcium transport in *P. pagenstecheri* is greater than the rate of mobilization from the eggshell of *S. mustelinus*. Funded by the National Science Foundation (IOB-0615695).

Theme: physiology, reproduction, lizards

Type of Presentation: oral symposium, 1 - Thompson and Parker

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MHC class II - a novel marker for amphibian conservation genetics

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The major histocompatibility complex (MHC) has a major role in the vertebrate immune system. MHC class II genes in particular play an important role in pathogen recognition and therefore in co-evolutionary processes of host-parasite interaction as well as mate choice. Evidence of positive selection acting on these genes is commonly observed as an excess of non-synonymous substitutions at the antigen binding sites. As genetic diversity of class II genes may significantly influence fitness, they have been examined in a conservation genetic context in a great number of species. However, most of these studies have focused on mammals, birds, and fish. In amphibians, the organization of MHC class II has so far been characterized in all but four species and only one study has examined genetic diversity in wild populations on a larger scale. We are currently characterizing MHC class II in the fire Salamander (*Salamandra salamandra*) and are planning to investigate the genetic variability

of this adaptive marker in salamander populations with different demographic histories as well as parasite loads and evaluate its use as a molecular tool for amphibian conservation. Furthermore, we are interested in examining if MHC class II plays a role in mate choice in amphibians as it has been found in other vertebrate taxa.

Theme: amphibians, anurans, salamanders, conservation biology, genetics

Type of Presentation: oral, Symposium 10: Conservation Genetics of Amphibians and Reptiles in the 21st Century

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Calcium Transport Across the Uterus in Two Species of Pseudemoia With Complex Placentae

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Reduction or elimination of the eggshell is among the major anatomical and physiological changes that must accompany the evolutionary transition from oviparity to viviparity. The loss of the eggshell in viviparous species represents the loss of a source of calcium for the developing embryo as there is insufficient calcium in the egg-yolk to sustain development. Calcium is a major requirement for developing embryos, raising the question of how calcium is transferred to the developing embryo in viviparous species. We are currently characterising the calcium transport mechanism of viviparous lizards with complex placentae. We have used indirect immunofluorescence to identify Ca²⁺ATPase channels in the uterus of two closely related species of *Eugongylus* group skinks, *Pseudemoia spenceri* and *Pseudemoia entrecasteauxii* throughout pregnancy. *Pseudemoia entrecasteauxii* is significantly more placentotrophic than *P. spenceri*, however localisation of Ca²⁺ATPase channels is broadly similar in both species. In the uterus of non-pregnant *P. spenceri* there is weak apical localisation of Ca²⁺ATPase channels in a small number of glandular epithelial cells (shell glands), but this completely disappears during vitellogenesis. Early in pregnancy (stages 0-25), immunofluorescent staining of Ca²⁺ATPase channels is visible in luminal epithelial cells of the uterus. As pregnancy progresses (stages 27-40) apical and basolateral (respectively) immunofluorescent staining of Ca²⁺ATPase channels is present in both the glandular and luminal epithelial cells in the uterus adjacent to the abembryonic (yolk sac) side of the egg. In contrast, the uterus adjacent to the embryonic pole of the egg only has basolateral immunofluorescent staining of Ca²⁺ATPase channels in the luminal epithelium. These trends continue and intensify throughout pregnancy till birth. The prolonged expression of Ca²⁺ATPase channels throughout pregnancy may provide a means to supply calcium to the embryo when the demand is likely to be greatest.

Theme: viviparity, Calcium ATPase, *Pseudemoia*, lizards, reproduction, evolution, complex placentae

Type of Presentation: Oral, Symposium 1: Reproduction in reptiles: from genes to ecology

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The Relationship of Body Shape and Maximum Pushing Force in Elongate Tetrapods

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Headfirst limbless subterranean locomotion (HLSL) has evolved independently numerous times among vertebrates. Previous studies of HLSL have focused on the functional consequences of variation in head-shape and the biomechanics of force production. Here, we present an initial report on the functional consequences of variation in body dimensions among vertebrates that engage in HLSL. We have gathered kinetic data from a wide variety of taxa representing several independent radiations (Caecilians, Amphisbaenians, Skinks and Snakes). The sample includes species that utilize 3 distinct modes of locomotion to generate forward directed forces (concertina, vermiform, and rectilinear) and several species that utilize cervical movements to generate forward forces. To gather kinetic data, individuals were induced to push vigorously against a forceplate from appropriate sized artificial acrylic tunnels. The best push (maximum total force - all vectors summed) of all the pushes observed for each individual are used as an estimate of maximum performance. When maximum force per body cross-sectional area is compared as a function of length to width ratio, more elongate squamates are stronger than their stout relatives. Among caecilians, in contrast, there is no evidence that an elongate body provides any performance advantage in terms of maximum force production.

Theme:caecilians, lizards, snakes, physiology, morphology

Type of Presentation: oral, Symposium 4: Evolutionary Transitions of Body Shape in Extant Amphibians and Reptiles: Call for Integrative Approaches.

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Recovery from the brink of extinction: Modelling the role of translocation for recovering the critically endangered grand and Otago skink.

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Conservation management often involves translocations as a reactive measure to supplement vulnerable populations or to re-establish a population in an area of extirpation. In such cases, costs and benefits of translocations are rarely calculated in terms of their value to metapopulation structure and resilience, nor are comparisons made with other management techniques or with natural dispersal. Here we evaluate model projections of management scenarios for the recovery of New Zealand's most endangered reptiles, the grand skink and the Otago skink. Following a four year experimental management trial to test effects of both reducing and entirely removing predatory mammals, both techniques offer management options that achieve recovery in skink populations. Therefore a combination of management techniques is being sought that can offer the most cost-effective options for metapopulation recovery and resilience to stochastic events for a 100 year management period. Whilst these management techniques both enable recovery in extant skink populations, much of the viable habitat in the vicinity of the proposed management is unoccupied and dispersal rates are extremely low in their frequency and extent. By taking a frequentist approach and modelling metapopulation dynamics across the management area as a network of ~500 communicating cells, each with specific demographic, environmental, management induced and stochastic characteristics, we have identified the relative merits of differing management scenarios. From this we determine the relative value of gaps in the network as translocation sites. Translocation of founder populations into areas where natural dispersal is low offers a viable population base for natural dispersers and also enables these habitat patches to approach carrying capacity more rapidly than would occur naturally, facilitating restoration of a metapopulation robust to stochastic events. By simulating the consequences of a range of management options from 'do nothing' to 'extended

pest eradication/suppression and translocation' we are able to identify the management responses possible for the funds available whilst also communicating to senior conservation managers the quantifiable risks of falling below the required levels of investment.

Theme: conservation biology, lizard, endangered species, translocation, metapopulation management

Type of Presentation: Oral, Symposium 5: Herpetofaunal Reintroductions, Translocations, and Supplementations

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Confocal laser scanning microscopy – a powerful technique with a large potential for effective applications in herpetology

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Confocal laser scanning microscopy (CLSM) is widely used in biological science with the focus of its application being in the disciplines cell biology, molecular biology, immunobiology and neurobiology. In recent years several new applications have successfully been tested in other fields of biology including morphology and taxonomy. However, CLSM is still rarely applied in herpetology although it has a strong potential for contributing to and improving a variety of herpetological studies. The aim of this poster is to demonstrate this potential and to highlight possible CLSM applications in the field of herpetology. Examples are shown of the improvement of gut content analyses, parasitological investigations and studies on amphibian development. It is demonstrated how high-resolution morphological imaging using CLSM may provide detailed information on tiny structures of plant material, small arthropods, parasites and amphibian eggs and embryos. Furthermore, easy and rapid preparation methods are described, and the comparative advantages of the application of CLSM are discussed.

Theme: Confocal laser scanning microscopy; Reptiles; Amphibians; Gut content analyses; Parasitological studies; Amphibian development

Type of Presentation: Poster

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Analysis of the reproductive parameters and the effect of the levels of calcium and phosphorus in the feeding of tracaja (*Podocnemis unifilis*) and amazonic turtle (*Podocnemis expansa*) in captivity.

Jânderson Garcez Rocha ¹

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The commercial farming of chelonians contributes for conservation. In the traditional systems of culture, the necessity exists to analyze the reproductive parameters and the effect of the levels of calcium and phosphorus in the feeding and performance of *P. unifilis* and *P. expansa*. This work was carried through in three chelonians farmings next to Manaus, from August of 2007 to May of 2008.

The animals had been measured and marked. From August to September, was made the search and marking of the nests, protected with screen. It was registered the amount of eggs, species that it disposed and was made the biometry of eggs. In October and November, it had eclosion, where the infertile eggs, pregiving had been counted and it was done the biometry of fingerlings after the absorption of vitelo. For the nutrition experiment, it had been used 189 fingerlings of *P. expansa* and 216 of *P. unifilis* becoming of the eclosion of farmings and from Vila Nova/Parintins/AM. These animals had been lodged in river steamers with nine compartments of 0,1m³ each. The density was of 15 fingerlings (8 *P. unifilis* and 7 *P. expansa*) in each compartment. The experiment was in factorial 3X3, with 3 calcium levels (1.0; 2.0 and 2.5%) and 3 levels of phosphorus (0,5; 1,0 and 1.5%), with three repetitions, in randomized blocks design. It was supplied ration with 29% of protein and 4000 kcal/kg of energy, 2% of the biomass. The properties had between 241 to 500 females of *P. expansa* with sexual reason varying of 12♀: 1♂ 9,5♀: 1♂, having on average 51,4±6,9 cm of length of carapace and 16,9±5,8 kg of weight, registered 6 nests of *P. expansa* with 60,5±4,95 eggs with 19,8±7,08 g. It had 7.20% of rotten eggs and 92.70% of pregiven eggs. Eggs with 16,4±1,67 g, the eclosion had been registered 11 *P. unifilis* nests of with 26,43±8,81 were of 20 fingerlings. It had 3.10% of infertile eggs 25.52% of rotten eggs and 64.50% of pregiven eggs. The fingerlings had been born with 35,5±2,12 mm of length of carapace and with 10,8±1,02 g of weight. Difference was not found significant enters at the offered levels of Ca and P. The daily weight gain varied of 0,173g/day to 2,479g/day. The alimentary conversion in the treatments varied of 1,75 to 2,03:1.

Theme:Reproduction; breeding; chelones; Podocnemis; Calcium

Type of Presentation: poster

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A key ecological trait drives the evolution of monogamy in a Peruvian poison frog

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There is considerable debate concerning the ecological and social factors that promote the evolution of monogamy. We report on an unusual example in which a simple change in an ecological trait (phytotelm pool size for tadpole rearing) is correlated with the evolution of monogamy. The Peruvian poison frog *Dendrobates imitator* is a Mullerian mimic of *Dendrobates variabilis* in the central cordillera of northern Peru. Molecular phylogeographic evidence indicates that this species recently colonized the area inhabited by *D. variabilis*. Detailed behavioral observations and ecological surveys revealed that *D. variabilis* uses large phytotelmata for tadpole rearing, has uniparental male care and a promiscuous mating system. In contrast, *D. imitator* uses small phytotelmata for tadpole rearing and exhibits social monogamy, pair-bonding and biparental care with tadpole provisioning. Preliminary molecular genetic analyses support our behavioral observations of monogamy. Reciprocal transplant experiments demonstrate that biparental care is required for tadpole growth and survival in small but not in large phytotelmata. Pool choice experiments demonstrate that these species show opposite size preferences of phytotelm for tadpole deposition. Competition experiments show that *D. variabilis* tadpoles are better adapted for competition and cannibalism than *D. imitator* tadpoles. In summary, our research indicates that the transition to rearing tadpoles in very small phytotelmata drove the evolution of biparental care and monogamy in Peruvian poison frogs.

Theme:anurans, reproduction, behavior, ecology

Type of Presentation: Oral, Symposium 11: Dendrobatoid Frog Biology.
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Amphibians of the Henri Pittier National Park and Neighboring Areas: a Checklist with Comments on their Distribution, Taxonomy, Natural History and Conservation Status.

Javier Valera-leal

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We present a checklist with update information of taxonomy, natural history, geographical distribution and conservation status of the amphibian species of the Henri Pittier National Park (PNHP in Spanish), Venezuela and neighboring areas. The PNHP is located in the Venezuelan Coastal range (CC) in North Central Venezuela and running parallel to the Caribbean coast, from which rises abruptly to reach 2,428 m. We used field (nocturnal and diurnal VES, pit fall traps and quadrats) and molecular methods during decade of 1990 and the period 2004-2008. A total 44 amphibian species constitute a highly richness assemblage which being influence by the high diversity of environments in the study area. Evidences indicated that some anuran populations of genus *Hyalinobatrachium* and *Mannophryne* correspond to new species with currently are in description process by senior author, co-authors of this study and others collaborators. Update of the geographical distribution of some species had changed. *Hylomantis medinae* considered endemic for long time of there type locality, was reported recently outside of the limit from the PNHP in the western extreme of the CC, but has not been observe again from 1974 in this park. New *Gastrotheca walkeri* and *Flectonotus pygmaeus* populations in lotic habitats of lowland between 30 and 90 m a.s.l., indicated that both species have a wider altitudinal distribution. Cloud Forest with 22 species in the environment with the highest diversity which 30.43% are included in the Red List as threatened. From in wider focus, the amphibian conservation status of the PNHP show following outlook: 2,3% Extinct (EX); 4.6% Critically Endangered (CR); 2,4% Endangered (EN); 10% Vulnerable (VU); 41% Learn Concern (LC); 4,6% Near Threatened (NT); 18.3% Data Deficient (DD) and 14.2% Not Evaluated (NE). Although, *Bolitoglossa borburata*, *Hylomantis medinae*, *Pristimantis stenodiscus*, *P. anotis* and *P. reticulatus* currently are not considered as threatened, we considered necessary to reevaluate it. Results obtained during the last two decades (2,873 diurnal and nocturnal person/hours; 13,050 days/tramp; 1,060 m² in quadrats) suggesting that species previously mentioned are declining in apparent pristine and slightly perturbed environments of the PNHP. *Eleutherodactylus johnstonei* and *Pipa parva* are introduced species.

Theme:amphibians, anurans, salamanders, taxonomy, genetics, endangered species

Type of Presentation: Poster

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Amphibians of the Henri Pittier National Park and their and neighbouring areas: a checklist with comments on their distribution, taxonomy, natural history and conservation status

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We present a checklist of Henri Pittier National Park (PNHP in Spanish) amphibians, Venezuela and neighbouring where we add information of taxonomy, natural history and geographical distribution. The 42 Anuran and single species of Caudata constitute a highly richness assemblage influenced by the high diversity of environments in the study area. We comment on *Hipsiboas alemani*, *Pseudis paradoxa* and *Rana palmipes* inhabiting surrounding to national park. Two introduced species *Eleutherodactylus johnstonei* and *Pipa parva* are also included. We discuss on the status of conservation of the species listed the Red List of the IUCN: *Atelopus vogli* like extinct (EX); 4,8% (two) in Critical Danger (CR); 2,4% (one) Endangered (EN); 11,9% (five) in Vulnerable (VU); 38% (16) in Least concern (LC); 7,1% (three) in Near Threatened (NT); 23,8% (10) in Data Deficient (DD); 14,2% (six) in Not Evaluated (NE). We discuss about the necessity of reevaluating the conservation status of *Bolitoglossa borburata*, *Hylomantis medinai*, *Pristimantis stenodiscus*, *P. anotis* and *P. reticulatus* that currently are not considered as threatened species, but results recent obtained of samplings realized during the decade of 1990 and the period 2004-2008 indicating an apparent populational decline in pristine or slightly perturbed environments of the PNHP.

Theme: Endangered species, anurans, salamanders, captive breeding, reproduction, natural history, taxonomy

Type of Presentation: Poster

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Hematology and plasma biochemical profile of *Paleosuchus trigonatus* inhabiting a fragmented area of Amazon rainforest

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In Amazon region, the Schneider's dwarf caiman *Paleosuchus trigonatus* (common name jacaré-coroa) is usually found in differentiated habitats from the other caiman species, like small and shallow streams (igarapés) and water bodies in closed canopy rainforest. Ecological studies revealed that adults of *P. trigonatus* are sedentary, males are territorial and they have a very cryptic behavior. Although this crocodilian species is widespread in Amazonian rainforest, no information on its physiological and biochemical features is available. This work was designed to investigate the hematology and blood biochemistry of wild *P. trigonatus* in a fragmented area of Amazonian rainforest. Eleven individuals of *P. trigonatus* (including four babies with age < six months) were caught in small streams (igarapés) located in the Campus of the Federal University of Amazonas (UFAM) and immediately restrained for blood sampling. Blood was withdrawn from the arterial bulb in the head by using sterile syringes with heparin (2500 UI) as anticoagulant. The hematological

parameters, hematocrit (Ht, %) hemoglobin content (Hb, g/dL) and circulating erythrocytes (RBC, $\times 10^6/\mu\text{L}$) were measured by routine methods used for vertebrate blood analysis, while the hematimetric indices (MCV, MHC and MCHC) were calculated according to Wintrobe's formulas. The biochemical analyses included the determination of glucose, triglycerides, total proteins, cholesterol and urea levels in plasma by commercial colorimetric and enzymatic kits (Doles, GO, Brazil). The hematology of *P. trigonatus* is similar to that found for two other Amazonian caimans, *Caiman crocodilus* e *Melanosuchus niger*, sampled under natural conditions, but differences are found between babies and subadults of *P. trigonatus*, with the former showing higher RBC and MCH and lower MCV values. The biochemical profile of plasma revealed that *P. trigonatus* has proteins and triglycerides levels that falls in the range of other crocodilian species, but lower urea and higher glucose concentrations in plasma. The hematology and biochemical profile of plasma of *P. trigonatus* are in agreement with its sedentary and territorial behavior and, as a consequence, a metabolism with low energy expenditures. Further studies are needed to cover a great number of animals, especially adults, when capture is not trivial.

Theme: Amazon, caiman, erythrogram, metabolism, plasma biochemistry, physiology

Type of Presentation: poster

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Different ecology patterns and reproductive strategies are correlated to physiological and biochemical blood profiles in congener *Podocnemis* turtles from the Amazon

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During the dry season in the Amazon basin, populations of the most important chelonian species from the genus *Podocnemis* can still be found nesting in sand beaches of some tributaries. In the Purus River, an important tributary from Solimões River, females of *P. expansa* (giant Amazon turtle), *P. unifilis* (tracajá) and *P. sextuberculata* (iaça) nest during the same period (September), but use different ecological strategies to make their annual reproductive cycle successful. While *P. expansa* use only one main nesting site (tabuleiro) for almost all females to lay their eggs, females of *P. unifilis* show preference for nest sites located near the marginal vegetation over the beach. On the other hand, females of *P. sextuberculata* build their nest scattered along the beach from the marginal vegetation to near water limits. At the onset of hatch, these distinct reproductive strategies impose different metabolic demands for hatchlings overcome the distance and predation pressure (high at this time) to reach the water, get some protection and disperse along the surrounding area. In this investigation, the physiological (hematology) and biochemical (glucose, triglycerides, cholesterol, total proteins and urea) blood profiles of *Podocnemis* were compared among themselves and correlated to their ecological strategies. In the years of 2000, 2001 and 2003, a total of 60 hatchlings for each species ($n=20/\text{year}$) were collected from randomized nests in the main beach of the Abufari Biological Reserve (Tapauá, Amazonas, Brazil) and acclimated until the 30th day of life to get blood samples and to establish the physiological and biochemical blood profiles. During the acclimation period hatchlings of all species were not fed and forced to use their endogenous yolk sac as the only energy source. Higher values for hematology and blood biochemistry were found for hatchlings of *P. sextuberculata* and *P. expansa*. They are more migratory and more active species, than *P. unifilis*.

The inclusion of hatchlings from an outer species (*Peltocheilus dumerilianus*) with similar ecological and reproductive features of *P. unifilis* revealed hematological and blood biochemical values that are in agreement with their low metabolic demands, territoriality and lower migratory capacity, when compared to the other turtle species. This work provides evidence that an integrated view of the biology, ecology and physiological aspects of Amazon turtles may improve the understanding that specific actions may be applied for their conservation and management.

Theme: Amazon turtles, hematology, metabolism, physiology, plasma biochemistry, Podocnemis

Type of Presentation: poster

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Chytrid epidemics: where do we go from here?

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The human-mediated transport of infected amphibians is the most plausible driver for the intercontinental spread of chytridiomycosis, a recently emerged infectious disease responsible for amphibian population declines and extinctions on multiple continents. Chytridiomycosis is now globally ubiquitous, and it cannot be eradicated from affected sites. Its rapid spread both within and between continents provides a valuable lesson on preventing future panzootics and subsequent erosion of biodiversity, not only of amphibians, but of a wide array of taxa: the continued inter-continental trade and transport of animals will inevitably lead to the spread of novel pathogens, followed by numerous extinctions. Herein we define and discuss three levels of amphibian disease management: (1) post-exposure prophylactic measures that are curative in nature and applicable only in a small number of situations; (2) pre-exposure prophylactic measures that reduce disease threat in the short-term; and (3) preventive measures that remove the threat altogether. Preventive measures include a virtually complete ban on all unnecessary long-distance trade & transport of amphibians, and are the only method of protecting amphibians from disease-induced declines and extinctions over the long-term. Legislation to prevent the emergence of new diseases is urgently required to protect global amphibian biodiversity.

Theme: amphibians, disease, chytrid, conservation

Type of Presentation: oral -symposium 6

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Turtles in the Well: Aspects of the Ecology of Sonora Mud Turtles at Montezuma Well, Arizona, USA

Jeff Lovich, Charles Drost, Dennis Casper, A.J. Monatesti

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The Sonora mud turtle (*Kinosternon sonoriense*) ranges from Durango and Sonora, Mexico, north into Arizona and New Mexico, USA, reaching their northwestern distributional limit near Montezuma Well, Yavapai County, Arizona, USA. Montezuma Well, a natural and unpolluted wetland, is chemically-challenging to most aquatic organisms, devoid of fish, and rich in invertebrate endemism. Sonora mud turtles appear to thrive in the 0.8 ha wetland along with non-native red-eared slider turtles (*Trachemys scripta elegans*), the latter introduced from the Mississippi River Valley as unwanted pets. Although the primary purpose of our ongoing study is to examine possible competitive interactions between the two turtle species, we report preliminary results of the ecology of the Sonora mud turtle in the unique wetland and nearby Wet Beaver Creek. From May-September, 2007, 89 turtles were recaptured 128 times. We recaptured some individuals up to three times but males were much more likely to be recaptured than females. Trappability of males declined during the same period while female trappability remained relatively constant. The sex ratio was 59 males:30 females (1.97:1) not including four juveniles of unknown sex. Maximum male carapace length was 146 mm while that for females was 149 mm, markedly smaller than turtles in the Chiricahua Mountains. Activity decreased from April through August, ranging from 0 to over 12.4 observations per hour, despite relatively constant water temperatures. Lizard and snake species were noted in the diet in sharp contrast to most other turtles in the United States. The egg laying season ranges from May to at least September. Clutch size ranges from 1-8 eggs with a mean of 4.73 eggs and is not correlated with body size. The smallest gravid female had a carapace length of 125 mm and some females produce at least two clutches per year. The proportion of gravid female mud turtles gradually increased from about 60%-90% from May through July, decreasing thereafter. Hatchlings appear to overwinter in the nest, emerging with the onset of summer rain in the year following oviposition, after a long diapause in the egg.

Theme:turtles, ecology, reproduction

Type of Presentation: oral: contributed

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Sex Identification In Anurans: A Method Using Urinary Hormone Metabolites

Jen Germano*, Frank Molinia, Phil Bishop, and Alison Cree

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With the world currently facing a global amphibian extinction crisis there is little doubt that proactive conservation measures will play a part in the future conservation of our amphibian fauna. As management methods such as captive breeding, supplementations, and reintroductions become more and more common, researchers and conservation managers are facing numerous hurdles. One of the major problems facing many anuran research and conservation management projects is the lack of a non-invasive technique to sex monomorphic species. Sexing of monomorphic species has been achieved in birds and mammals through the monitoring of hormone metabolite concentrations in urine and feces, and more recently in two toad species using feces. However, it has never been attempted for anurans using urine, a waste substance that can be collected in the field with minimal handling or from specific individuals held within a group tank in a captive environment. Using dimorphic *Litoria raniformis*, the Southern Bell frog as a model species we have developed enzyme immunoassays to measure hormone metabolites found within the urine to test whether these hormone concentrations could be used to differentiate between males and females. Parallelisms between serially diluted urine from *L. raniformis* and hormone standards were demonstrated for estrone conjugate, testosterone, and progesterone. Preliminary results show that significant differences exist between males and females sampled from the wild during the breeding season in the urinary levels of

estrone conjugate metabolites and that these can be used to differentiate sex in this species. Although hormone differences would have to be verified for each new species, our aim is to adapt these methods to sex rare, monomorphic anurans in the future.

Theme:anurans, amphibians, captive breeding, conservation biology

Type of Presentation: Poster, contributed

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A review of fifteen years of herpetofaunal reintroductions

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The number of reintroductions and translocations conducted over the last 20 years has increased dramatically for all taxa as they become more widely recognised as important tools in conservation management. Similarly, for the world's amphibians and reptiles there has been a significant increase in the number of publications and the appearance of dedicated meetings and symposia (such as this one) covering the topic in relation to these species. For herpetofauna, reintroductions and translocations have been utilized for both conservation and the mitigation of human conflicts with venomous species and animals occupying land designated for development. However, despite the increased popularity of herpetofaunal reintroductions, the appropriateness of this tool for this particular group of animals has been widely debated for the past 15 years. To provide a comprehensive evaluation of the suitability of herpetofauna for reintroduction, we reviewed the results of amphibian and reptile reintroduction projects published between 1991 and 2006. Projects published prior to 1991 have been previously reviewed (Dodd and Seigel 1991). The current percentage of successful amphibian and reptile reintroductions is twice that reported in 1991. Success and failure rates were independent of the taxonomic class (Amphibia or Reptilia) being released. Reptile reintroductions driven by human-wildlife conflict mitigation had a higher failure rate than those motivated by conservation reasons. The outcomes of amphibian reintroductions were significantly related to the number of animals released with projects releasing over 1,000 individuals being most successful. The most common reported causes of reintroduction failure were homing and migration of introduced individuals out of release sites and poor habitat. The increased success of herpetofaunal reintroductions in the past 15 years compared to the 1991 review is encouraging for future conservation projects. However, more preparation, monitoring, reporting of results, experimental testing of techniques and methods needs to occur to improve herpetofaunal reintroductions as a whole.

Theme:amphibian, reptile, conservation biology, management

Type of Presentation: oral, Symposium 5 (Herpetofaunal Reintroductions, Translocations, and Supplementations)

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Competition, Mate Choice, and Genetic Compatibility in Tuatara (*Sphenodon punctatus*)

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Indirect genetic benefits, although still somewhat debatable, are often invoked to explain mate choice when direct benefits are not obvious. Although poorly understood in reptiles, indirect genetic benefits may be gained through 'good genes' or genetic compatibility of male and female genotypes. Major histocompatibility complex (MHC) genes are major determinants of pathogen resistance, and have been proposed as a link between mate choice and increased offspring fitness. In this study, we examined the genetic and phenotypic factors affecting competition, mate choice and genetic compatibility in a wild population of an archaic reptile (tuatara, *Sphenodon punctatus*). Tuatara are territorial and sexually dimorphic, and exhibit primarily facultative seasonal monogamy. On Stephens Island, New Zealand, we monitored the mating season of tuatara from 2005-2007, and collected data from 75 mated pairs. We genotyped all individuals at seven polymorphic microsatellite loci and MHC class I genes. We compared pairwise microsatellite relatedness, average percent difference (APD) and amino acid difference of MHC alleles between real mated pairs and simulated random pairs and examined mating patterns for assortative mating based on size. We also investigated whether male mating success was based on body size, heterozygosity, or particular MHC alleles. Pairwise relatedness and APD values of mated pairs were not different from random pairs, providing no evidence for inbreeding avoidance or genetic compatibility. However, amino acid difference, which takes into account the functional similarity of MHC alleles, was higher for mated pairs than for random pairs, but the difference was not significant. We found weak yet significant size-assortative mating at high population density, which is probably the result of large males competing successfully for larger, more fecund females. Body size, which was not related to heterozygosity, was the only significant predictor of male mating success. Overall, our results provide limited support for mate choice based on genetic compatibility or 'good genes'. We suggest that mating patterns in tuatara are driven by male competitive ability, which is more strongly linked to body size than heterozygosity or MHC diversity. A stronger genetic effect may be evident in a more inbred population and future studies should focus on comparing populations with different genetic histories.

Theme:reproduction, behaviour, *Sphenodon*, reptiles, endangered species, genetics

Type of Presentation: oral, Symposium 10: Conservation Genetics of Amphibians and Reptiles in the 21st Century

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Successful Reintroduction of the 'World's Rarest Snake' to Restored Islands Around Antigua, West Indies.

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The Critically Endangered Antiguan racer (*Alsophis antiguae*) was common throughout the Antiguan archipelago until the late 19th century, when Asian mongooses (*Herpestes javanicus*) were introduced. Although declared extinct in the 1930s, a relict population survived on one mongoose-free offshore island, the 9.9 hectares Great Bird Island. A mark-recapture survey in 1995 estimated this population to number only 50.5 ± 7 individuals, and discovered that the snakes were under attack from a high density of alien black rats (*Rattus rattus*): over 50% were scarred with rat

bites and 42% had truncated tails. The Antiguan Racer Conservation Project was founded in 1995 by five national and international organisations, and its first achievement was to eradicate the rats from Great Bird Island using a brodifacoum-based rodenticide. In the two years after rats were removed, the racer population more than doubled to 113 adults and subadults, but further increases were seemingly constrained by the availability of prey (lizards) on Great Bird Island. 17% of racers were seriously underweight in 1998, and the population crashed to 86 ± 12 in 1999. To allow recovery, project staff eradicated alien rats and mongooses from ten offshore islands around Antigua and measured their lizard populations to estimate their snake carrying capacity. In 1999, 10 Antiguan racers were removed from Great Bird to re-stock the nearby Rabbit Island, and a further 46 racers were translocated from Great Bird and Rabbit to Green Island between 2002 and 2005. The translocated individuals exhibited significant increases in growth rates and reproduced successfully on both islands. A third reintroduction began in 2008 with the translocation of 13 racers to York Island. This reintroduction programme has thus enlarged the species' present distribution range from one island (9.9ha) to four islands (65 hectares). The total population has increased by six-fold, to more than 300 adults and sub-adults (January 2008 census), and could exceed 500 by 2011. The Antiguan racer meta-population requires continued management, however, to mitigate the problems caused by escalating human disturbance and to control the chronic threat of reinvasions by rats, mongooses and other alien species. The species may also be at severe risk from inbreeding depression, as approximately 25% of Antiguan racers exhibit abnormally fused scales, missing eyes, kinked spines and other potentially congenital defects. A genetic study will therefore be carried out in 2008 to help guide the future management of the meta-population. PLEASE INSERT 1 FIGURE AND 1 TABLE

Theme: reptiles, snakes, genetics, conservation biology, endangered species, predator-prey.

Type of Presentation: Oral, Symposium 5: Herpetofaunal Reintroductions, Translocations, and Supplementations

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A Review of Fifteen Years Of Herpetofaunal Reintroductions

Jennifer Germano* and Phil Bishop

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The number of reintroductions and translocations conducted over the last 20 years has increased dramatically for all taxa as they become more widely recognised as important tools in conservation management. Similarly, for the world's amphibians and reptiles there has been a significant increase in the number of publications and the appearance of dedicated meetings and symposia (such as this one) covering the topic in relation to these species. For herpetofauna, reintroductions and translocations have been utilized for both conservation and the mitigation of human conflicts with venomous species and animals occupying land designated for development. However, despite the increased popularity of herpetofaunal reintroductions, the appropriateness of this tool for this particular group of animals has been widely debated for the past 15 years. To provide a comprehensive evaluation of the suitability of herpetofauna for reintroduction, we reviewed the results of amphibian and reptile reintroduction projects published between 1991 and 2006. Projects published prior to 1991 have been previously reviewed (Dodd and Seigel 1991). The current percentage of successful amphibian and reptile reintroductions is twice that reported in 1991. Success and failure rates were independent of the taxonomic class (Amphibia or Reptilia) being released. Reptile reintroductions driven by human-wildlife conflict mitigation had a higher failure rate than those motivated by conservation reasons. The outcomes of amphibian reintroductions were significantly related to the number of animals released with projects releasing over 1,000 individuals being most successful. The most common reported causes of reintroduction failure were homing and

migration of introduced individuals out of release sites and poor habitat. The increased success of herpetofaunal reintroductions in the past 15 years compared to the 1991 review is encouraging for future conservation projects. However, more preparation, monitoring, reporting of results, experimental testing of techniques and methods needs to occur to improve herpetofaunal reintroductions as a whole.

Theme: amphibian, reptile, conservation biology, management

Type of Presentation: Oral, Symposium 5: Herpetofaunal Reintroductions, Translocations, and Supplementations

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Wood Frog (*Rana sylvatica*) Repatriation in Central Ohio

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Among the many factors that appear to be responsible for amphibian declines, the loss of high quality wetlands is one of the most straightforward. The state of Ohio has lost about 90% of its wetlands to agriculture, industry, and urban sprawl. Although the Environmental Protection Agency now has a wetland mitigation bank to compensate for lost wetlands, this is usually biased to larger, semi-permanent wetlands. Smaller, ephemeral pools are more likely to be overlooked. Many amphibian species are dependent on these fishless pools for reproduction, and will become locally extinct if these are destroyed or become inaccessible. Wood frogs (*Rana sylvatica*) are often described as a good indicator of wetland health, as they need high-quality, fishless wetlands. Wood frogs have disappeared from many areas in central Ohio where they were once found, and where suitable habitat is still available. In 2006, 2007, and 2008, a repatriation study was done in collaboration with the Columbus and Franklin County Metropolitan Park District and the Ohio Environmental Protection Agency. The focus of the project was to re-introduce *R. sylvatica* to protected locations where they were found historically and also newly preserved areas converting from an agricultural to forested landscape. *Rana sylvatica* eggs were introduced into several pools in each park two years in a row. Tadpoles were known to survive to metamorphosis during each of the two years eggs were introduced. Males were sighted in 2007, and egg masses were found in 2008 in two of the parks. In one park, eggs were introduced three years in a row due to a failure of tadpole survivorship during the 2006 season, and breeding is expected to occur in 2009. Although this repatriation effort is still in its early stages, the results appear promising. Monitoring of breeding establishment will continue in future field seasons.

Theme: amphibians, anurans, ecology, conservation biology

Type of Presentation: poster, symposium 5: Herpetofaunal Reintroductions, Translocations, and Supplementations.

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Biomass and species richness of Amazonian leaf litter herpetofauna: A comparison from young and old geomorphologies

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The Amazon Basin, representing the largest expanse of intact tropical rainforest on the planet, harbors the largest diversity of amphibians and reptiles. Despite their apparent homogeneity due to relatively low elevation and limited barriers to dispersal, upland forests across Amazonia exhibit dramatic differences due to soil age and nutrient levels. Secondary consumers in the leaf litter herpetofauna community on ancient soils of Central Amazonia may suffer reduced biomass compared to those found on younger soils of the Western Amazon. Where population densities are driven below viable thresholds, diversity may also be reduced. We tested abundance, biomass and species richness differences from sites on old and young geomorphologies of Amazonia. Total herpetofauna abundance, biomass and overall species richness was significantly greater on younger soils. When looked at separately, amphibians were slightly more abundant and biomass was more than two times greater on younger soils than biomass of amphibians on older soils. Even more impressive was the variation exhibited by lizards: abundance was not significantly different but lizard biomass was five times greater on younger soils. Neither abundance, biomass nor species richness differences were explained by local environmental variables. We suggest that the most important driver of differences in herpetofauna biomass, abundance and possibly diversity may be the underlying geomorphologic differences. Reduced primary production on ancient soils reverberates up the food chain, leaving fewer resources available for higher trophic levels. We suggest that biomass, which has largely been ignored in established collecting protocols, become a standard measurement of herpetofauna sampling regimes. We also recommend expanded comparisons of litter herpetofauna communities on soils of differing geologic ages.

Theme: amphibians, lizards, biomass, Amazon, community ecology, species richness, Brazil, Ecuador

Type of Presentation: oral: contributed

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Herpetofaunal Reintroductions And Translocations In The UK: Policy And Practice

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Herpetofauna translocations and reintroductions are undertaken for two broad purposes in the UK: (1) conservation (reintroduction to establish populations, reinforcement, genetic management, or predator/competitor control), and (2) wildlife management (mitigation to resolve development conflict, or removing/introducing animals for personal reasons). Mitigation translocations are the most frequent. Guidance notably includes a recent (2003) policy that transposes the IUCN reintroduction guidelines into a UK framework. However, the degree to which guidance is followed varies widely, mainly depending on the level of legal protection. An attempt is made to review the outcomes of reintroduction and translocation practice. Reintroductions have generally been remarkably successful. Of 62 sand lizard *Lacerta agilis* reintroductions, mainly from captive bred stock, at least 80% have resulted in viable populations. At least 17 natterjack toad *Epidalea* (*Bufo*) *calamita* populations have been established through translocation of wild-caught spawn and metamorphs. The pool frog *Pelophylax* (*Rana*) *lessonae* went extinct from the UK and has recently been reintroduced by translocating animals from Sweden, with encouraging early results. Unfortunately, non-native species have been introduced (and translocated within the UK), some forming large, expanding populations. Where development threatens legally protected herpetofauna, typical mitigation comprises removal (translocation), exclusion and habitat enhancement. The number of mitigation schemes has increased considerably over the last decade. Political imperative for development means mitigation translocations will continue to be frequent, as it is unrealistic to

fully protect all populations. Many early mitigation efforts were futile because of poor attention to objectives and methods. Statutory guidance has aided some encouraging trends in mitigation: populations are more likely to be detected through early survey, which has massively improved. Adverse impacts (core habitat loss) are more frequently avoided by altering development plans. Individuals are typically relocated within their home range. A net gain in breeding habitat is now more common. Unfortunately, monitoring has been generally poor, and outcomes, where known, are highly variable. For less regulated species there is a worrying increase in poorly planned translocations, where outcomes are unknown. Ensuring long-term habitat management remains problematic for many projects. In summary, viable populations of UK species can be established through translocation and reintroduction if properly planned, and they are therefore often valuable tools. However, the “success” of such activities must be assessed in terms of the desired conservation or wildlife management outcome, which will often include other considerations.

Theme: amphibians, reptiles, anurans, snakes, lizards, ecology, conservation biology, endangered species

Type of Presentation: Oral, Symposium 5: Herpetofaunal Reintroductions, Translocations, and Supplementations

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Developing Good Practice In Invasive Amphibian Control: The North American Bullfrog In England

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The North American bullfrog *Lithobates catesbeianus* is an invasive species in many parts of the world. Nature conservation authorities in England have taken a robust approach to prevent the establishment of this species. The strategy includes prevention (legislation, guidance and awareness) and rapid removal. Through public awareness campaigns, bullfrogs reaching the wild have been traced and removed. One population (A) is probably now eradicated, as no bullfrogs have been seen for three years despite targeted surveillance; however, it is feasible that undetectably small numbers remain. Site A came to the attention of conservation authorities in 1999. We initiated a programme of pond isolation, draining, frog removal, survey and education. As little information was available on bullfrog control, our approaches were to some extent experimental. A review of the eight year programme may be instructive when formulating other amphibian control projects. Larval eradication focused on pond drainage, undertaken in frosty weather. This aided control of post-metamorphic animals, which also included isolating breeding ponds with frog-proof fencing combined with pitfall trapping, netting, electrofishing and shooting. Methods varied in their value according to life stage and phase of control project. In total 11,997 individuals were removed from the ponds. Of 53 ponds surveyed locally, bullfrogs were found at seven ponds close to the original breeding site. There were at least four breeding events. To date the total cost of control has been approximately £100,000 (BRL325,000; US\$195,000). The first detection of the chytrid fungus *Batrachochytrium dendrobatidis* in the UK (outside captivity) was from this site. Populations of native amphibians persist despite bullfrogs and chytrid, though some unusual mortalities are currently being investigated. Population B was discovered in 2006 and control is in progress. Adults are numerous here and eradication may prove more difficult. Key learning points from our experiences include: (a) with rapid and intensive action, complete eradication of isolated *L. catesbeianus* populations is possible in a landscape with small, scattered wetlands; (b) authorities need several years of survey and contingency to act; (c) publicity and careful follow-up helps detection and control; (d) close liaison with landowners is crucial; (e) rapid action requires clear responsibilities, and flexibility in

budget allocation and contract letting; (f) legislative (not voluntary) control on invasive species is essential. Our findings are probably most applicable to areas where bullfrogs are not yet widely established.

Theme: amphibians, anurans, ecology, reproduction, behaviour, conservation biology

Type of Presentation: Oral, Symposium 2: Invasive Reptiles and Amphibians: Global Perspectives and local solutions

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Anuran Diversity in the Departamento Pando, Bolivia

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Departamento Pando represents the northernmost region of Bolivia situated in the south-western Amazonian basin within the zone of tall evergreen lowland rainforest. Until recently, the list of anuran species of Pando was very incomplete (47 reported species; De la Riva et al. 2000). With the aim to improve the knowledge of species richness and biogeographic affinity of the regional anuran fauna we surveyed 20 different localities within the whole territory of Pando and obtained data on 102 frog species. Compiling the obtained and published data the updated list of anuran species of Pando comprises 108 species belonging to 11 families (Aromobatidae 3, Brachycephalidae 11, Bufonidae 8, Centrolenidae 2, Ceratophryidae 1, Dendrobatidae 5, Hylidae 50, Leptodactylidae 18, Leiuperidae 2, Microhylidae 7, Pipidae 1). Following evaluation of the regional anuran diversity was based on data sets from 16 localities assorted according to their geographic origin: (i) western Pando (Bioceanica, Bolpebra, Cobija, San Antonio del Matti, Tahuamanu), (ii) central Pando (Barracon, Canada, Nacebe, Sacrificio, San Antonio, Sena), (iii) eastern Pando (Caiman, Manoa, Palmira, Piedritas, Santa Crucito). The longest distance between the marginal western and eastern localities was 480 km; the shortest distances separating western and central as well as central and eastern study sites ranged around 150 km. Species diversities found in western, central and eastern Pando were nearly identical (62, 62, 59 species; 55–57% of the species richness of the entire Departamento). Comparison of the coefficients of biogeographic resemblance (CBR; Duellman and Mendelson 1995) showed that generally high similarity of the regional anuran faunas tends to decrease towards the east (CBR: W/C=0.71, W/E=0.66, C/E=0.68). Analysis of biogeographic affinities of the given faunas (distributional patterns adopted from De la Riva et al. 2000) revealed the following trends: (1) species widespread in the Amazon basin represent 35.0–44.1% of the regional faunas and their proportional representation increases towards the east, (2) upper Amazonian elements represent 20.3–32.3 % and their percentage decreases towards the east, (3) proportion of south-western Amazonian species is more or less balanced (20.0–22.6%), (4) elements of peri-Andean forest are more prominent in western Pando only (6.5%), (5) lower Amazonian species are rare (0.0–1.6%), (6) occurrence of Cerrado and Chaco elements increases towards the east (1.6–8.5%), (7) proportion of endemic or distributional data deficient species is balanced (8.1–9.7%). (Supported by MK00002327201)

Theme: anurans, biogeography, Pando, Bolivia

Type of Presentation: Poster contributed

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Using Diamondback Terrapin (*Malaclemys terrapin*) and Other Turtles as Bioindicators of Heavy Metal Contamination, Food Chain Exposure, and Human Exposure

Joanna Burger and Michael Gochfeld

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The public, scientists, governmental agencies, and public policy makers are increasingly interested in understanding the health of ecosystems and their component parts. Thus, there is a need to develop bioindicators of metal exposure that provide information for determining potential risks to organisms themselves, to other biota that eat them, and to humans that consume them. We examined heavy metal levels (arsenic, cadmium, chromium, lead, manganese, mercury, selenium) in Diamondback Terrapin (*Malaclemys terrapin*) collected in Barnegat Bay New Jersey in 2000, and again in 2008. Our objectives were to examine: 1) temporal patterns of metal levels, 2) levels in the liver that might indicate potential risk to the terrapins themselves, 3) levels in the muscle that might indicate potential risk to other organisms that consume them, including humans, and 4) their utility as bioindicators. Metals levels in the terrapin are also compared to other turtles, including Slider Turtles (*Trachemys scripta*) and Snapping Turtles (*Chelydra serpentina*), and to turtles from the Rio Negro (after L. Schneider et al.). Diamondback Terrapin live in estuarine waters from Cape Cod (Massachusetts) to the Texas coast of the United States. While adult turtles are less vulnerable to predators than young, adult turtles are eaten by large predators and are considered a delicacy by many people, including many years of commercial exploitation and formerly farming. Most metal levels were higher in liver than muscle, although muscle had the highest levels of arsenic and chromium. Most metal levels in the muscle were below the levels known to be toxic or to cause sublethal effects in organisms that consume them, including humans. However, mercury levels in liver were above this threshold for both humans and other predators. The levels of metals in Diamondback Terrapin are below or similar to those of other turtles. Because of their use by people and other predators, and because they accumulate heavy metals, they are useful as bioindicators. The study has been funded in part by NIEHS grant P30ES005022 to EOHSI and USDOE grant DE-FC01-06EW07053 to CRESPI.

Theme: Turtles, Diamondback Terrapin, *Malaclemys terrapin*, bioindicators, heavy metals, mercury, lead, cadmium, chromium, selenium, natural history, human consumption, predators

Type of Presentation: contributed poster

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Effects of Handling, Marking, and Recapturing Pine Snakes (*Pituophis melanoleucus*): Report of 33-Years of Study in the New Jersey Pine Barrens (USA)

Joanna Burger, Robert Zappalorti

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Biologists assume that study, handling, and recapturing reptiles has minimal effect on behavior and survival. Although this is seldom the focus of any study it is critical to continued research and management, particularly of threatened and endangered species. It is difficult to obtain such data, except from long-term studies. Herein we report on the effects of handling, branding, and PIT-tagging

Pine snakes (*Pituophus melanoleucus*) in the New Jersey Pine Barrens from 1976 to 2008. Pine Snakes lay eggs in long underground tunnels, and hibernate in burrows dug by mammals. The NJ Pine Snake is isolated from others and lives where there are no suitable burrowing mammals. These snakes dig their own nest burrows and modify or entirely dig and excavate their own hibernation sites. We captured and marked Pine Snakes using a variety of methods. We found: 1) There was no difference in the rate of re-sighting of Pine Snakes as a function of whether they were branded or fitted with passive integrated transponder devices (PIT-tags), 2) Over half of the Pine Snakes that were marked were re-sighted at least 5 months later, 3) Females that were digging nests generally did not permanently abandon their nests regardless of whether they were branded or injected with PIT tags, 4) Handled and marked females generally continued to use the same nest site in successive years, 5) Nests that were opened for examination, then covered over, had the same success as non-opened nests, 6) Hatching of eggs in the wild was only about half the rate of eggs incubated in the laboratory (due mainly to predation and poaching of entire clutches), 7) hatching in the laboratory was similar to hatching rates in field nests where some eggs hatched, 8) Hibernacula that were excavated for study were only abandoned due to habitat destruction or destruction by predators, and 9) Nearly half of the snakes handled while hibernating were found at least once in subsequent years in the reconstructed hibernacula. These data indicate that Pine Snakes are resilient, returning to the same nest and hibernacula sites regardless of being handled, marked, and released back to their collection sites. This work has been funded in part by NIEHS grant P30ES005022.

Theme: Pine Snakes, Biology, Natural History, Nesting, Hibernating, Handling, Branding, Pit-tags, Marking, Recapture, Long-term Study, Longevity, New Jersey Pine Barrens.

Type of Presentation: oral contributed

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Claudin-5 is restricted to tight junction region of uterine epithelial cells in uterus of pregnant/gravid squamate reptiles

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Claudin-5, a tight junctional protein associated with ion and size selectivity has been found in the uterus of skinks. This study has generated critical information about the molecular assembly of the tight junction at various stages of the reproductive cycle in the skink uterus. Recent studies looking at tight junctional proteins found occludin expression in the tight junction region of uterine epithelial cells in the skink uterus however, the increase in occludin did not disclose any further information about the ions and size of ions permeating across the paracellular pathway. A ~22 kDa claudin-5 band was detected in the uterus of the skinks present in this study and immunohistochemistry revealed that claudin-5 redistributes to the tight junction region of the lateral plasma membrane of uterine epithelial cells in late stage pregnancy/gravidity. This indicates that the tight junction becomes more assembled to precisely regulate ion and solute permeation in late stage pregnancy/gravidity. Claudin-5 and its functional role as a molecular sieve due to the formation of ion and size selective pores, suggests that permeation of ions smaller than 0.8 kDa are restricted when claudin-5 is redistributed to the tight junction region of the later plasma membrane. This is the first description of the molecular mechanisms which may be involved in regulating

Theme: reptiles, lizards, reproduction, physiology, morphology

Type of Presentation: oral, symposium 1

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A Conservation Strategy for the Amphibians of Southeast Asia

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From 29-30 April, 2008, a workshop entitled “A Conservation Strategy for the Amphibians of Southeast Asia” (ACSASEA) was convened in Phnom Penh, Cambodia, by Conservation International in order to discuss the current state of amphibian conservation and prioritize actions necessary for the long-term conservation of amphibians of Southeast Asia. Seventeen specialists representing Cambodia, Laos, Indonesia, Malaysia, the Philippines, Singapore, Thailand, Vietnam and southern China attended the meeting. It was agreed that the foremost threat to amphibian diversity in Southeast Asia is habitat loss. The over-harvesting of amphibian species for the pet and food trades, environmental contaminants and pollutions were also identified as threats, however, the nature and scale of their impacts on amphibian populations are poorly understood. Infectious disease and climate change are also likely to pose a risk to amphibian diversity in the region, but their current and potential future impacts are difficult to estimate based upon present knowledge. Major barriers to amphibian conservation in the region include taxonomic problems, a lack of basic biological and ecological data and baseline population information, and limited local scientific capacity. The most urgent conservation action required for amphibian conservation in Southeast Asia is the

establishment and strict protection of Important Amphibian Areas (IAA's), areas that are assessed as having high species diversity and as representing distinctive regional amphibian faunas. Other actions needed include long-term amphibian population monitoring, collection of basic biological and ecological information, continued taxonomic research to clarify the nature of the regional faunas, and evaluation of the impact of commercial food, medicine and pet trades and environmental contaminants on amphibian populations. Capacity building to train cohorts of young regional scientists is needed to accomplish these actions. Increasing public awareness and the production of local language field guides are also essential tools to accomplish these conservation goals. Increased efforts to monitor the distribution and impact of infectious diseases including *Batrachochytrium dendrobatidis* and tailoring amphibian monitoring methods to assess the effects of climate change are also required in order to initiate adaptive management plans if necessary. At present, captive breeding does not appear to be a priority for amphibian conservation in Southeast Asia, although it may become required if infectious diseases are determined to be responsible for population declines in the field, under future climate scenarios, or due to the major loss of habitat for specific range-restricted species.

Theme: amphibians, anurans, salamanders, caecilians, conservation biology, captive breeding, endangered species, Southeast Asia

Type of Presentation: Oral, Symposium 14: Amphibian conservation.

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The Evolution of Snake-like Body Form in Squamate Reptiles: Patterns, Rates, and Levels of Explanation

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The origin of snake-like body form is one of the most dramatic transitions in morphology among vertebrates. Yet, this transition has occurred dozens of times in squamate reptiles, offering an exciting model system for evolutionary studies of major changes in body-form. In this talk, I will describe recent research by my collaborators and myself looking at this transition, using an extensive phylogenetic and morphometric data set for >250 species of squamates. Snake-like morphology appears to have evolved at least 25 times in squamates, although this number may increase dramatically with greater phylogenetic resolution in skinks. There are two distinct ecomorphs of limb-reduced squamates: a long-tailed, surface-dwelling ecomorph which has evolved five times (including some anguids, cordylids, gerrhosaurids, and pygopods), and a short-tailed, burrowing ecomorph, which has evolved at least 20 times, but possibly many more (including dibamids, gymnophthalmids, and many skinks). For both ecomorphs, the transition to snake-like morphology involves correlated evolution of body elongation, limb-length reduction, and loss of digits. By combining a time-calibrated phylogeny and ancestral reconstructions, we find that the transition from fully limbed to limbless morphology can occur in 20 million years or less. Surprisingly, intermediate morphologies (i.e., some digits lost but limbs still retained) can persist for similar amounts of time or longer, suggesting that there may be selection to favor the long-term maintenance of these intermediate morphologies. We also find additional evidence for the re-acquisition of digits that have been evolutionarily lost. Understanding why snake-like morphology has evolved dozens of times in squamates requires consideration of many different levels of explanation (and subdisciplines of biology), including genetics, development, functional morphology, and microevolutionary change within populations. However, some of the most important levels may be quite counterintuitive. Specifically, the community context of trait evolution (i.e., have other sympatric lineages evolved the ecomorph already?) and large-scale biogeography (i.e., the evolution of ecomorphs on different continents and in different regions) seem to be essential for understanding why this transition occurs

so frequently and yet not as often as it could.

Theme:reptiles, morphology, ecology

Type of Presentation: oral, Symposium 4: Evolutionary Transitions of Body Shape in Extant Amphibians and Reptiles: Call for Integrative Approaches.

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Clutch and Egg Size Variation of the Smooth Softshell (*Apalone mutica*) in Louisiana and Texas, USA

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The Smooth Softshell (*Apalone mutica*) is restricted to river habitats in the eastern and central United States, including all major rivers in Louisiana and the eastern portion of Texas. A study of the reproductive ecology of this species has been conducted intermittently since 1973 based on information obtained from nests found on sandbars. Nests were collected from two rivers in Louisiana (Red and Ouachita), the Sabine River on the Texas-Louisiana border, as well as the Brazos River in Texas. Entire clutches were gathered and egg measurements were recorded subsequently. All data from 1973-2006 were pooled for initial analysis, thus obscuring any temporal patterns. In a comparison of clutch size by river, the Ouachita River had the largest mean clutch size (avg. = 12.5 eggs, n = 6) and the Sabine River had the smallest (avg. = 5.7 eggs, n = 92). Although Sabine River clutches were smaller, the eggs were nearly 40% larger than those of the nearest river drainage, the Red River (mean egg mass = 9.23 g, n = 128 vs. mean egg mass = 6.69 g, n = 180, respectively). Egg mass was significantly different among all rivers ($p < 0.001$). Of the four river systems, the Sabine River is the most distinctive in terms of clutch size, egg size and nest site characteristics.

Theme:turtles, ecology, reproduction

Type of Presentation: poster, contributed

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Conservation of the enigmatic Cuban Crocodile

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The Cuban crocodile is the most morphologically, ecologically and behaviorally distinctive member of the genus *Crocodylus*. We argue that this is a result of species having evolved largely to fill the niche of a terrestrial predator in Cuba and adjacent Caribbean islands during the Pleistocene. During this period Cuban was home to several species of ground sloths and no species of large mammalian predators. Contemporary fossil remains of Cuban crocodiles indicate the species grew significantly larger than it does today and. In this presentation we discuss evidence to support the hypothesis of Cuban crocodile was preying to a large extent on terrestrial mammals and much of its unique

character are derived from its evolution as a terrestrial or semi-terrestrial predator. We also discuss the consequences of the extinction of the mammalian megafauna on Cuba some 4,000 to 5,000 years ago, and interpretations of how the Cuban crocodile has adapted. This information is vital for planning a conservation future for the species in its remaining habitats.

Theme:crocodilians, conservation biology

Type of Presentation: Oral, Symposium 7: The biology and management of crocodilians.

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Variation in Alkaloid-Based Chemical Defenses of Madagascan Poison Frogs (Mantella)

John W. Daly, H. Martin Garraffo, Thomas F. Spande, Leslie A. Giddings, N. Rabe Andriamaharavo, Ralph A. Saporito*, David R. Vieites, & Miguel Vences * = presenter

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Poison frogs represent a group of vertebrates that sequester alkaloid-based chemical defenses from dietary arthropods, which include mites, ants, beetles, and millipedes. Variation in alkaloid composition (a measure of the type, number, and amount of alkaloids) has been reported for dendrobatid, bufonid, and mantellid poison frogs. This study was designed to provide further insight into the factors that are involved in alkaloid composition variability within and among populations of poison frogs of the mantellid genus *Mantella*. In this study, we examined variation in alkaloid composition for six species of mantellids, *Mantella aurantiaca*, *Mantella baroni*, *Mantella bernhardi*, *Mantella cowanii*, *Mantella crocea*, and *Mantella madagascariensis* from Madagascar. We used multidimensional scaling as a graphical tool to visualize differences in alkaloid composition, and analysis of similarity to detect statistical differences in composition. Marked individual differences in alkaloid composition were observed between different species and between populations of the same species. Disjunct populations of each of the species differed significantly in alkaloid composition. Sympatric populations of different species also differed significantly in alkaloid composition. In *M. bernhardi*, differences in alkaloid composition were marginally associated with different sexes. In general, the numbers of alkaloids were positively correlated with snout-to-vent length, with larger frog species tending to have a larger number of alkaloids. The majority (47%) of alkaloids appear likely to be obtained from dietary mites, whereas many of the other (18%) are presumed to be from ants, and a few (4%) are from millipedes. Putative dietary sources for the remaining alkaloids are generally unknown, but beetles are probably the source of at least some of the tricyclic alkaloids (6%). Alkaloid compositions in mantellid frogs are diverse and highly dependent on geographic location, which appear to be largely determined by the nature and availability of alkaloid-containing prey items.

Theme:alkaloids, analysis of similarity, anosim, ants, chemical defense, chemical sequestration,

mantellid frogs, mites, mds, multidimensional scaling, trophic relationships, vertebrates

Type of Presentation: oral, symposium 13: Sequestered Defensive Compounds and Other Defensive Tactics in Tetrapod Vertebrates.

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What Factors Limit Frogs In Agricultural Landscapes?

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Agricultural landscapes over the world tend to become increasingly monotonous which means less suitable habitat for most animals. Such a landscape is found at the present study area in south Sweden. Two of the most common frogs in here Sweden are the Common frog and the Moorfrog. Although ponds are at many places present, the former is rare and the latter absent from the extreme agricultural landscapes in this area. Actually, Common frogs only seem to breed in ponds that are within a few hundred meters of suitable terrestrial habitat. What are the factors that limit their distribution? Possibilities are (A) the quality of the ponds, (B) the quality of the terrestrial habitat and (C) landscape factors; size and isolation of suitable habitats. We made an experiment to test these alternatives. Spawn from both species was introduced into a total of 18 ponds, previously lacking breeding frogs. At 12 (Common frogs) and 9 (Moorfrogs) of these, metamorphs were later found emerging. These were usually similar in size to those at control ponds (with previous populations of both species). It thus seems most ponds in this area are suitable for the survival of tadpoles. The ponds were monitored in the years after the experiment. Common frogs were breeding in 8 out of those 12 ponds and Moorfrogs in 5 out of those 9 where metamorphs were found. In the short run it thus seems also the terrestrial habitat may be suitable for both species. The study was ended in 2008, 5 years after the introductions took place in 10 ponds and 4 years after those in 8 ponds. At this time only one of the ponds still saw breeding Common frogs and none Moorfrogs. We suggest that populations completely dependent on agricultural habitat are too small and isolated for long term survival in this type of landscape.

Theme:amphibians, anurans, natural history, conservation biology

Type of Presentation: oral. contributed

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Why the long faces? A Computational Fluid Dynamics analyses of the head of the European (semi-) Aquatic snake genus *Natrix*.

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Species of the (semi-) aquatic snake genus *Natrix* vary considerably in the degree of dietary specialisation. For instance, the three species (*N. natrix*, *N. maura* and *N. tessellata*) are considered to be a frog specialist, a generalist and a fish specialist respectively. Previous data on these three species show that there is a large variation in head morphometrics, not only between, but also within the three species, which is suggested to be linked with the diet. This is not unexpectedly as biomechanical considerations predict a functional trade-off in the ability to prey on fish or frogs. Catching fish under water requires a small, streamlined head, because of the density and viscosity of the water (which is 900 and 80 times higher than air, respectively). In this way drag forces and generated bow waves are reduced. Whereas swallowing frogs necessitates a large, mobile head as

frog struggle more than fish while eaten and are typical bulky prey. However to test these predictions, we performed computational fluid dynamics (CFD) on 3D scans of the heads of the three Natrix species and two additional Natrix tessellata populations. In this way we are able to compare the drag forces of the head between the several Natrix species and frog and fish specialists of Natrix tessellata, at different velocities and open-mouth angles. Preliminary analyses reveal that there is a large difference in bow waves and drag forces between the several species and selected populations.

Theme:Snakes, Morphology

Type of Presentation: Poster

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POLLUTION EFFECTS OF WATER STREAMS ON EGGS AND LARVAE OF *Osteocephalus taurinus* (AMPHIBIA, ANURA, HYLIDAE) .

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Amphibian populations are declining all over the world, and one of the main causes is the pollution of rivers and lakes. In Manaus, the largest city in the state of Amazonas, Brazil, uncontrolled urban expansion over the last decades has severely impacted the water quality of streams that flow through the city, which are contaminated by untreated domestic sewage and industrial effluents.

Contaminated streams frequently flow into forested areas, affecting wildlife that use these and adjacent habitats. This study assessed the effects of heavily polluted water from a stream in Manaus on the eggs and Gosner 25-stage tadpoles of *Osteocephalus taurinus*, a common hylid species in the region of Manaus, that spawns in streamside ponds. We estimated the CL5096 value (standard estimate of contaminant concentration that kills 50% of sample organisms over a 96-hour interval) for tadpoles and eggs, and estimated the long-term effect of three decreasing sub-lethal concentrations on the survival, time to and size at metamorphosis. CL5096 for tadpoles was 47,5ml/L, and was not calculated for eggs due to the difficulty in determining mortality in the immobile stages. In lower concentrations of the CL50 test with eggs, where no mortality was registered, embryos developed faster and turned into larger tadpoles than the control individuals. However, tadpoles in the higher non-lethal concentrations presented swollen abdomens and locomotion difficulties. The concentrations used for the long-term exposure experiment were 9, 18 and 36 ml/l, using 50 replicates per treatment level + control. One replicate was one Gosner 25-stage tadpole raised in a 1-liter plastic pot, fed ad libitum with rabbit chow and weekly water exchange to control for fungus development. No significant difference was observed among treatment levels and control for survival rate, growth rate. Size at metamorphosis differed significantly between the control and the highest concentration, while time to metamorphosis differed significantly only between the two highest concentrations. Our results indicate that tadpole development remains unaffected by very low pollution levels (up to 18ml/L) but important demographic parameters may be impaired at concentrations as low as 36ml/L.

Theme:Anurans, *Osteocephalus taurinus*, ecotoxicology, tadpoles, water pollution

Type of Presentation: Poster

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Intraspecific Variation in Resistance to Fungal Infection of Frog Embryos: Is there a Genetic Component?

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Pathogens can have a large impact on population dynamics via their effect on individual fitness. Documenting the sources of variation in host viability during pathogen exposure within and among populations is therefore important in order to predict host-pathogen evolutionary dynamics. Using artificial fertilization, we examined family and population variation in embryonic infection of the pathogenic fungus *Saprolegnia* spp. by infecting eggs from six moor frog (*Rana arvalis*) populations in south-western Sweden and exposing them to two different temperatures. We found a significant family effect on the degree of *Saprolegnia*-infection of eggs and embryos. Infection level also differed significantly between temperatures, with most families having more infected eggs and embryos in the colder temperature. However, eggs and embryos from different populations showed different degrees of *Saprolegnia*-infection in the two temperatures, i.e. there was a significant population \times temperature interaction on the proportion of infected eggs (Fig 1). Using a half-sib design, we showed that the significant variation among families in susceptibility was due to genetic variation in embryo resistance rather than genetic or environmental maternal effects. Furthermore, within-population crosses yielded more infected eggs and embryos than between population crosses (Fig 2), suggesting that population divergence partly reflects genetic divergence in embryo resistance. Indeed, analysis of microsatellite genetic diversity within and among populations showed that populations are genetically distinct. However, there was no relationship between the within-population genetic diversity and susceptibility to infection. In summary, our results suggest that there is significant standing genetic variation in embryonic resistance to *Saprolegnia* in moor frog populations and, hence, that an evolutionary response to emergent infections can occur. High variation in resistance in the wild could be maintained by high temporal and spatial variation in *Saprolegnia* outbreaks. Furthermore, since the degree of infection was sensitive to variation at the level of the family, population and water temperature, responses to fungal outbreaks will vary both temporally and spatially and will be difficult to predict.

Theme: amphibians, anurans, ecology, reproduction, genetics, conservation biology, developmental biology

Type of Presentation: Oral, symposium 6: Disease and amphibian declines - where do we go from here?

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Rediscovery After One Century: Three Limbless Reptile Species From Sandy Soils Of Northern Madagascar

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We report on the rediscovery of three reptile species described by Mocquard in 1905 and 1906 that were all donated from Maurice de Rothschild to the museum in Paris and share the imprecise locality information "Madagascar". Despite intensified field surveys none of the species was found on this island for more than a century and thus even the Malagasy origin of the species was doubted. During fieldwork in 2007 and 2008 in the far north of Madagascar, we rediscovered the two scincid lizards *Cryptoscincus minimus* Mocquard, 1906, *Paracontias rothschildi* Mocquard, 1905 and the typhlopoid snake *Xenotyphlops grandidieri* (Mocquard, 1905) in the Orangea forest (Baie des Sakalava, SE of Ramena, Antsiranana Province). The morphology (measurements, scalation, coloration) of the collected specimens agrees with the original descriptions and comparisons with type specimens confirmed their identity. All three species occur in syntopy in the uppermost sandy soil layer below thin layers of organic material in dense scrub forest on heavily overgrown coastal dunes and the two skinks show a typical "sand-swimming" behavior. Comparisons indicate that *Cryptoscincus minimus* is possibly not closely related to the similar looking *Voeltzkowia* species from dry western Madagascar, as suspected by some researchers, but might be part of a separate radiation. Forthcoming molecular genetic analyses will corroborate or reject the hypothesis of a separate radiation of these limbless scincids in northernmost Madagascar. Furthermore, morphological data indicate that the recently described *Xenotyphlops mocquardi* Wallach, Mercurio & Andreone, 2007 from the same general area is possibly conspecific with *X. grandidieri*. The presence of these forgotten species in northern Madagascar will provide some new insight to the evolutionary history of Malagasy endemic reptiles and the ecology of the Orangea habitat type. All three species are tentatively considered to represent northern endemics restricted to sandy soils. Although locally very abundant they may therefore be seriously threatened by habitat destruction, as intensive charcoal production is taking place in the Orangea forest.

Theme:reptiles, Scincidae, Typhlopidae, morphology, taxonomy, ecology, conservation, Madagascar

Type of Presentation: Poster contributed

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Should we be concerned about the frog-killing chytrid fungus in the African tropics?

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The pathogenic fungus *Batrachochytrium dendrobatidis* (Bd) has in recent years become a major focus in herpetological research. There is now consensus that this fungus is causing a panzootic of a disease named chytridiomycosis that leads to mass die-offs in amphibian communities and probably even global species extinctions. The emergence of disease outbreaks are suggested to be strongly influenced by environmental conditions. However, research has so far suffered from a geographic bias whereby Asia and tropical Africa have been left at a loose end. We here present the results of a Bd survey in Kenya and model the potential distribution of Bd throughout the African tropics. We analyzed nearly 900 skin-swab samples of anurans, collected on focus localities across the country, using quantitative realtime PCR. Infection with Bd was widespread in our study both geographically and taxonomically. A third of all animals tested carried Bd with infection burdens ranging from the detection threshold to over a million zoospore genome equivalents. However no mortality, morbidity or clinical signs of infection were encountered throughout the fieldwork including examination of approximately 1500 amphibians. Some localities showed prevalence and individual infection burdens equivalent to what in other studies coincided with mass die-offs. This could be interpreted as a sign of co-adaptation in the specific host-pathogen system or could indicate that the detected strain of Bd has intrinsically low virulence. To say whether Bd is causing disease and declines in the region is however still very premature because of the cryptic nature of this pathogen, and lack of long-term

population data. To infer the potential distribution of Bd in the afro-tropical region we have applied a maxent based climate envelope model. This confirms that large parts of the African highlands including our study area are climatically highly suitable for Bd. Further research should focus on experimental studies of susceptibility in native afro-tropical amphibians and comparative genomics on fungal isolates to answer whether the fungus is emerging or endemic in the region. Moreover, there is a strong need for improving our knowledge on the conservation status of afro-tropical amphibian fauna in general. As a priority, we urge the initiation of focal population studies and monitoring programmes for threatened taxa.

Theme:Amphibian decline, Batrachochytrium dendrobatidis, chytridiomycosis, Africa, Kenya

Type of Presentation: Oral, symposium 6: Disease and amphibian declines - where do we go from here?

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Pregnancy and Heat Transmission Mode in Lizards

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Shifts in thermoregulatory behaviour during pregnancy have been reported for a number of squamate reptiles. Postulated benefits on development and survival of embryos have been considered, although pregnancy in squamates involves such changes in females' vital activities (foraging, locomotion, predator avoidance) that thermoregulatory shifts could perfectly be a byproduct reflecting ecological constraints to an accurate thermoregulation. Whether one or the other, pregnant females will presumably be among the individual lizards that better exploit all mechanisms available for behavioural temperature regulation. Heliothermy has been given a prominent role in basking lizards, while heat transfer by conduction has frequently been considered to be negligible to the energy balances of lizards. The aim of this study was to ascertain the importance of the different heat transmission modes for thermoregulatory processes in pregnant lizard females. Selected body temperatures, heating rates, and selection of the source of heat for heating were studied under laboratory conditions in four lizard species, *Psammotrogon algericus*, *Acanthodactylus erythrurus*, *Podarcis muralis* and *Lacerta vivipara*. *L. vivipara* was the only species showing differences in pregnant and postpartum selected temperatures, *P. algericus* was the only species for which heating rates were not influenced by the source of heat, *A. erythrurus* was the only species showing an active selection of thigmothermy for heating, and *P. muralis* showed a slight modulation in thermoregulatory behaviour depending on the source of heat. The four species provide a wide scenario of thermoregulatory, microhabitat and reproductive requirements where the contribution of the different heat transmission modes has been contrasted.

Theme:behaviour, lizards, physiology, reptiles.

Type of Presentation: oral

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An amphibian conservation action plan for Mesoamerica

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Central America has important tools to monitor and assess its biodiversity. Key among these is the Regional Program for Biodiversity Assessment and Monitoring (PROMEBIO), which requires the generation of monitoring protocols and standard monitoring localities. This program is starting its implementation thanks to collaboration with the Interamerican Development Bank (IDB) from a Regional Public Goods standpoint. The region is getting ready to implement its Regional Agro-environmental Strategy (Estrategia Regional Agroambiental, ERA), and will soon also have a Climate Change Strategy that will include monitoring of key species as one of its pillars. Amphibians are declining even in protected areas unaffected by surrounding environmental destruction, and it is thus critical to monitor closely population trends in this vulnerable group. As some amphibians are already being affected by Climate Change, this seems to be a key indicator group that can alert us about changing environmental conditions. In June 2008, 28 amphibian experts from Mesoamerica and further afield have been invited to participate in a workshop in Honduras to generate practical and standardized tools that allow the unification of criteria and localities to monitor amphibians in Mesoamerica. The workshop aims to achieve the following: 1) standardisation of protocols, particularly in terms of amphibian surveys and in terms of chytrid fungus sample collection and processing; 2) establishment of long term monitoring programs - selection of sites and methodologies; 3) discussion about captive breeding programs: technical recommendations ; 4) policy guidelines to ensure official protection, and implementation of those guidelines and 5) funding issues to implement the recommendations. The regional framework for amphibian conservation in Mesoamerica that will serve as the basis for the national action plans that each country should develop.

Theme: action plan, amphibians, conservation, Mesoamerica

Type of Presentation: oral_symposium_Amphibian Conservation

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Observations on Habitat Preference, Movement Patterns, and Survival of Introduced Juvenile Alligator Snapping Turtles (*Macrochelys temminckii*) in the Wolf River Drainage, Fayette County, Tennessee, USA

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The Alligator Snapping Turtle, *Macrochelys temminckii*, is North America's largest freshwater turtle. Endemic to the Southeastern United States, it is a species of conservation concern in Tennessee and throughout much of its historical range. In 2000, the Tennessee Wildlife Resources Agency initiated a state reintroduction program by releasing the first of more than 400 individuals, mostly juveniles, into all of the major Mississippi River drainages within the state. In an attempt to evaluate the success of the program and its established protocols, we used marked-recapture and radiotelemetry to monitor non-native juveniles following release at the Wolf River Wildlife Management Area, Fayette County, Tennessee. Habitat preferences and movement patterns of eighty-four individuals (20 with transmitters and all uniquely marked) were studied in two unique habitats (a cypress/tupelo dominated slough and the Wolf River channel) from May 2007 through August 2008. The turtles exhibited non-random use of habitat, strongly associating with the water's edge, shallow depths, cover objects, high canopy cover, and aquatic vegetation. These habitat preferences were determined to be more consistent within the slough habitat. Movement was limited over the summer months and occurred more frequently during May and June than in July and August. Substantial movement occurred in the days directly following release, especially in the river channel where the majority of movement was against the direction of water flow. Some individuals captured were suspected to be from a previous release and were among those animals captured most frequently, indicating survival success and the establishment of a home range. Global Information System technology was utilized to

represent our findings both spatially and temporally, providing a baseline database for future sampling efforts. Funding for this work was provided by the Tennessee Wildlife Resources Agency and Austin Peay State University's Center for Field Biology.

Theme:reintroduction, reptiles, turtles, behaviour, Macrochelys, conservation biology

Type of Presentation: oral

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Molecular phylogenetics and biogeography of the Neotropical snake *Leptodeira* (Serpentes: Colubridae)

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The genus *Leptodeira* is one of most conspicuous snakes in the Neotropical region. It is distributed from the Pacific and Atlantic coasts of Mexico to the eastern coast of Brazil. *Leptodeira* inhabits a wide variety of habitats from dry and thorny forests, open savannas to humid rainforests. Currently, nine species and 15 subspecies are recognized. However, their phylogenetic relationships, taxonomic status, and biogeography are not well known. Our goals in this study were to determine 1) the evolutionary relationships among *Leptodeira* species and its phylogenetic position within Dipsadinae, 2) the taxonomic status of species groups, species and subspecies and, 3) the time of diversification and biogeography of the genus. We sequenced three mitochondrial regions for 120 individuals of *Leptodeira*, including all the species and most subspecies currently recognized. Additionally, we sequenced two nuclear coding regions for representatives of all species of *Leptodeira* and several genera within the subfamily Dipsadinae. The alignment for the mitochondrial dataset was 1966 bp and for the nuclear dataset 1266 bp. Using Bayesian methods and Maximum Likelihood we inferred the phylogenetic relationships among species of *Leptodeira* and within Dipsadinae and tested for the monophyly of species groups and subspecies. We also estimated divergence times for *Leptodeira* diversification in a Bayesian framework using relaxed clock methods. Mitochondrial and nuclear datasets both individually and in a combined fashion recover *Leptodeira* as a well supported monophyletic group, with the genus *Imantodes* as its sister taxon. Currently recognized species groups are not supported by mitochondrial and nuclear datasets. Instead, clades correspond to the biogeographic regions of Mexico, Middle America and South America. The diversification of *Leptodeira* started in the middle Miocene and throughout the Pliocene, with some lineages diverging as recently as the Pleistocene. Our results highlight the importance of the Miocene and Pliocene for the diversification of snakes in the New World. In addition, our results are consistent with a complex evolution in the transition zone between the Neotropical and the Neartic biogeographic regions, a north to south expansion, and final colonization of the tropical ecosystems of South America

Theme:reptiles, snakes, genetics, taxonomy.

Type of Presentation: Poster

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Population trends of *Melanosuchus niger* and *Caiman crocodilus* (Crocodylia: Alligatoridae) in four black water lakes in Reserva de Producción Faunística Cuyabeno, Ecuador

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The population biology of *Melanosuchus niger* and *Caiman crocodilus* was monitored in four black water lakes within Reserva de Producción Faunística Cuyabeno (RPFC), located in north-eastern Ecuadorian Amazonia. Nightlight surveys, capture and marking of individuals were performed in two different periods: (1) the dry seasons of 1992–1994 and (2) the dry seasons of 2004–2006, to assess the composition of species, size and sex of populations. Estimates of relative abundance were calculated and compared between periods. Influence of a biotic factors in the estimation of relative abundance was determined. Both species were recorded in the five localities surveyed. Species composition, size class distribution and relative abundance estimates suggest that *M. niger* populations are increasing and *C. crocodilus* populations are declining (mean= 3,23 *M. niger*/km; mean= 3,15 *C. crocodilus*/km). Males were captured more often than females in both periods. Water level and water temperature influenced relative abundance estimates, however this influence was not present in all localities surveyed.

Theme: Abiotic factors, *Caiman crocodilus*, *Melanosuchus niger*, population composition, relative abundance

Type of Presentation: Oral, Symposium 7: The biology and management of crocodilians.

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Human use of freshwater turtles in Lower Negro River, Amazonas, Brazil

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The relationship between human populations of the Rio Negro River basin and the vertebrate fauna was studied, with emphasis on freshwater turtles. The areas studied between 1997 and 2002 were the Jaú, Carabinani and Unini Rivers, that together represent the main drainage basin of the Jaú National Park (PNJ). Study methods included the application of hunting calendars, the collections of the skulls of hunted animals, interviews (on meals, hunting, fishing and on hunting and fishing lore), and direct observation of hunting and fishing, as well as personal experimentation with local fishing and hunting techniques. In the local diet, fish are the predominant source of animal protein, both in number of species consumed (at least 21) and frequency of consumption (51,5% of the meals), followed by mammals (11 species, 27,6% of meals), reptiles (10 species, 15,2% of meals), and birds (7 species, 5,7% of meals). Seasonal differences in this general pattern were found only for the reptiles, basically represented by aquatic turtles, that were less important during the high-water season (June and July). Specific situations were observed in which local residents demonstrated their skills and knowledge of local conditions with highly productive fishing and hunting excursions. Such factors are evaluated in terms of their consequences for faunal conservation in the region. Contrary to what has long been thought of river-dwellers on blackwater rivers, the inhabitants of the PNJ never or only rarely go hungry, and the absence of fish or game in their meals (2,38%) is restricted to the period of very high water levels, when the aquatic fauna is most dispersed. Freshwater turtle fishing strategies are highly diversified and subject to spatial and temporal variations in use, production and selectivity. The most common turtle hunting technique, a baiting and harpooning combination called “baliza”, was employed in 37,5% of the hunts. This was highly productive (17,9 kg of game per hunter per day) and selective for the bir-headed Amazonian turtle (*Peltecephalus dumerilianus*), the most consumed turtle species. Some techniques are seasonal and related to the annual flooding cycle of the river.

Among these, the capture of nesting “tracajá” females (*Podocnemis unifilis*), either manually or in traps, and the capture of this species in dry season aggregations are considered to represent the most serious impacts.

Theme: ecology, conservation, turtles, amazonia, negro river

Type of Presentation: poster

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Kinematics of snake locomotion in the presence of obstacles

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Loss or reduction of limbs, in association with body elongation, has been recurrent along the evolution of many vertebrate taxa. In association with such transition in body shape, internal changes are often observed, such as new musculature arrangement and increases in vertebral number, resulting in a unique kind of locomotion, denominated serpentiform or snakelike. Although the locomotion of a limbless-elongated body shape might imply functional limitations do deal with variation in a tree-dimensional space, snakes can be found in a variety of complex habitats where they need negotiate with physical barriers disposed along their traveling routes in order to perform their usual ecologic activities. In the present study, we examined the locomotion patterns of the two snake species **Oxyrophus guibei** and **Python molorus bivittatus** in the presence of obstacles, using a high-speed video system (60 fps). We analyzed two experimental situations, one where the animals had to swerve from the obstacles and another where they needed to climb over it. The behavioral analyses were implemented using chi-square tests, and kinematics of locomotion was analyzed among obstacle sizes using ANOVA and correlated with anatomy traits (body length, vertebrae number and muscle thickness). The increase of obstacle size affected most the behavior of **Oxyrophus** snakes and most the kinematics of **Python**. Animals with higher number of vertebrae (**Python**) moved preferably using concertina, while snakes with lower number of vertebrae (**Oxyrophus**) used mostly lateral undulation. This study represents a landmark in biomechanics research because it investigates non-steady locomotion in the presence of obstacles for limbless elongated animals (snakes), integrating behavior, anatomy and kinematics.

Theme: snakes, behaviour, morphology

Type of Presentation: Poster

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Factors determining the fluctuations in Pygmy Bluetongue Lizard populations and the implications for conservation.

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Pygmy bluetongue lizards, *Tiliqua adelaidensis*, were once widespread in native grasslands, in the mid north of South Australia, with a known historic range, extending from Burra in the north, south to Marion in the Adelaide plains, a distance of approximately 150 km. However, the species has since undergone a considerable range contraction since European settlement to the point that it was once thought to be extinct after no specimens had been collected for over 30 years. In 1992 however, a specimen was rediscovered in the stomach of a road killed eastern brown snake *Pseudonaja textilis*, that rekindled the search effort and subsequently, small isolated populations were found. The current known range is now confined to 24 small, fragmented patches of grassland around Burra. Two years after the rediscovery of the pygmy bluetongue lizard, a monitoring hectare was set up to learn more about the population dynamics. Initial measures indicated approximately 120 lizards in the monitoring hectare and the count peaked at 212 in 1999. Since then the counts have declined markedly to between 20- 30 adults over the past two years. To determine if the same trends were occurring across the Pygmy Bluetongue lizards range, the Department for Environment and Heritage established 7 other monitoring sites in 2005. Over a 4 year period the number of pygmy bluetongues, rainfall, spider numbers, ground cover, plant height and diversity and insect availability were examined at each site to determine the variables driving the population fluctuations. Understanding what factors cause these population fluctuations will contribute significantly to the species management, by providing better information to manage the species and provide information to the landholders.

Theme: conservation biology, lizards, endangered species

Type of Presentation: oral: in symposium 8 Herpetological Conservation and Biology

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Restoring a Depleted Population of Madagascar sideneck turtles, *Erymnochelys madagascariensis*, in Ankarafantsika National Park

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In order to save an important population of the critically endangered Malagasy endemic turtle *Erymnochelys madagascariensis*, a captive breeding program started in 1999 in Ampijoroa, Ankarafantsika National Park, Madagascar. Hatchlings were also collected from wild nests for headstarting. In March 2004, 158 head-started juveniles, aged 3 to 5 years, were released in lake Ankomakoma, the same watershed as the hatchlings were born in. The species had been virtually extirpated from the lake during the 1990s due to over-fishing, but management changes since then ended the exploitative use of the shore area (e.g. *Raffia* collection) and the fishing pressure. Monitoring of the released turtles is conducted in November and February in the lake, and April in the out-flowing Andranohobaka river to coincide with the wet season. The methods used are mark-recapture by trapping in the lake and by using nets in the river. Captured individuals are weighed and measured before release. Monitoring was halted during November 2006 and February 2007 due to the threat from crocodiles. 58 released juveniles have been captured during the 10 trapping sessions in the lake and river. The probability of re-capture is about 0.60, similar to wild re-capture rates. Analysis of survival probability predicts that 90% of the 58 captured individuals are alive in 2008 and remain in the lake and river. Therefore at least 52 individuals (90% of 58), representing 32% of the released population, probably survive, four years after release. These results

demonstrate that a good proportion of the head-started turtles successfully established home ranges in the release habitat. The mean growth rate of released turtles during the first two years was positive, with some individuals losing and some gaining body mass. From the third year onwards, all captured individuals showed body mass increases, even those that had lost weight before. The comparative analysis of Body Condition Index (BCI), before and after release, shows no significant differences. This suggests that the lake is a good habitat for the species and that the initial weight losses were simply due to adapting to wild conditions. Population reinforcement through headstarting appears a good method to speed up the recovery of depleted natural populations of *E. madagascariensis* once the causes of their decline have been removed.

Theme:Headstarting, Release, Side-necked Turtle, *Erymnochelys madagascariensis*, Ankarafantsika National Park, Madagascar

Type of Presentation: Oral, Symposium 15: Development and Implementation of Recovery Programs for Endangered Chelonians.

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Reproductive Mode Plasticity in the Treefrog *Dendropsophus ebraccatus*

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Dendropsophus ebraccatus is a relatively well-studied Neotropical treefrog, common from Southern Mexico to Columbia. It is known as a leaf-breeding species; it lays eggs on vegetation over water and, after 3-4 days of embryonic development, tadpoles hatch and fall into the water below. We discovered that *D. ebraccatus*' reproductive mode is plastic. These frogs lay eggs both terrestrially, attached to emergent or overhanging vegetation, and aquatically, supported by submerged and floating vegetation. They choose oviposition sites based on shading of the pond. To quantify natural variation in egg mortality, we monitored survival of aquatically and terrestrially laid egg clutches at three ponds near Gamboa, Panama. Canopy shade varied between the three ponds and more shade increased terrestrial egg survival. Aquatically laid eggs were found only in the pond with the least shade and survived better than previously observed flooded terrestrial clutches. To test if canopy shade influenced the reproductive mode choices of adult *D. ebraccatus* we built 12 pond mesocosms containing both floating and emergent vegetation and placed half under forest shade and half in an unshaded field. We collected amplexant pairs from the three ponds and placed them in mesocosms overnight. In shaded mesocosms, adults laid most egg clutches on leaves above water. In shadeless mesocosms, most egg clutches were laid submerged or at the water surface in partial contact with air. Frogs from all ponds laid eggs both aquatically and terrestrially and 48% of pairs laid both aquatic and terrestrial eggs in a single night, indicating that aquatic or terrestrial reproduction is a plastic choice. Laying eggs in the water appears adaptive in unshaded ponds, where it protects eggs from desiccation, although submergence can have developmental and predation costs. Intraspecific variation in reproductive mode is unprecedented within populations, much less individuals, and *D. ebraccatus* is the first vertebrate known to exhibit such aquatic/terrestrial reproductive mode plasticity. Phylogenetically, *D. ebraccatus* branches from the basal node in a clade of terrestrially breeding species, nested within a larger lineage of mostly aquatic-breeding frogs. Reproductive plasticity in *D. ebraccatus* may thus represent a retained ancestral state intermediate in the evolution of terrestrial reproduction; alternatively, it may be a novel trait recently evolved. Terrestrial reproduction has evolved independently at least four times within *Dendropsophus*, making the group particularly well-suited for studying the ecological pressures leading to the evolution of terrestrial egg-laying.

Theme:amphibians, anurans, ecology, natural history, reproduction, behaviour, evolution

Type of Presentation: Oral Paper - Contributed

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Great Pets or Potential Pests? Bioclimatic Predictions for Red-Eared Sliders in New Zealand

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Reptiles are popular pets in New Zealand and numerous exotic species are legally kept in captivity. The most common pet reptile is the red-eared slider (*Trachemys scripta elegans*), a species which has also been listed as one of the “World’s 100 Worst Invaders”. As red-eared sliders (RES) are often released in New Zealand, the potential for their establishment in this country warrants investigation. We conducted a climate-matching exercise for RES. Input data consisted of location records of the species’ native range as well as areas where RES have become established overseas. Climate data were collected from the Intergovernmental Panel on Climate Change and a binary logistic regression was performed. Results show that RES may be able to establish in New Zealand, albeit in limited and concentrated areas. According to the model, marginally-suitable establishment sites for this species are clustered in the top of New Zealand’s North Island, where mean summer temperatures exceed 18°C. In an effort to identify areas of suitable habitat for this species in New Zealand (areas where RES could survive but where breeding was unlikely), we ran the climate-matching model again, incorporating location records where RES had been reported, but where breeding status was unconfirmed. The resulting model showed a larger area of possible habitat than the previous model, however still concentrated towards the warmer areas of the North Island. This is consistent with reports of feral RES in New Zealand, although to date, successful breeding has not been observed. Climate is not the only factor which determines a species potential to establish invasive populations. Factors such as propagule pressure, presence of competitors, and availability of resources must also be taken into account. Thus, further research, including the incorporation of predicted climate change, is needed to complete a more holistic risk assessment of RES currently present in New Zealand to determine if this species poses a credible risk to New Zealand’s environment and economy. In the meantime, precautionary measures should be taken to ensure that more RES are not released into the wild and that existing feral individuals are removed from the New Zealand environment.

Theme:reptiles, turtles

Type of Presentation: Oral, Symposium 2: Invasive Reptiles and Amphibians: Global Perspectives and local solutions

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Unique Breeding Behaviour In Endemic Frog Genus *Nyctibatrachus*

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Nyctibatrachus is an endemic frog genus from the Western Ghats, India with little known natural history. The genus comprises of 15 nominal species, size varying from mere 10mm (*N. minimus*) to 80mm (*N. karnatakaensis*) along streams and forest floors of the region. Natural history observations including call pattern, courtship, amplexus and oviposition were made in *Nyctibatrachus* cf. *petraeus* (n=10), *N. cf. major* (n=5) and *N. cf. aliciae* (n=3) during 2006-2008. Calls were recorded with Olympus digital voice recorder and analysed in Audacity software. Individuals were marked (dorsum colour and banding pattern through photographs or tags) and observed for two- three consecutive nights. SVL (male and female after oviposition), weight and number of eggs were recorded. Although these species are aquatic inhabitants, they prefer non-aquatic micro-habitats for oviposition. Larger of the three, *N. cf. petraeus*, exhibits more arboreal adaptations among the three species and also has straddle like amplexus, which is known from Mantellidae of Madagascar. *N.cf.aliciae* and *N.cf.major*, both have axial amplexus, but invert in pair at the time of oviposition on a non-aquatic substrate. These species co-occur in the same stream, but have marked differences in their niches. Such breeding behaviour has both evolutionary as well as ecological significance.

Theme:Amphibians, anurans, ecology, natural history, reproduction, behaviour,

Type of Presentation: Oral: _contributed

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Combined morphometric and genetic analysis of the Asian pitviper *Ovophis monticola* complex

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Ovophis is a widely distributed genus of Asian pitvipers, occurring in montane regions across Asia from Nepal and North India to Eastern China, and Southwards through Laos, Vietnam, Myanmar, Thailand and Cambodia to Malaysia and Sumatra. Establishing relationships and species boundaries in related genera has proven difficult due in great part to the prevalence of morphological convergence among genera and cryptic speciation. Great progress has been made in recent years by means of a combination of genetic and multivariate morphological analysis. In this work these methods are applied to *Ovophis*. A combined analysis is presented based on a phylogeny derived from mitochondrial sequence data from around 60 specimens and multivariate morphometric analysis of over 250 specimens. Classifications established by more traditional methods are discussed in light of this new data and the utility of the original diagnostic characters for the species and subspecies are assessed. Further work involving AFLP analysis, derived from whole nuclear DNA is discussed, and ongoing work concerning the genetics and expression of PLA2 venom components is also discussed.

Theme:reptiles, genetics, taxonomy, snakes, morphology

Type of Presentation: Oral, contributed

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Vibrational Cues in Predator-Induced Hatching of Red-Eyed Treefrogs

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The aquatic tadpoles of red-eyed treefrogs, *Agalychnis callidryas*, hatch from their arboreal eggs up to 30% prematurely to escape from egg-eating snakes and wasps. Premature hatchlings are more vulnerable than full-term hatchlings to aquatic predators, and undisturbed embryos typically hatch later, when they are more developed. Opposing selection pressures from egg and larval-stage risks should act to improve the risk assessment mechanisms that inform hatching timing. We used recordings and playback experiments to assess the role of vibrational cues in predator-induced hatching and to elucidate the risk assessment mechanisms of embryos. Vibrations in egg clutches are sufficient to cue escape hatching in snake attacks. The vibrations caused by snakes are highly variable, and their properties broadly overlap with those of vibrations from benign sources, such as rainstorms, creating a discrimination challenge. Nonetheless, vibrations from benign sources rarely induce premature hatching. Due to the non-stereotyped nature of both predator and benign-source vibrations, embryos must discriminate patterns based on the statistical regularities of cues. Thus their error rate is dependent on the amount of information they use. Embryos do not hatch instantly in attacks, but instead sample a period of vibration first. During this sampling, they attend to multiple non-redundant properties of vibrations, including the duration and spacing of vibration events, the presence of stimulatory low frequencies and inhibitory higher frequencies, and the amplitude envelope shape. Moreover, they adjust the amount of information they sample prior to hatching based on the rate at which information accrues, or the time/risk cost of gathering information. This complexity of the risk assessment mechanism is consistent with strong selection against both missed cues and false alarms. Vibration-cued antipredator defenses offer an excellent opportunity to use detection and information theory and the power of playback experiments to explore how animals use non-stereotyped information.

Theme: amphibians, anurans, snakes, ecology, natural history, behaviour, developmental biology, predator-prey

Type of Presentation: oral, Symposium 3: Sensory Ecology of Anuran Communication

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Observing and Reproducing Dendrobatoid Frogs in Captivity: Opportunities and Shortcomings

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Dendrobatoid frogs (Aromobatidae, Dendrobatidae) have been study objects in terraria for more than 70 years. Researchers' interests focused on behavioral aspects, such as reproductive behavior, parental care, social interactions including calling, calling behavior, agonistic behavior and territoriality. Ethograms using data taken from captive specimens were used to set up species groups and new genera. How reliable are those data? Bearing in mind that most of the behavior exhibited by frogs is innate and observations on these predominantly diurnal frogs taken from swivel chairs in labs is comparatively easy and can be made repeatedly, they seem to be safe. However, numerous errors have occurred because observers have interpreted behavioral traits in the light of well-known behavior of non-dendrobatoid frogs. Especially the position of mating pairs and the timing of sperm release and egg deposition have been misinterpreted. Studies of territoriality in the confines of a terrarium are likely to be inadequate. Behavioral artefacts, especially in F generations do occur. Nonetheless, there is a wealth of information still to be gained by observing captive specimens, especially among the numerous species of genera like *Allobates*, *Anomaloglossus* or *Hyloxalus*, that may not only serve to further elucidate their systematics, but also to gain insight into the evolution of reproductive behavior or complex social systems. Using captive frogs not only saves time: more species may be observed and compared within a given time. Actions and interactions can be staged

fairly well – and usually much easier than in the field - to address certain questions. The know-how of keeping dendrobatid frogs is not very difficult. Recently, another aspect of reproducing captive dendrobatid frogs has become obvious: the spread of the chytrid fungus and ex situ-conservation.

Theme: amphibians, anurans, Dendrobatoidea, captive breeding, natural history, reproduction, behaviour, conservation biology, taxonomy, endangered species

Type of Presentation: Oral, Symposium 11: Dendrobatoid Frog Biology.

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Effects of Testosterone on Morphology, Whole-animal Performance and Muscle Mass in the Lizard *Gallotia galloti*.

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Sexual selection has often been demonstrated to target whole-animal performance through intrasexual competition. The proximate mechanisms underlying this selection for bigger, faster, more attractive males, however, remain largely unstudied. A potential mechanism that may mediate differences in performance among males is the endocrine system; specifically the effect of circulating testosterone levels on an individual's morphology, physiology, whole-animal performance and ultimately competitive abilities. In this study, we implanted males of a sexually dimorphic lizard (*Gallotia galloti*) with testosterone and subsequently compared their morphology and physiological performance to that of sham-operated individuals. Prior to operation, inter-individual variation in plasma testosterone levels correlated positively with bite force capacity. Moreover, administration of exogenous testosterone resulted in an increase of the mass of both jaw closing and locomotory muscles compared to sham-operated individuals, but the responsiveness varied considerably among muscle groups. The strongest effects were seen on the jaw-closing muscles. In contrast to our expectations, the dramatic testosterone-induced changes in muscle masses did not result in concordant changes in bite performance or sprint speed.

Theme: ecomorphology, hormones, muscle, performance

Type of Presentation: oral contribution

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Incidence, Causes and Conservation Consequences of Pregnancy Failure in Viviparous Lizards

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Successful offspring production is a vital component of any captive management programme. Successful production of neonates from viviparous species is complex, with correct thermal regimes, stress and nutrition all factors that influence whether offspring are viable or aborted. Despite provision of seemingly optimal conditions, some pregnancies may still fail. Suggested additional causes of pregnancy failure include parasites in captive animals and abdominal palpation. We tested the effect of palpation and examined links between ectoparasite presence and pregnancy failure in a viviparous New Zealand endemic skink (*Oligosoma maccanni*). *Oligosoma maccanni* has a similar

annual cycle of female reproduction to at least two sympatric and critically threatened skinks, providing a valuable model for its endangered relatives. Contrary to anecdotal suggestions that abdominal palpation is linked with pregnancy failure in *Oligosoma* species, we found no significant difference in pregnancy success between palpated and unpalpated females ($P=0.272$). With maternal snout-vent length as a covariate, final litter size ($P=0.794$) and snout-vent length of offspring ($P=0.780$) did not differ between palpated and unpalpated females. Removal of ectoparasitic mites was associated with pregnancy success. In an earlier study, female *O. maccanni* were brought into captivity during early pregnancy, not treated for mites and pregnancy success was low (6% of females had at least one viable offspring; all females had mites). In our study, all mites were removed when females were captured, and females kept under the same husbandry conditions as the earlier study. Pregnancy success was high with 80% of females having at least one viable offspring. The loss of some embryos during pregnancy may be inevitable, and perhaps it is unrealistic to assume that all pregnant females produce offspring each season. In other animals, pregnancy failure is also associated with lack of fertilisation, genetic defects and other embryonic abnormalities, and mothers 'choosing' to allocate resources to fewer offspring. At least 19% of all lizards are viviparous (Blackburn, 1982) and two-thirds of all viviparous lizards are skinks. In New Zealand alone 43% of skinks are threatened, and translocations (sometimes including captive breeding) are increasingly seen as tools to assist population recovery. Thus, increased understanding of the causes and consequences of pregnancy failure in viviparous lizards is needed. Increasing pregnancy success is the first step in captive management; also of importance are improved husbandry conditions that provide high quality offspring for future populations.

Theme: lizards, reproduction, conservation biology, captive breeding

Type of Presentation: Oral, Symposium 8: Herpetological Conservation & Biology

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Management Implications of Training Captive Crocodilians

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Although the idea of training captive reptiles is only just recently being widely accepted, examples of training crocodilians and other reptiles have been going on for decades. In the 1960's and 70's, the St. Augustine Alligator Farm trained subadult American alligators up to six feet in length to climb a concrete ladder and slide down a long shoot into a pool of water. Feeding shows of large captive crocodilians, often performed in zoos or tourist attractions for the entertainment of their visitors, generally involve training the animals to take food from a keeper. The ability to tame otherwise aggressive reptiles is another example of their ability to learn. In North American zoos and aquariums, training programs for crocodilians are becoming ever more common. Training offers numerous advantages to the captive management and husbandry of these animals, including behavioral enrichment, physical fitness, keeper safety, improved guest experience, proactive medical care and possibly decreased stress. Numerous examples of training of captive crocodilians are highlighted, including shifting, crate training, stationing, target training, and desensitization. Benefits of training programs for keeper safety, reduction of anxiety and stress of captive animals and facilitation of reproduction will be discussed.

Theme: crocodilians, behaviour, captive breeding, endangered species

Type of Presentation: Oral, Symposium 7: The biology and management of crocodilians.

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SAVE THE FROGS! Nonprofit Organization – The Future of Amphibian Conservation

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Herpetologists have made significant gains in understanding amphibian declines and extinctions since the problem was identified at the first World Congress of Herpetology in 1989. While there have been occasional success stories, however, amphibian conservation as a whole is failing: the species extinction rate is as high as ever and shows no signs of abating. This is not due to poor science: on the contrary, herpetologists have been at the forefront of conservation biology for the last two decades. Amphibian conservation is failing due to (1) a lack of funding, (2) a shortage of political and social will that stems from a lack of awareness of the amphibian decline crisis within the general population, and (3) a shortage of scientists, lawyers, educators and lobbyists dedicated to amphibian conservation. SAVE THE FROGS! is a nonprofit organization I recently founded and direct. SAVE THE FROGS! is comprised of an international team of scientists, educators, policymakers and naturalists dedicated to protecting the world's amphibians. We plan to build SAVE THE FROGS! into the world's leading amphibian conservation organization: a primary contributor to scientific research, policy-making and legal defense; a major source of amphibian conservation grants to students, postdoctorate fellows, and academics; and the principal source of amphibian information and education available to the public. We will accomplish this by (1) convincing the public that amphibians are worth saving; (2) increasing the public's awareness of the amphibian decline crisis through online photographs and information, educational calendars and posters, improved environmental education in the school system, live lectures, and benefit concerts; (3) providing an online meeting place where amphibian conservation experts, educators and others can exchange ideas; (4) providing politicians, musicians, lawyers, educators, members of the media, business executives, celebrities and average citizens with explicit ways in which they can help; (5) providing an online, incentive-based donation system; (6) providing an incentive-based program to persuade politicians to protect amphibian habitat and enact crucial legislature; (7) increasing the number and capabilities of herpetologists and other dedicated researchers by providing grants related to amphibian conservation science, policy, education, and improved communication in the media; and (8) enabling skilled members of the public to contribute their talents on a volunteer basis, in order to significantly reduce organizational costs and thus increase our effectiveness. SAVE THE FROGS! invites you to view our website (www.savethefrogs.com) and welcomes any input you may have. Together we can SAVE THE FROGS!

Theme: amphibians, frogs, extinction, nonprofit, ecology, conservation, donate, donation, endangered, chytrid

Type of Presentation: Oral, Symposium 6: The biology and management of crocodilians.

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Amphibian Ark: Addressing Ex Situ Conservation Needs for Globally Threatened Amphibians

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The Amphibian Conservation Action Plan (ACAP) outlines those measures thought necessary to understand and curb the amphibian extinction crisis. One chapter of the ACAP identifies the need to manage certain species in ex situ survival assurance populations, species that would otherwise go extinct in the wild. The IUCN/SSC Conservation Breeding Specialist Group and Amphibian Specialist

Group, working with the World Association of Zoos and Aquariums, created the Amphibian Ark (www.AmphibianArk.org) to help coordinate and further develop the ex situ conservation programs of zoos, aquariums, botanical gardens, natural history museums, universities, governments, and the private sector. Species are being evaluated around the world to determine which most desperately need and would most benefit from ex situ intervention. Simultaneously, capacity is being built in terms of expertise and facilities: AArk partners are leading husbandry training courses around the world while partnerships are built to share resources where they are most desperately needed but lacking. To support these endeavors, AArk has declared 2008 as the Year of the Frog, the first global campaign of the ex situ community, to raise awareness and requisite funds. In addition to preventing outright extinctions, AArk can also provide surplus animals to support the research goals of the ACAP. Assuming that the other chapters of the ACAP are implemented and that the causes of amphibian declines can be understood and mitigated, the AArk hopes to provide options for future reintroductions utilizing funds that would not otherwise be available for amphibian conservation.

Theme:amphibians, anurans, salamanders, caecilians, conservation biology, captive breeding, endangered species

Type of Presentation: Oral, Symposium 14: Amphibian conservation.

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Tadpoles through Time: Interplay of Innovation and Homoplasy in Anuran Larval Evolution

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The past decades have seen an accumulation of paleontological and phylogenetic evidence for a tight association between species radiations and accelerated morphological change. However, inherent factors that determine the outcome of this association in terms of morphological diversity remain cryptic. Recent phylogenetic analyses have shown that the diversification of Anura (frogs and toads) was an episodic process, involving several successive periods of accelerated speciation. To search for historical trends of morphological diversification in the anuran tadpole, we reconstructed the evolution of a large set of larval morphological characters on a renewed phylogenetic timetree, inferred from nine nuclear gene fragments. Analyses of morphological change through time indicate that larval evolution was fast during the initial anuran radiation and underwent several temporary accelerations in subsequent episodes of increased cladogenesis. However, recent radiations did not produce the same morphological disparity as the initial one, despite showing similar rate accelerations in change. Comparative plots of homoplasy through time explain this pattern by showing that evolutionary innovation rapidly decreased after the basal anuran radiation and remained low during several of the most intense subsequent radiations. This pattern is not biased by individual body parts or tissue types and exceeds beyond the traditionally recognized tadpole morphotypes defined by Orton in the 1950s. High levels of homoplasy and directional change among taxa of the same morphotype suggest that the early fixation of distinct ontogenetic designs constrained further larval innovation. Our results explain recent phylogenetic conflicts between morphological and molecular studies and identify decline of evolutionary innovation as a pattern that may underlie other vertebrate radiations as well.

Theme:amphibians, anurans, genetics, morphology, paleontology

Type of Presentation: oral

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Translocation and the Maintenance of Genetic Diversity in Tuatara (*Sphenodon*)

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Reintroductions are increasingly used as a tool for species and ecosystem restoration. Despite the demographic and genetic consequences of small population size, translocations of small numbers of individuals are often required for the conservation of threatened species. Reintroduced populations may only retain a portion of the genetic variation of their source populations, and a loss of genetic diversity can affect both the probability of establishment and extinction risk of a population. Species with low population growth rates, such as tuatara (*Sphenodon* spp.), are most susceptible to continued losses of genetic diversity after a founding event. Between 1995 and 2007, tuatara were reintroduced to 12 islands in New Zealand from a total of nine source populations. We selected four of these projects with variable founding histories to investigate the influence of source selection criteria and propagule size on the retention of genetic diversity in translocated populations. We genotyped source and founding tuatara from low- and high-diversity source populations at up to seven microsatellite loci. Genetic diversity, measured by number of alleles, heterozygosity, and changes in allele frequency, was retained during founding events from both low- and high-diversity source populations. Significant differences in allele frequencies were not detected between source and founder groups. Thus, founder group sizes used in tuatara translocations (50-70 animals) are adequate to represent source variation, even where source population diversity is high. However, unequal founder representation due to high reproductive skew in one population resulted in a 14% loss of heterozygosity in the first generation. This source population was recently reduced to 8 animals, and 1/4 of the founding males were not represented in the offspring. Variation in reproductive success could accelerate a loss of genetic diversity during a long period of population growth in each reintroduction project, and it will take several generations to understand how founder group size and composition affect the long-term maintenance of genetic diversity after translocation.

Theme:tuatara, reintroduction, genetic diversity, inbreeding, conservation

Type of Presentation: Oral, Symposium 5: Herpetofaunal Reintroductions, Translocations, and Supplementations

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Consequences of Inbreeding for Individual Performance in a Translocated Skink Population

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Inbreeding depression can influence the probability of establishment and extinction risk in reintroduced populations, yet studies correlating inbreeding in translocated populations and decreased fitness are rare. In 1992, 30 Egg-laying skinks (*Oligosoma suteri*) were translocated from Green Island to Korapuki Island, New Zealand; the population has since expanded to over 400 animals. Using 10 microsatellite loci, we tested for genetic bottleneck effects and differences in the level of inbreeding between age classes on Korapuki. Further, we tested for an association between an index of inbreeding (Internal Relatedness) and maximum sprint speed, a performance measure that influences biological fitness because of key roles in predator escape, foraging, and social interactions. The population showed signatures of a bottleneck, including an excess of heterozygosity

($p = 0.0008$) and significant changes in allele frequencies from the source population ($\Phi_{pt} = 0.06$). Younger individuals in the translocated population were also more inbred than older individuals ($p = 0.042$). In contrast to predictions, we found a positive relationship between inbreeding and sprint speed in juveniles, but we did not find this relationship in adults. Inbreeding influenced a significant proportion of variation in juvenile sprint performance ($R^2 = 0.18$), but direct fitness consequences of this association may not be biologically significant right now. As inbreeding in this population affected performance of age classes differently, inbreeding dynamics may change as genetic diversity is eroded in future generations, but the influence of inbreeding on fitness remains unclear.

Theme: reintroduction, genetic diversity, inbreeding, conservation, reptiles, lizards

Type of Presentation: Poster, contributed

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From pattern to cause in amphibian anomalies: possibilities and limitations

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Amphibian anomalies have attracted human curiosity for centuries. More recently, increased environmental awareness, the global decline in amphibians, and the increased number of observations of populations exhibiting mass anomalies have created renewed interest in amphibian anomalies as potential indicators for environmental perturbations. Some of these observations have been linked to pollution from agricultural sources. Whatever the actual causes of any observed incidence of elevated incidences of deformities, the biggest challenge will be to determine what are their causes, are they natural or anthropogenic, and what are the current and future hazards for environmental and human health. To extract cause from patterns is a central issue in ecology and crucial for the use of amphibian anomalies not only as an indicator that an environmental perturbation has occurred but also as an indicator to the type of the environmental perturbation. Opinions about the possibilities and limitations of inferences from patterns to cause in amphibian anomalies range from those that regard such an endeavour as futile to those that make liberal extrapolations from limited data and comparisons. A major handicap to such inferences is the widely dispersed but substantial literature on amphibian anomalies, which has not yet been summarized adequately. Based on an extensive review covering > 1500 publications, tables have been developed that link types of anomalies and causes and facilitate the identification of potential causes. While anomalies in single individuals provide insufficient clue to potential causes, a careful assessment of field data and literature data allows the separation of likely from unlikely causes. The use of the tables is illustrated by a case study and research needs are outlined.

Theme: amphibians, anurans, salamanders conservation biology ecology developmental biology morphology

Type of Presentation: Oral, Symposium 8: Herpetological Conservation & Biology

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A Parallel Geographic Mosaic Of Variation Between Morphological And Behavioural Aposematic Traits Of The Newts

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Aposematic animals advertise their unprofitability to potential predators with conspicuous colouration and occasionally, in combination with other life history traits. Aposematism theory posits that selection on functionally interrelated aposematic characters will promote the unidirectional evolution of these characters, resulting in increase or decrease in the effectiveness of the signal. To test whether this prediction applies to microevolution, I investigated complex intra- and inter-population variation in aposematic colouration, behaviour (which enhances the effectiveness of the colouration), and body size of newts, *Cynops pyrrhogaster* (Urodela: Salamandridae). I found parallel geographic mosaic of variation between aposematic colouration and behaviour, which was independent of newt body size. Newts on islands displayed more conspicuous aposematic traits, both morphologically and behaviourally, than those on the mainland. There was no significant relationship between variation in the colouration and the behaviour within populations. The intra-population analyses also revealed a significant sexual difference in the colouration, that male newts displayed more conspicuous than female newts. Surveys of local potential predator fauna suggest that variable natural selection at a local scale, such as predation pressure, may have played a leading role in the microevolution of variable aposematic traits in newts.

Theme:amphibians,salamanders,ecology,predator-prey

Type of Presentation: Poster

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Preferred body temperature and thermal sensitivity of locomotor performance in a melanistic/striped color-dimorphic snake *Elaphe quadrivirgata*

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Organismal characteristics of ectotherms are profoundly affected by body temperature (T_b). Despite constraints imposed by environmental factors, they can adjust T_b by several means. However, if thermoregulatory ability is limited by their own property such as coloration and this constraint affects individual's fitness, selection may promote coevolution of coloration and thermal aspects. I investigated this topic using a color-dimorphic (melanistic/striped) snake *Elaphe quadrivirgata* as a model species. Recent laboratory experiments revealed slower body warming in striped individuals than in melanistic individuals. Under this circumstance, several possible means exist by which striped individuals can manage their slower body warming. First, they may maintain a level of thermoregulation similar to that of melanistic individuals and accept a suboptimal T_b for activities. Second, they may adopt a thermoconforming strategy. Third, they may have more effective thermoregulation by occupying warmer microhabitats than melanistic individuals. Fourth, they may prefer a lower T_b than melanistic individuals. Fifth, they may perform better at low T_bs. The present study focused on and examined the last two scenarios. I examined thermal preference using a thermal gradient apparatus and measured the crawling speed at several temperatures as an indication of performance capability. Contrary to the expectations, there was no intermorph difference in preferred T_b. Shape and position of the performance curve were almost identical between melanistic and striped individuals. Thus, striped individuals did not exhibit faster crawling speed than melanistic individuals at lower temperatures. Coupled with the results of field studies, I suggest that striped individuals manage their slower body warming by behavioral thermoregulation (i.e., the third scenario). Furthermore, constraints (e.g., high predation risk due to conspicuousness under thermally superior habitats) imposed on melanistic individuals may lessen their thermal advantage. The notion

that melanism confers thermal advantage in the wild may be less generally applicable than has been proposed.

Theme:snakes, behaviour, morphology

Type of Presentation: Poster

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BEHAVIORAL DEFENSES OF ANURANS

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Although several defensive strategies have been reported for anurans, with a few exceptions these reports are limited in scope and scattered in the literature. This may be due to the lack of a review on defensive strategies of the anurans, which could offer a basis for further studies and insights on basic mechanisms that underlie these strategies, and thus lead to theoretical assumptions of their efficacy and evolution. Here we review the present knowledge on defensive behavioral tactics employed by anurans, add new data on already reported behaviors, describe new behaviors, and speculate about their origins. Twenty nine defensive behaviors, some with a few sub-categories, are here recognized. The terminology already adopted is here organized and some neologies are proposed. Some of the behaviors here treated seem to have an independent origin, whereas others might have evolved after preexistent physiological and behavioral characteristics. The role of predators in the evolution of defensive behaviors is still scarcely touched upon and this overview adds data to exploit this and other evolutionary unsolved questions.

Theme:amphibians, anurans, behaviour, natural history, defense, predation

Type of Presentation: oral, symposium 13: Sequestered Defensive Compounds and Other Defensive Tactics in Tetrapod Vertebrates.

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Cytokines in vertebrate reproduction

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Mechanisms determining survival and growth of the semi-allogeneic fetus in the maternal uterus are still not completely defined. Studies in mammals have shown that soluble substances with autocrine/paracrine action (cytokines) have a central role in modulating the maternal immune response and contributing to the expansion of fetal tissues in the maternal uterus. We hypothesized studies on different classes of vertebrates could help clarify the role of cytokines in acceptance of the embryo by the maternal tissues. We examined the presence of the cytokine interleukin-1 beta (IL-1 β) and of its functional membrane receptor IL-1 receptor type I (IL-1R tI) in uterine/oviductal tissues of species with different reproductive strategies. In particular, we carried out studies on non-mammalian

vertebrates (squamate reptiles, amphibians and elasmobranch fishes), presenting placental or aplacental viviparity, oviparity or ovuliparity. Since in ovuliparity eggs are released and fertilized in the external environment, species adopting this reproductive strategy can be considered a natural negative control in studies on materno-fetal immunotolerance. Findings showed The IL-1 system is expressed in the reproductive tissues of all the species regardless the vertebrate class or the reproductive strategy adopted. However, marked differences exist between ovuliparous species and oviparous and viviparous ones. In fact, expression of IL-1 β and IL-1R tI is limited to the luminal epithelium in the ovuliparous species, while it is extended to most cellular components of the uterine wall (including connective tissue, glandular and endothelial cells, and the muscle layer) in oviparous and viviparous specimens. These findings highlight the role of the IL-1 system in the acquisition of the ability to retain the embryo in the female genital tract during the transition from ovuliparity to viviparity and suggest non-mammalian vertebrates as a good animal model for studies on cytokines in materno-fetal immunotolerance.

Theme:vertebrate reproduction; cytokines; materno-fetal immunotolerance

Type of Presentation: Oral, Symposium 1: Reproduction in reptiles: from genes to ecology

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Proteolytic, Hemorrhagic, and Neurotoxic Activities Caused by Cat-Eyed Snakes *Leptodeira bakeri* Ruthven 1936 (Serpentes: Colubridae) Venom in Venezuela

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Leptodeira genus is distributed from Texas (USA) and Mexico to all South American countries except Chile. In Venezuela probably is the snake genus more ample distributed and abundant. It is of median size (80 cm), thin and cylindrical body. Differentiated head with big eyes and vertical pupil. Distribution: predominates in lower ground near water courses, mainly eating frogs and toads and occasionally lizards. It has terrestrial habits, non aggressive and opisthoglyphous. Oviparous (6 to 12 eggs): deposition from February and May. The *Leptodeira bakeri* snakes were collected between Pueblo Nuevo and San Román cape of the Paraguaná peninsula, Venezuela. Species in Venezuela: *Leptodeira annulata annulata*; *Leptodeira annulata ashmeadii*; *Leptodeira septentrionales* and *Leptodeira bakeri*. *L. bakeri* has originally been described in Aruba Island and at present in Venezuela, Paraguaná Peninsula. The main aim was to investigate the diverse toxin activities: proteolytic, hemorrhagic, and neurotoxic of *L. bakeri* venom. To visualize the different proteins present in *Leptodeira bakeri*, 20% sodium dodecyl sulfate-polyacrylamide gel electrophoresis (SDS-PAGE) was run. To in part purify the proteolytic activity, Superose 12 (GE, USA) molecular exclusion chromatography was used. Hemorrhagic activity was tested in chicken embryos and mice (skin and peritoneum). Neurotoxic clinical manifestations were examined in mice inoculated with *L. bakeri* venom. Proteolytic activity was assayed on gelatin film. The approximate relative mass of 13 protein bands was observed by the Multi-Analyst PC version 1.1 (Bio-Rad) program. *Leptodeira bakeri* venom confirmed to have proteolytic, hemorrhagic, and neurotoxic activities. Known the *L. bakeri* venom activities, this snake should be considered a venomous Colubridae snake.

Theme:*Leptodeira*, Opisthoglyphous Venezuela, Venom

Type of Presentation: Poster

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Diversity, ecological aspects and ecotourism influence on the anurofauna from Parque Ecológico Quedas do Rio Bonito, Lavras-MG.

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The Cerrado is the second largest Brazilian biome and one of the most threatened hotspots of the planet. There are 141 species of amphibians registered in this biome (47 endemic). However, most of the studies are concentrated in central Brazil and those ones concerning the amphibian communities and natural history of the species are scarce, specially in the state of Minas Gerais. We've been studying an anuran assemblage at Parque Ecológico Quedas do Rio Bonito, southern Minas Gerais (21°20'00''S 44°58'45''W), since October, 2007. This ecological park has about 235ha of area, located in a transitional region between the biomes Cerrado and Atlantic Forest. It has two different areas (for conservation and touristic purposes) that includes four vegetation physiognomies: 'cerrado', montane grassland, rocky montane grassland and riparian forest. Visual transect surveys have been conducted twice-a-month, in 8 transects along streams throughout the park. Data on the richness of anuran species and its natural history (temporal and spatial distribution) has been collected and effects of tourism activities were analyzed based on the composition of anurans community. We registered 22 species so far, belonged to 8 families: Brachycephalidae (3), Bufonidae (2), Centrolenidae (1), Cycloramphidae (1), Hylidae (10), Leiuperidae (1), Leptodactylidae (3) e Microhylidae (1). Two of these species are not identified yet, and one of them can be a new species (*Phyllomedusa* gr. *hypochondrialis*). The anurofauna found in the park is comprehended mostly by species with wide distribution and high tolerance to habitat disturbance, as well as species typically found on the Cerrado biome, as *Rhinella rubescens*, *Hypsiboas lundii*, *Ischnocnema juipoca*, *Leptodactylus cunicularius* and *Odontophrynus cultripes*. The amphibians assemblage also includes *Bokermannohyla luctuosa*, *Hypsiboas beckeri*, *Phyllomedusa* gr. *hypochondrialis* and *Rhinella pombali*, whose geographic ranges were considered more restrict. The high abundance of species strictly found in primary and secondary forests (*Bokermannohyla luctuosa*, *Hyalinobatrachium uranoscopus* and *Scinax* cf. *longilineus*) suggests a good status of conservation of the riparian forest areas. However, differences in the amphibians diversities were observed between transects in areas with and without tourists visitation. There is also a clear distinction between the composition of communities in forest areas and the other physiognomies, but such difference was not observed between montane grassland, rocky montane grassland and 'cerrado'. In fact, the continuity of this study is necessary to provide additional information on habitat use and human-influence responses of Brazilian Cerrado anurans.

Theme:amphibians, anurans, community ecology, natural history, conservation biology.

Type of Presentation: Poster

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Diet of *Podocnemis erythrocephala* (Testudines: Podocnemididae) during the rising water season in the National Park of Jaú, Amazonas, Brazil.

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Podocnemis erythrocephala is heavily exploited for meat consumption in the Negro River Basin, and its diet is poorly known. In the Negro River, during the dry season this turtle feeds primarily on plant material, filamentous algae comprising more than 50% of the volume. The diet in the rising and in the high water season is unknown, and sexual dietary differences are not reported for this species. Turtles were captured in the Jaú River, a black-water tributary of the Negro River within Jaú National Park, located 200 km northwest of Manaus. We used trammel nets in February, 2008, during the rising water season. We flushed stomach contents of 20 *P. erythrocephala*: 11 adult males and 9 adult females. The average of SCL and mass were 24.12 cm (± 1.8) and 1,288.89 g (± 296.33) for females, and 20.82 cm (± 1.4) and 862 g (± 159.78) for males. The stomach contents were stored in 40% alcohol. The turtles were released at the site of capture. We sorted and classified the food items to the lowest possible taxon. The volume of each food item was measured and the frequency of occurrence was registered for each food group. We used the Index of Relative Importance (IRI) to assess what were the most representative taxa. Plant material occurred in each of the stomachs. In females, plant material represented 97.7% of the volume. The most representative taxa were: unidentified vegetable matter (37.77) fruits and leaves of *Simaba* sp (14.41) stream and leaves of *Graminea* (13.62) and fruits of *Pouteria* sp (12.45). Vegetables represented 90.15% of the volume in males. The most representative taxa were seeds of *Leguminosa* (42.40), fruits of *Pouteria* sp. (26.36) unidentified vegetable matter (4.89), and fruits of *Posoqueria* sp (4.01). In females animal matter was present in 100% of the samples. Fish were present in 88.89% of the samples, crustaceans in 77%, and insects in 44%. However, the volume of animal matter represented only 2.21%. In the males, animal remains were present in 63.64% of the samples and represented 1.6% of the volume. The Morisita Index showed a similarity of 0.49 between the diet of males and females. Females ate more animal matter, probably due to distinct physiological needs between the sexes. Studies involving more individuals and analyzing temporal changes in the diet will contribute to the knowledge of the diet of this species and will be useful in conservation efforts.

Theme:reptiles, turtles, ecology

Type of Presentation: poster

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Are males of *Podocnemis erythrocephala* (Testudines: Podocnemididae) more susceptible to predation?

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Presence of injury marks on the carapace and missing limbs and digits are thought to be indicators of predation attempts in turtles. The aim of this study was to register the occurrence of marks on carapace and missing limbs and digits in *Podocnemis erythrocephala* in the Jaú river, as a index of predation pressure. Turtles were captured in the Jaú river, a black-water tributary of the Negro river within Jaú National Park, located 200 km northwest of Manaus, Brazil. We used trammel nets during 12 days in February-2008, at the beginning of the flooding season. Nets were set in backwaters, next to the flooded forest, and along its shore. This capture effort resulted in the collection of 49 *P. erythrocephala*, 31 females and 18 males, from which we registered the occurrence of injury marks on the marginal scutes and missing limbs or digits. The mean straight carapace length and mass were:

20.84 cm (± 1.14) and 860 g (± 130) for males and 24.4 cm (± 2.11) and 1,345 g (± 334) for females. All chelonians were mature. We found that 73.47% of the turtles had injuries. Almost all males (94.44 %) had some kind of injury: 72.22 % had missing limbs, 66.67% had missing digits and 50% had marks on the marginal scutes of the carapace. While only 61.29% of the females had injuries: 29.03% had missing limbs, 41.94% had missing digits and 32.26% had marks in the marginal scutes of the carapace. Males had more injuries than females probably because they are smaller and more colorful, what could make them more susceptible to predation. In Middle rio Negro a study involving 2,263 *P. erythrocephala* didn't detect any significant difference between injuries in males and females. Therefore, studies involving more individuals are required to best understand this pattern in Jaú river and its relation to the presence and abundances of crocodilians, otters, piranhas and other voracious fish.

Theme: reptiles, turtles, ecology

Type of Presentation: poster

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Freshwater turtles from National Park of Jaú, Amazonas, Brazil

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There are few studies on communities of freshwater turtles in the Amazon. The aim of this study is to describe the chelonian community in a large river. Turtles were captured in the Jaú river, a black-water tributary of the Negro river within Jaú National Park, located 200 km northwest of Manaus, Brazil. There are human communities living inside the Park, and people there exploit chelonians for meat consumption and for trade. We used trammel nets during 12 days in February-2008, at the beginning of the flooding season. The nets were set in backwaters, next to the flooded forest, and adjacent to the shore. These efforts resulted in 62 turtles, being captured: 39 *Podocnemis erythrocephala*: 18 males and 31 females; 2 males of *Podocnemis unifilis*; 11 *Podocnemis sextuberculata*: 3 females and 8 males and one female of *Peltocephalus dumerilianus*. The mean Straight Carapace Length and mass were: 20.84 cm (± 1.14) and 860 g (± 130) for males of *P. erythrocephala*; 24.4 cm (± 2.11) and 1,345 g (± 334) for females of *P. erythrocephala*; 21.4 cm (± 1.28) and 1,014 g (± 149) for males of *P. sextuberculata*; 27.13 cm (± 2.72) and 1,940 g (± 502) for females of *P. sextuberculata*; 24.85 cm (± 0.64) and 2,000 g (± 283) for males of *P. unifilis* and 31.3 cm and 3,500 g for one female of *P. dumerilianus*. All turtles captured were mature. Other species also occur in the Jaú River but they were not present in this capture effort; such as *Podocnemis expansa*, not easily captured along the Rio Negro and in the Jaú River. For centuries this species has been heavily exploited for meat and egg consumption thus it is now scarce. *Phrynops raniceps* and *Chelus fimbriatus* are species hardly captured along the Amazon, and appear to occur in low density. *P. erythrocephala* is apparently the most abundant species in Jaú river, as suggested by other studies. *P. dumerilianus* is very abundant in rio Negro basin, but is not easily captured using trammel nets and fike nets. It is captured in large number using local river people techniques: “jaticá” (a kind of harpoon) and “cacuri” (a baited trap). Thus, sampling that includes other techniques and larger capture efforts, also during the dry season, are needed to reflect better the community of freshwater turtles living in rio Jaú.

Theme: turtles, community ecology, reptiles

Type of Presentation: poster

Ecology and Conservation of Chelonios in the state of Maranhão, Brazil

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The Maranhão has the second largest coastline of Brazil and a mesh hydrographic very favorable for occurrence of many species of aquatic turtles. The tracking study was conducted on 7 areas: Island of Curupu, Lençóis Maranhenses National Park, Baixada Maranhense, Island of Caju, Island of São Luís and Balsas. Data on population structure were obtained over the years 2005, 2006 and 2007 for *T. adiutrix* and *K. scorioides*, by counting the number of individuals per species and the determination of sex and class size only in the island of Curupu. The species of freshwater turtles were observed: *Trachemys adiutrix*, *Rhinoclemys punctularia*, *Phrynops tuberculatus*, *Phrynops cf. gibbus* and *Kinosternon scorioides*, and the sea turtle, *Eretmochelys imbricata*, *Chelonia mydas*, *Caretta caretta*, *Lepidochelys olivacea*, *Dermochelys coriacea*. For *T. adiutrix*, results showed no significant difference between the number of males and females in the years 2006 (N=24 males and 15 females, GL=10; $\chi^2=17.67$, $p=0.06$) and 2007 (N=20 males and 19 females, GL=8; $\chi^2=10.50$, $p=0.23$), only in 2005 (N=35 males and 38 females, GL=9; $\chi^2=16.95$, $p=0.0049$). For three years added together, there was significant difference in size between males and females, but there was no clear definition of the sexes which showed greater size ($F=12.31$; GL=149, $p=0.00059$). For *K. scorioides* the analysis showed significant difference in the number of male and female captured in 2005 (N=66 males, N=44 female; $\chi^2=23.61$; GL= 5, $p=0.0002$) and for 2006 (N=45 males, N=35 female; $\chi^2=15.75$; GL=6, $p=0.0015$). For the year 2007 the difference between the number of males and females caught was not significant (N=90 males, N=108 female; $\chi^2=9.62$; GL=7, $p=0.2116$). In the three years were a greater number of females and males with 11cm to 12cm. The results showed that for both species over the years the number of males and females was captured almost equivalent and that both sexes were captured in different sizes, with no predominance of size and therefore of age. In further consideration in the future we can infer that these populations, although suffering the impact as a food resource exploitation and human influence, may be maintaining their population size over time on the island of Curupu. But we need to increase the effort to capture and to collect data in the long term in order to propose plans for management and conservation safer for these species.

Theme:reptiles, turtles, ecology

Type of Presentation: Poster

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Etnobiology and Support For The Conservation of the Yellow-Spotted River Turtle (*P. unifilis*) For The Food Security Promotion and Sustainable Development of The Communities of Xingu Native Park, Mato Grosso, Brazil.

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This work presents the results of the supporting action that was undertaken in behalf of the Yellow-spotted River Turtle (*Podocnemis unifilis*), which is an important food resource for riverside and native populations. The initial recovering of *P. unifilis* populations started with the Indians Kamaiurá

that inhabit the Village Morená at the Xingu Indigenous Park. The Indians were introduced to control techniques regarding the reproduction of *P. unifilis*, by means of an awareness process for the defense of the rational use of these resources. The protection and management actions began with the selection of the most intensively used beaches. Also, by means of daily beach inspections, the pits were georeferenced and enclosed to facilitate the observation and to make difficult the natural predatory process. Any considered animal have had its biometric data taken: curvilinear length of the shield (CCC); curvilinear width of the shield (LCC); and length and width of the plastron (CP and LP), all in cm. Due to the environmental education action that was accomplished with the Indians, 30 representative individuals from the communities were trained and that allowed the achievement of the established marks. A total of nine beaches were georeferenced and they have had their pits protected, (n = 251). The major of those pits were attacked by the Indians themselves (n=66), and a small part of the pits were attacked by natural predators (animals). Material (skin tissues) was collected for genetic analysis in four females individuals whose biometric data averages were: CCC = 30,75; LCC = 27,75; CP=32,0 and LP=29,75. A hatchery was built at the targeted village of the project, for deposition of the hatchlings which were born during the reproductive season. Tissue samples of the hatchlings were collected for future genetic analysis. It was found a clutch of *Phrynops* sp. Trying to minimize the predatory process of these turtles by the local communities is a difficult task, since this species is traditionally exploited by the Indians. The RAN'S Sustainable Management Project that is carried out in the behalf of the Amazon turtles has a unique importance in such a regard, providing the opportunity of live this reality and planning future actions based on these results, next steps of this study.

Theme: Turtles, Ethnobiology, reproduction, conservation biology

Type of Presentation: Poster

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Relation Between Mercury Bioaccumulation Levels in *Podocnemis erythrocephala* (Podocnemididae: Testudines) and Environmental Factors in the Rio Negro Basin

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In nature, a number of environmental factors have been shown to influence the dynamics of Hg in aquatic ecosystems. *Podocnemis erythrocephala* is easy to collect in the black waters of Negro river, making it the most consumed species in the region. In this study, environmental factors were investigated to determine their influence on the Hg concentration in muscle, liver and carapace of the red-headed river turtle. We investigated the influence of turtle length, turtle weight, pH, dissolved organic carbon and availability of potential methylation sites (floodplain forests and hydromorphic soils) on the concentration of total Hg in this species. The study was conducted in the Negro river basin, where we collected water and turtle muscle, liver and carapace samples from 12 tributaries for chemical analysis. Through radar imagery and existing soil maps with GIS, the percentage of alluvial floodplains and hydromorphic soils (potential methylation sites) was estimated for each drainage basin at sampling points. The mean Hg concentration in muscle of *Podocnemis erythrocephala* was 33 ppb (SD = 11), blood 1.64 (SD = 1.36), liver 470 ppb (SD = 313) and carapace 68 ppb (SD = 32). The Hg bioaccumulation by *Podocnemis erythrocephala* in blood, muscle and liver has no significant relation with sex (ANCOVA p = 0.48, p = 0.11, p = 0.19, respectively) neither length size (ANCOVA p = 0.22, p = 0.19, p = 0.39), but there was a significant relation when analyzing Hg bioaccumulation in the carapace tissue and length size (p = 0.007). Also, none of the environmental factors studied

have been shown to be significant to the Hg concentration in the blood, muscle, liver and carapace of *P. erythrocephala* ($p = 0.24$, $p = 0.60$, $p = 0.88$, $p = 0.28$ respectively) in the Negro river basin. Chelonians might be eliminating mercury from muscle and liver tissues since only in the carapace represents very well the bioaccumulation of mercury along the years. A species to be a good bioindicator of Hg concentration in the open and interconnected aquatic systems of the Amazon basin characterized by high levels of limnological variability, besides the fact it is a non migratory species, need to have restricted rooming to represent a specific habitat. Locomotion of specimens among habitats, even they are close but with different characteristics, won't allow animals to reflect the real influence of environmental factors in the Hg concentration level.

Theme:Podocnemis erythrocephala, turtle, Mercury, Amazon, Rio Negro Basin

Type of Presentation: poster

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Occupancy Modelling of Amphibians in Luxembourg: Absent or Undetected?

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Surveying for amphibians in the natural environment produces variable results according to survey methods, site characteristics and local conditions. Although the presence of a species may be simple to prove, it is difficult to be confident that a species is absent rather than merely undetected. Recognition of the extent of amphibian decline has prompted increased monitoring efforts, which could be further maximised by statistically evaluating the 'detectability' of species by different survey methods. Occupancy modelling is a practical approach to improving the accuracy and efficiency of presence-absence surveys where the detection probability is less than one. Two parameters are determined in an occupancy model: the probability of site occupation by a species and the probability of detecting it during a survey if it is present. Key site- and survey-specific variables were used to model occupancy in amphibian ponds in Luxembourg, Europe, and used to compare the efficiency of each survey method. Great crested newts (*Triturus cristatus*) were found in 41% of ponds surveyed with three methods simultaneously – night time visual encounter surveys (VES), netting and trapping. Without traps, surveys would have failed to detect *T. cristatus* in nearly half of the occupied ponds. Analysis of *T. cristatus* detection data suggests that four survey visits using all three survey methods (during their aquatic phase) are necessary to be 95% confident that the species is truly absent from a pond. In contrast, 18 visits using just netting do not achieve 95% confidence that the species was absent if it was undetected. Occupancy modelling is a powerful means to analyse presence-absence data, accounting for true and false absences and imperfect detection. The results can be used to guide survey design and assess the distribution of species at the landscape level.

Theme:amphibians, anurans, salamanders, endangered species, detection probability, presence, absence, Europe, survey methodology

Type of Presentation: Oral: contributed

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Turtles of Viruá National Park, Roraima, Brazil.

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Knowledge about turtles of the Brazilian Amazon has been accumulating, thanks to continued efforts of the research institutions and governmental organs engaged in environmental management and conservation of species, especially those of economic interest, practice fundamental to the maintenance of wild populations, as opposed to strong pressure from hunting and collecting eggs. Currently 16 turtles species are known for the Brazilian Amazon. Of these, eight are in the red list of endangered species in the IUCN categories vulnerable (5), low risk (2) and in danger (1). Here we present the characterization of turtle fauna of the Viruá National Park, located in the Municipality of Caracaraí, state of Roraima, Brazil. We carried out two expeditions, one during the rain season, and another during the dry season. The methods of capture were trammel nets, fike nets, Legler traps and visual encounter. The study covered the wide variety of environmental physiognomies, and sampled areas of igapó, streams, rivers, semi permanent flooded land and dry land. Nine species have been recorded, belonging to five families. The species most frequently recorded was *Podocnemis erythrocephala* (n = 38), popularly known as irapuca, captured only in black-water river. The species *Chelus fimbriatus* (matamatá), generally considered rare or difficult to detect was caught with frequency (n = 22) in almost all the sampling points. *Podocnemis expansa* (n = 4) was probably under-sampled apparently because the methods used to catch are not efficient for that species. The other species recorded were *Podocnemis sextuberculata* (n = 33), *Podocnemis unifilis* (n = 25), *Platemys platycephala* (n = 1), *Rhinoclemmys punctularia* (n = 1), *Geochelone carbonaria* (n = 3) and *Geochelone denticulata* (n = 2). The results show the importance of the implementation of conservation units as a measure of protection to turtles of the Amazon, by alleviating the pressure of human hunting and predation of nests.

Theme:turtles, inventory, Amazonia, Roraima

Type of Presentation: poster

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Developing a National Action Plan for Amphibians in the People's Republic of China

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The results of an upcoming workshop (June 2008) to develop a national action plan addressing research and conservation priorities for amphibians in the People's Republic of China will be presented.

Theme:amphibians, anurans, salamanders, caecilians, conservation biology, captive breeding, endangered species, People's Republic of China

Type of Presentation: oral: symposium, Amphibian Conservation (moderator: Don Church)

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Saprophytes Molds In *Dendropsophus columbianus* From Caloto, Cauca - Colombia

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Amphibians are very susceptible to acquire microorganisms through the skin, as saprophytes molds, which are potentially pathogenic and may affect the viability of populations. Therefore, identifying and understanding the different mold types present in a locality would allow setting adequate strategies for the conservation of anurans communities who may be affected. In environments with the presence of cattle activities, is expected that the mobility of cattle facilitate the dispersal of molds present in the soil. In order to identifying saprophytes molds affecting a local population of *Dendropsophus columbianus*, and evaluate the dispersal of these molds in the area of interest duo to the mobility of cattle, mold isolations were carried out using a pour plate method in potato-dextrose agar (PDA). Frog skin and cattle hooves molds samples were obtained ussing a sterile swab over their surfaces. In order to evaluate the presence of mold in the soil of the study area, a small soil sample (10 cm deep) was collected and mold cultures was carried out in PDA using dilution technique. We identified 11 genera of mould (Table 1). *Penicillium* and *Trichoderma* were in the soil, cattle hooves and skin of *D. columbianus*. Moreover, *Cladosporium* and *Paecilomyces* were also present in frogs. Although most of the identified molds have mutual symbiosis, the potential parasitic relations cannot be ignored since the molds would be opportunistic. Moreover, the presence of common mold genera in frogs and cattle hooves, suggests that the cattle could act as vectors for mold dispersion, rather than as fixed hosts.

Theme:amphibians, anurans, ecology, conservation biology

Type of Presentation: Poster contributed

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What's for lunch? Visual prey selectivity in the dart-poison frog *Phyllobates terribilis*

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Dart-poison frogs are typically considered diet specialists. Several studies have stated the reason for this specialization, is the ability of this frogs to sequester several alkaloids from dietary sources and transform these substances into powerful toxins to avoid predation. Thus, for an individual to keep its toxicity, it should be able to recognize which type of prey will have a greater alkaloid contribution. Opposing theories suggest poison frogs are not diet specialists, directing their eating habits to the most abundant prey items on their specific niche, and modifying this preferences according to ontogenic changes. General prey recognition patterns may be dictated by specific characteristics on an insect's movement such as speed and/or size. Visual prey recognition was evaluated using videoplayback techniques in order to discard any odour or chemical cues, on 20 captive raised individuals of *Phyllobates terribilis* having different ages and body sizes. Three types of prey were

chosen from a continuum of prey specialization degree which included ants, mites and *Drosophila melanogaster* flies, considered to be a rare item to be found in nature. Our results suggest there is in fact a preference for certain kinds of prey, particularly a remarkable one for mites, not depending on the prey's speed or size. Individuals always preferred ants over flies and ants over mites only when the latter had the smaller size. There were no differences on prey selection related to different body sizes. Results are consistent with the idea that diet preferences are innate, and that vision plays a significant role on prey recognition in anurans.

Theme: Dart-poison frogs, *Phylllobates terribilis*, vision, diet preferences, prey recognition, predator-prey, videoplayback

Type of Presentation: Poster

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Galapagos Tortoises: The ABCs of Successful Recovery

Linda J. Cayot and Washington Tapia*

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The Breeding, Rearing, and Repatriation Program for Galapagos Tortoises began over 40 years ago as a joint program of the Galapagos National Park Service (GNPS) and the Charles Darwin Foundation (CDF). The giant tortoise was one of the most devastated taxa in Galapagos. The initial onslaught occurred in the 1800s, when 100 to 200 thousand tortoises were removed by whalers and fur sealers for food during their long voyages. This was followed by the devastating impacts of introduced species – both predators (pigs, cats, dogs, rats, and ants) and competitors (goats and donkeys). With the establishment of the Galapagos National Park and the CDF in 1959, a systematic review of the tortoise populations began. Only 11 of the 14 original populations remained and most were endangered. The breeding and rearing program was initiated in 1965, with little knowledge of Galapagos tortoise ecology. The 40-year history of the program exemplifies the critical integration of research and management to achieve conservation goals. Ecological understanding and the management program developed in parallel in the following sequence: 1960s – determination of the status of the populations and inclusion of threatened populations in the program; 1970s – field research on tortoise reproductive and nesting behavior and establishment of effective nesting areas in the corrals; 1980s – experiments in the tortoise center to determine and then implement best practices for incubation and rearing; 1990s – nutritional research and initiation of genetic analyses; and 2000s – fine-tuning of small, isolated populations and restoration of tortoise populations on islands where they are extinct with closely related captive-reared animals. A total of 600 to 700 tortoises (hatchlings to 4-year-olds) are reared at the tortoise centers annually. Mortality in captivity has been reduced to near zero. The repatriation program has released over 4500 tortoises into eight populations (Table 1). Natural reproduction of repatriated tortoises began in the early 1990s. Field work in the 1990s showed survival rates between 55 and 77%. Successful eradications of goats, pigs, and donkeys in recent years have improved conditions for tortoises in the wild. Current efforts are aimed at eliminating rats in critical conservation areas. Long-term programs for long-lived animals are critical to recovery and eventual restoration of their populations.

Theme: reptiles, turtles, ecology, reproduction, conservation biology, captive breeding, endangered species

Type of Presentation: Poster, Symposium 15: Development and Implementation of Recovery Programs for Endangered Chelonians.

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The Global Amphibian Trade and Disease Spread

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The international trade in live amphibians has been implicated in the global spread of amphibian diseases. This study investigates the potential for pathogen transport through the commercial sale of amphibians for food and as pets. Market, farm and import frogs representing 46 genera and 50 species were sampled across North America, South America and Asia to test for the presence of two prominent pathogens afflicting amphibian populations today: chytridiomycosis (*Batrachochytrium dendrobatidis*) and ranaviral disease. Preliminary results confirm the presence of both pathogens in international trade routes. We also analyzed U.S. Fish and Wildlife Service importation data for all live amphibians entering the U.S. from 2000-2007. More than 4.5 million live anuran imports were recorded in 2007 alone. The top species import in 2007, representing more than half of all live individuals, was *Rana catesbeiana* (the American bullfrog). Our research identified the presence of both *B. dendrobatidis* and ranavirus in trade individuals of this species. This study highlights the need to address the transport of live animals as a mode of pathogen dispersal that could significantly impact the persistence of amphibians worldwide.

Theme:amphibians, anurans, disease spread, wildlife trade, pet trade, batrachochytrium dendrobatidis, ranavirus

Type of Presentation: oral, contributed

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Reproductive Cycle and Criteria for Sexual Maturity of *Leposternon microcephalum* (Squamata, Amphisbaenidae) from Southeastern Brazil

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Studies on amphisbaenians (Squamata, Amphisbaenia) are often made difficult due to their fossorial habits. Consequently, there are a limited number of studies available on their reproductive biology. *Leposternon* (Wagler 1824) is a South American genus from the family Amphisbaenidae. Using gross morphology and histological data from museum specimens, our work aims to characterize the reproductive cycle of *L. microcephalum* from Southeastern Brazil. Furthermore, we compared gross morphology and histological data to discuss the possibility of inferring maturity and reproductive

stages using morphologic features of reproductive organs. Our results support evidence for inferring maturity in *L. microcephalum* by using the characteristics of opaque oviducts and vas deferens, turgid testes, convoluted vas deferens (which indicates sperm storage), and vitellogenic follicles (which are yellowish, larger than 4 mm). We observed the largest vitellogenic follicles between October and December (figure 1). During this period, females with follicles measuring greater than 15 mm show pleated oviducts. Histologically, the median portion of those oviducts showed conspicuous glands, and the posterior most portion displayed an epithelium with several reentrances and tall cells. Because we found females with vitellogenic follicles measuring smaller than 15 mm throughout the year, we suggest that yolk deposition can begin almost a year before ovulation. In this case, deposition would greatly increase at the last three months before mating. We also found mature females without vitellogenic follicles throughout the year, suggesting that perhaps this species has a biennial cycle. Oviducts of mature and nonreproductive females are pleated only at the anterior portion, and histologically show a large lumen, short epithelial cells and small glands. Immature females have transparent oviducts that histologically show a narrow lumen. We suggest that spermatogenesis occurs between September and October. During this time, testes are turgid and seminiferous tubules have stratified epithelium, while spermatozoa develop near the lumen. From October to December, we observed the vas deferens to be convoluted, filled with sperm and its epithelium formed by secretory cells (figure 2). During the sperm storage period and along the rest of the year, we observed that the seminiferous tubules have reduced diameters and just a few spermatogonia. Specimens collected throughout December already showed vas deferens without convolution. This occurs in conjunction with the appearance of larger follicles in females. Based on our results, we suggest that mating season of *L. microcephalum* in Southeastern Brazil most likely occurs during December.

Theme:reproduction, sexual maturity, morphology, histology, Amphisbaenidae, *Leposternon microcephalum*

Type of Presentation: Poster

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Genetic variation and interspecific hybridization in New World Crocodiles: Implications for Conservation and Management

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The New World crocodiles, *Crocodylus acutus* (American crocodile), *C. intermedius* (Orinoco crocodile), *C. moreletii* (Morelet's crocodile) and *C. rhombifer* (Cuban crocodile) represent a recent divergence and radiation, probably less than 4 mybp. While the latter 3 species are relatively limited in their ranges, the American crocodile (*C. acutus*) is a large New World crocodylian found in fresh and estuarine waters from Florida to Venezuela. The development of genetic markers (e.g., microsatellites and mitochondrial DNA) has allowed preliminary characterization of some crocodile populations from different parts of its range that provide some hints about their population structure. We are now involved in a comprehensive characterization of *C. acutus* to fully understand the genetics of this species, which will be critical for a program of sustainable use that we would like to see in place for American crocodiles in Central America by the year 2012. Progress has been made as a strong foundation for such a genetic assessment of *C. acutus* has been provided by a recent review of critical habitat, the demonstration that pedigrees can be successfully generated using genetic markers and the population analyses mentioned above. Together these studies provide the necessary baseline data required to produce an American crocodile action plan for the conservation and sustainable management of this species. Recent collaborative efforts spearheaded by the Wildlife Conservation Society, the Smithsonian Tropical Research Institute in Panama, the SENACYT program in Panama and Texas Tech University (TTU) have laid the groundwork for such a regional

study that will insure the long term survival and conservation of *C. acutus*, while allowing some animals to be raised in captivity and used for skins and meat. As has been demonstrated in the American alligator, the first step is to document as much information as possible about the genetic diversity that resides in this species in each of the different locales where it is found as well as across its range. A potential difficulty for this planned program is the recent discovery of relatively frequent hybridization between American crocodiles and members of at least two of the other New World species (Morelet's crocodile and the Cuban crocodile). In this paper, I discuss our findings and the implications of hybridization on the conservation and management of all of the species involved.

Theme: crocodilians, genetics, conservation biology, endangered species

Type of Presentation: Oral, Symposium 7: The biology and management of crocodilians.

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Conservation genetics of the Chinese cobra (*Naja atra*) using mitochondrial DNA sequences

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We collected Chinese cobras (*Naja atra*) from one island (Dinghai) and four mainland (Huangshan, Lishui, Quanzhou and Baise) populations in southeastern China, and used sequence data derived from ND2 (1032 bp) and cytochrome b (1117 bp) genes and molecular variance estimates to investigate the population genetic structure of the species. Our sequence data show that: (1) the three eastern (Dinghai, Huangshan and Lishui) populations are genetically segregated from the two southern (Quanzhou and Baise) populations; (2) the Quanzhou and Baise populations consist of two well-defined subclades, suggesting that the two populations have been well differentiated; (3) *N. atra* from the Huangshan population do not differ from those from the Lishui population, and lineage sorting in the northeastern part of the cobra's distributional range has not been completed yet because of the young age of Zhoushan Islands. The three eastern populations, the Quanzhou population and the Baise population should be regarded as different management units (MUs). For these MUs, we suggest that in situ protection measures should be taken because of their genetic uniqueness. Re-introductions or translocations are required to protect or resume natural populations of *N. atra*, but great care should be taken to enhance or retain local genetic variability.

Theme: Elapidae; *Naja atra*; Conservation genetics; Mitochondrial DNA; Management unit

Type of Presentation: Poster

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Vocalization microhabitat and acoustic communications in *Ameerega braccata* (Steindachner, 1864) (Anura, Dendrobatidae) in Midwestern Brazil

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Ameerega braccata is an aposematic and small dendrobatid anuran actually known from its type-locality in Chapada dos Guimarães municipality, state of Mato Grosso, and additional locations in Mato Grosso do Sul and Goiás, Brazil. To this date, there are no biological studies on this species and its vocalization is so far unknown. Herein, we describe the advertisement, territorial and courtship calls of this diurnal species, and include descriptions of vocalization microhabitat (substrate and height from the floor) in the type-locality. Vocalizations were obtained under natural conditions in the field with a Sony TCM 5000EV tape recorder and a directional YOGA EM 9600 microphone. Calls were analyzed in the Cool Edit 96 (Syntrillium), with a 16 bit resolution. The study was based on 22 reproductive males, observed between October 2007 and March 2008. When performing advertisement calls, males were usually found at an average height of 31.4 cm ($N = 19$, $SD = 12.2$ cm), on leaves of shrubs and herbaceous plants (59%), on termite mounds (18%), trees trunks (1%) or on the floor (22%). Advertisement call of *A. braccata* is composed by a single note, not pulsionated, with a frequency range between 3.5 and 4.2 KHz ($N = 110$), and average duration of 65.8 ms ($N = 110$, $SD = 11.6$). Territorial vocalization is composed by 5 to 6 repeated notes, structurally similar to advertisement call notes. Courtship vocalization is emitted in close-range interactions between male-female during the courtship process and may reach frequencies between 2.2 and 5.3 KHz ($N=10$), with shorter notes (average duration 43 ms; $N=10$; $SD = 4.9$). Individuals of *A. braccata* were found in open physiognomies of “campo sujo” and “cerrado stricto sensu”, in opposition to previous researchers findings, which reported an association of the species with gallery forests amidst Cerrado. Males of congenierics usually vocalize over rocks near streams (*A. flavopicta*), amidst leaf litter (*A. hahneli*), and among dead tree branches on the leaf litter (*A. picta*), therefore differing from what was observed in *A. braccata* in its type-locality.

Theme:Amphibia, Dendrobatidae, *Ameerega braccata*, vocalization, habitat use.

Type of Presentation: Poster

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Herpetofauna of the Thermo eletric Power Station Silves, Amazon, Brazil.

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The Silves electrical plant is located 260 km of Manaus, in the hydrographic basin of the Amazon River in the municipality of Silves (S 02° 44' 32'' W 58° 10' 55'') Field trips to evaluate herpetofauna at the Silves electrical plant site were made during November 16th and December 10th of 2007. Four different methods were applied to evaluate the herpetofauna of this area: captures with pitfall traps using containers with a capacity of 100 liters, visual encounter, vocalization (in the case of amphibians), occasional encounters and the collaboration of third persons: all this incremented the list of species found. In total, two groups of pitfalls were installed in permanent high ground environments. Every sample site was 100 meters long, and it was composed of a plastic barrier (1 meter high) that was intercalated with containers every 10 meters. The samples taken by active search were made for at least two hours during the day and night in different high permanent lands (for example streams and areas with anthropogenic impact). We look for amphibians and reptiles during their foraging activities and their habitats; this search was made during walks along trails in different environments. In total 54 species were registered, 19 anurans that were part of 6 different species groups: Hylidae (8), Leptodactylidae (4), Bufonidae (4) Aromobatidae (1), Microhylidae (1),

Brachycephalidae (1). In reptiles we captured 35 species, 19 of them were lizards of 7 different families: Gymnophthalmidae (6), Teiidae (3), Tropiduridae (2), Gekkonidae (3), Scincidae (1) e Iguanidae (4). For the snakes we registered 13 species of four different families: Colubridae (9), Viperidae (2), Leptotyphlopidae (1), Elapidae (1). Among the quelonians two different species were registered, these were part of two different families; Chelidae (1), Testudinidae (1). For the case of alligators only one specie of the family Alligatoridae were found. All the specimens are deposited in the collection of reptiles and amphibians of the Instituto Nacional de Pesquisas da Amazônia.

Theme: Silves, Herpetofauna, Manaus, Amazônia, Brasil.

Type of Presentation: Poster

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An Analysis Of The Advertisement Call As A Plastic Trait In Response To Environmental Structure

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Most studies regarding the effect of environmental characteristics on anuran acoustic signals have focused on the analysis of genetically determined variations, which reflect evolutionary pressures. However, variability in vocalizations as a product of phenotypic expression has been reported. This suggests that amphibians would be able to modify the structure of their acoustic signals in response to the ecological context in which they are broadcasting. Notwithstanding its key role in reproductive fitness, little attention has been devoted to anuran advertisement calls as a plastic attribute. The strong theoretical and methodological framework available for the analysis of acoustic signals offers a notable opportunity for the study of phenotypic plasticity at this level. In this context, three main points are studied: i) the structure of the advertisement call of *Hypsiboas pulchellus* and its attenuation pattern in different environmental contexts; ii) signal variation associated to vegetation density; iii) alternative theoretical hypotheses that could account for the connection between the physical environment and call attributes. Using path analysis, we identify the most likely causal structure that connects variations in call attributes to the environment in which the signal is broadcast. Our study attempts to advance in the connection between two well developed theoretical frameworks: those of phenotypic plasticity and acoustic communication in anurans.

Theme: plasticity, acoustic signal, environment, amphibians, structural equations

Type of Presentation: oral, Symposium 3: Sensory Ecology of Anuran Communication

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Phylogenetic signal in the evolution of the advertisement call of dart poison frogs (Anura: Dendrobatidae)

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Communication plays an essential role in animal life history, species diversification and reproductive isolation, once ritualised signals can be used to recognise and discriminate between heterospecifics and conspecifics individuals. Advertisement signals evolution has been explained by different evolutionary forces as natural selection, sexual selection and stochastic processes. The relative importance of selective or non-selective forces can be estimated by its phylogenetic signal which is inversely correlated to the evolutionary lability. But advertisement signals can be composed by multiple features, that can respond semi-independently to evolutionary forces. The advertisement call is the most heard call type in anurans and it is used in species recognition and mate choice. In this study we estimate the phylogenetic signal for advertisement call traits from poison frogs (Phylllobates, Ranitomeya, Adelphobates, Oophaga and Dendrobates). Morphological effects were also tested, since the relationship between spectral features and body size is expected. We found a high phylogenetic signal for all call traits, indicating they present low evolutionary lability. And an interesting question arises remaining without solution: if call low lability is widespread among anuran clades or if it is unique to dendrobatid frogs. Call traits differed in their phylogenetic signal, indicating differential response to evolutionary pressures. Pulse duration has the strongest phylogenetic signal. Peak frequency and body size are correlated and presented high phylogenetic signal indicating both are evolving in pleiotropy. Differential use of call traits in communication can lead to distinct evolutionary patterns, our results suggest pulse duration more important to species recognition whereas pulse number should be more important to mate choice, but these predictions need to be tested.

Theme: Dendrobatidae, dart poison frogs, phylogenetic signal, advertisement call, evolution

Type of Presentation: Poster

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Captive breeding of the Cuban Long Nosed Toad (*Bufo longinasus*), a first attempt for ex situ conservation of an endangered species

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The Cuban Long Nosed Toad (*Bufo longinasus*) is an endangered (EN) species following the UICN categories and criteria. A preliminary captive breeding protocol for this species is described. The chytrid fungus was found in one population of this toad (*Bufo longinasus dunni*), suggesting that it is at a high risk by the presence of the disease. There are not captive breeding programs for Cuban endangered amphibians, and the experiences we already have with *Bufo longinasus* might be useful as a starting point for zoos, aquaria, universities, and other institutions that can play a decisive role developing programs for ex situ conservation.

Theme: Anurans, Cuba, captive breeding, *Bufo longinasus*, Cuba

Type of Presentation: oral

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Tadpole diversity in Cuba

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Cuba is inhabited by 62 species of amphibians, 95% of which are endemics. Only 15% of these species, belonging to the families Bufonidae, Hylidae, and Ranidae have larvae. For the first time, tadpoles of *Bufo cataulaciceps*, *B. empusus*, *B. gundlachi*, *B. florentinoi*, *B. fustiger*, *B. longinasus cajalbanensis*, and *B. peltoccephalus* are described. We classify Cuban tadpoles following previously described ecomorphological guilds and provide information on habitats. Tadpoles of *Osteopilus septentrionalis* exhibit an unusual variation in morphology, when occurs in lentic or lotic habitats. Most of the Cuban larvae are identifiable to species, or even subspecies, level.

Theme: Anurans, Cuba, tadpoles, *Bufo*, *Osteopilus*, ecology, morphology

Type of Presentation: oral

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Conservation status of the Cuban Amphibians

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Cuba has one of the most endangered amphibian fauna in the World. Of the 62 currently known species, 26% are critically endangered (CR), 35% are endangered (EN), and 15% are vulnerable, following categories and criteria of UICN. We propose a conservation reassessment of Cuban frogs and toads, analysing geographic and ecological distribution, together with breeding patterns. Again, more than 50% of Cuban amphibians are much endangered. We found that five species were not covered by the Cuban National System of Protected Areas. Mean threats are discussed, especially the habitat lost, introduced species, and the presence of *Batrachochytrium dendrobatidis*.

Theme: Anurans, Cuba, conservation biology, *Batrachochytrium dendrobatidis*

Type of Presentation: oral

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Influence of characteristics of streams in structuring riparian communities of frogs in the Uatumã Biological Reserve, central Amazon

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We studied the composition of species of frogs and their relations with abiotic variables in 14 plots of 250m in length on the banks of streams in the Uatumã Biological Reserve, about 100 km north of Manaus, central Amazon. The presence and abundance of species along each stream segment was based on three nocturnal samples (visual and auditory) during a rainy season (November 2007 - May 2008). We relate the composition of species to altitude, the size of stream, the current velocity and the width of the floodplain. We found 50 species of frogs, the most frequently encountered being *Pristimantis fenestratus* (420 individuals) and *Hypsiboas fasciatus* (324). In visual sampling *Atelopus spumarius* was the most frequently encountered (294 individuals). The number of species encountered in each plot ranged from 15 to 34 species and was not related to the predictor variables. The composition of the species was related to the size of stream, which strongly influenced the

presence and abundance of some species. *Atelopus spumarius*, *Hyalinobatrachium nouraguense* and *Synapturanus mirandaribeiroi* were found in plots around larger streams, while *Hypsiboas multifasciatus* was recorded around small streams. The current speed and the width of the floodplain had little affect as the distribution of species, despite the abundance of *Hypsiboas* boans have being influenced by current velocity. Altitude did not affect the distribution of species. The results of this study indicate preferred habitat for some species of frogs, taking an ecological interest and a practical significance for the conservation and management of these species.

Theme: anurans, community ecology,

Type of Presentation: Poster

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Frogs of Bangladesh: analyzing and documenting an understudied fauna

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Situated between the Himalayas and the Bay of Bengal, Bangladesh comprises a great diversity of ecoregions and occupies a key biogeographic location between India and Southeast Asia. However, the knowledge of the diversity, distribution and population status of the amphibians of Bangladesh is very limited. Although some museum specimens from the region date back to the 19th century, the area has remained under collected and the available records from colonial times are scattered. Most of Bangladesh's conservation areas have never been surveyed herpetologically, and all are threatened by encroachment and conflicting economic interests. Recent publications list only 21–37 species of amphibians for Bangladesh including taxa whose existence in the country is not supported by physical evidence, and the calls of most if not all of the frogs of Bangladesh have never been analyzed scientifically. Based on preliminary surveys in six ecologically divergent regions of Bangladesh, we provide an overview of the observed amphibian species and first results of bioacoustics studies on their calls. We propose that the amphibian species diversity of Bangladesh, and the country's herpetological diversity in general, have been greatly underestimated. More extensive biotic surveys accompanied by integrative research combining morphological, bioacoustics and molecular analyses of preserved voucher specimens will be required to reveal and to permanently document previously overlooked species diversity. In particular, the routine use of DNA sequence analyses will be a prerequisite for addressing the role of climatic, geological and hydrological events in shaping the contemporary diversity of Bangladesh's amphibians, as well as for determining the impact of environmental pollutants and climate and land use changes on frog populations in Bangladesh.

Theme: amphibians, anurans, behaviour, conservation, diversity, morphology, taxonomy, Asia, Bangladesh

Type of Presentation: Poster, contributed, related to symposium 09

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See-through Frogs Created By Breeding

The skins of frogs are generally covered with dermal chromatophore units consisting of xanophores, iridophores and melanophores, so the internal organs cannot be seen through the skin. Although some small fish are see-through, see-through tetrapods have never been reported. We have succeeded for the first time in producing see-through frogs from two natural color mutants of the Japanese brown frog *Rana japonica*, whose backs are usually ochre or brown, enabling their organs, blood vessels and eggs under the skin to be observed without performing dissection. Two kinds of recessive color mutants (black-eyed and gray-eyed) are known to lack the normal iridophores and melanophores in this species, respectively, and cause the frogs to be pale or albino. We crossed these two mutant frogs through artificial insemination, and F2 offspring led to frogs whose skins are see-through throughout life. It is possible to see through the skin how organs grow, and how cancer starts and develops. The organs of the same frog can be monitored over its entire life without the need for dissection. Researchers can also observe how toxins affect bones, the liver and other organs at low cost. Dramatic changes of organs can be also seen when tadpoles metamorphose into frogs. Although artificial insemination is necessary to breed such frogs at present, in the near future see-through and even illuminating frogs could be produced by injecting into see-through frogs an illuminating GFP protein gene attached to a gene, which would light up the gene once it manifests, in order, for example, to reveal at what stage cancer starts.

Theme: amphibians, anurans, genetics

Type of Presentation: Poster

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Virtually First: An Online Museum of Reptiles of South Africa, Lesotho and Swaziland

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South Africa, Lesotho and Swaziland have an extraordinary diversity of reptiles: approximately five times the number of species expected on the basis of land area, with over 1/3 of species endemic to the region. Yet reptiles are traditionally overlooked in conservation plans. This is partly due to a shortage of resources for adequate monitoring, but also due to the poor public image of this faunal group. The Southern African Reptile Conservation Assessment (SARCA) has addressed these issues through the creation of a novel tool – an online Virtual Museum (VM). This makes use of open source software - MySQL provides the database backend, and the front end was written entirely in PHP. Photographs of reptiles are submitted by the public via email, along with basic information in a simple format. Submissions are processed, locality information verified and photos edited, before uploading onto the project's website (<http://sarca.adu.org.za>). Species identifications are then made by a panel of experts. VM records feed into a larger database of reptile distribution records, compiled from museum and other collections and from published literature. Real-time distribution maps are available online. In the three years since its launch, SARCA's VM has received 5000 submissions (comprising 4.3% of the distribution database) from about 400 contributors. Results of a questionnaire indicated that wildlife enthusiasts submitted most records, and amateur naturalists were most responsible for promoting the VM to other people. A moderate to considerable increase in knowledge or appreciation of reptiles as a result of the VM was indicated by most respondents (57% and 72%, respectively). Submissions include new distribution records, including records of seldom seen fossorial species; records of rare or threatened species; records of species' range extensions; and records of unusual colour morphs. Map coverage by VM records is fair, and concentrations of VM records correspond with those received from other sources (e.g. museum collections). SARCA's VM

has been so successful that it has been adopted by the Southern African Butterfly Conservation Assessment and the concept has also been adapted for the South African National Survey of Arachnida. However, the future of these VM's beyond the projects of which they are a part has yet to be resolved. If they are continued, then consideration should be given to advances in technology (such as cell phone technology) that would further automate the sending, processing and uploading of submissions.

Theme:reptiles, conservation biology

Type of Presentation: Poster

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Genetic composition and mode of reproduction in hybridogenetic water frog *Rana ridibunda*-*Rana esculenta* mixed population.

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Rana esculenta is a natural hybrid between *R. lessonae* (genotype LL) and *R. ridibunda* (RR). Diploid hybrid genotype is composed of two parental genomes (RL). The hybrids reproduce by hybridogenesis based on the modified gametogenesis, in which the genome of one of the parental species is eliminated from the germ line. *R. esculenta* usually live syntopically with *R. ridibunda* or *R. lessonae* and form mixed populations *lessonae-esculenta* or *ridibunda-esculenta* (L-E or R-E genetic systems). The *ridibunda-esculenta* populations studied by us inhabit the Barycz river valley that is one of the most valuable regions in Europe and its water management system has not been changed since the Middleages. For this reason the area may serve as a reference for water frog populations facing environmental difficulties. Taxonomical status of frogs was established according to morphology and cytogenetics. The population is composed mainly of *R. ridibunda* (RR) and *R. esculenta* (RL) males and females. Frogs (N=2296) were collected between 2001 and 2008 in three main localities within ca. 70 km long transect along the axis of the valley: east (3 pond complexes), center (2 complexes), and west (2 complexes). The percentage of *R. esculenta* (6%, 20.7%, and 48.38%) changes along the transect (from east to west). The percentage of triploid *R. esculenta* RRL was low (6.97%, 1.2%, and 3.67%). The F:M sex ratio was 1:2.1, 1:4.45, and 1:5.66 for *R. ridibunda*, and 1:5.3, 1:2.45, and 1:2.1 for *R. esculenta*. Age of most of adults ranged from 2 to 5 years; less than 10% live up to 6-7 years, and only few frogs were 8-9 years old. We noticed a significant change in population composition over a decade. Originally the central population was composed of 34% RR and 66% RL of both sexes, whereas now the percentage of RR increased to 80%. The reasons influencing the change are: chromosome composition of gametes produced by hybrids (89.9% R, 9.9% L, and 0.7% R) and low fertility of hybrids accompanied by high mortality of their progeny. Gametes produced by hybrids do not fit the traditional model of hybridogenesis in R-E systems, in which hybrids should produce the L gametes. In conclusion we can say that population composition reflects the availability of gametes produced by species and hybrids (R or L) and thereby fluctuate over time.

Theme:anurans, hybridogenesis, water frogs, *Rana ridibunda*-*Rana esculenta* system

Type of Presentation: oral,

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Genetic divergences and phylogenetic relationships of the *Fejervarya limnocharis* complex in Thailand and neighboring countries revealed by mitochondrial and nuclear genes

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Among anuran species, *Fejervarya limnocharis* is one of the most widely distributed species, extending from Japan in the east to Nepal in the west and Indonesia to the south. Because of few morphological differences, “*F. limnocharis*” has been conventionally regarded as a single species. However, recent detailed analyses have demonstrated that there is a degree of genetic divergence within conventional *F. limnocharis*, and therefore it has been suggested that “*F. limnocharis*” contains several cryptic species. Recently, genetic analyses using allozymes and mitochondrial (mt) DNA have been performed for several populations of the *F. limnocharis* complex in Thailand, and a degree of genetic divergence was observed in this area. In this study, to clarify the genetic divergence in the *F. limnocharis* complex from Thailand and its neighboring countries and to elucidate the phylogenetic problems of this taxon, we analyzed three mt (12S and 16S rRNA, and Cyt b) and five nuclear (CXCR4, NCX1, RAG1, RAG2, and tyrosinase) gene sequences. Mitochondrial gene data showed two major clades for the genus *Fejervarya*, corresponding to the Southeast and South Asian groups. Mitochondrial gene data also showed that the surveyed *F. limnocharis* complex from Thailand contains three distinct haplotypes for the mt genes. The nucleotide similarities and phylogenetic relationships indicated the followings: (1) the haplotype 1 group corresponds to the real “*F. limnocharis*”. (2) The haplotype 2 group is *F. orissaensis* or closely related to it. These taxa are phylogenetically nested in Southeast Asian group. (3) The haplotype 3 group is a species belonging to South Asian group. Although *F. orissaensis* is only known from Orissa in India so far, the same or closely related species was observed in Southeast Asia. This novel finding of distributed area and the resultant phylogenetic relationship suggested that the origin of *F. orissaensis* and the haplotype 2 group might lie in Southeast Asia and *F. orissaensis* have spread to South Asia. A possible geographical barrier between areas of Southeast and South Asian groups was the mountain arc that stretches from the Arakan Mountain Range to the Patkai Mountains. However, in this study, the Arakan and Patkai mountains were not the cause of the division between these two groups. Furthermore, the results from mt and nuclear gene data suggested the paraphyly of “*Fejervarya*”.

Theme: Sequence divergence, molecular phylogeny, mitochondrial genes, nuclear genes, *Fejervarya*, Thailand

Type of Presentation: oral

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Occurrence of sea turtles in the coast of Pará, Brasil

There is virtually no information on sea turtles on the northern coast of Brazil. A survey of the occurrence of sea turtles on the coast of Pará state was carried out on in three Areas in the coast of Pará State. Semi-structured questionnaires were used in interviewing fishermen in each region to collect information on the occurrence of species of sea turtles and nesting areas. Local beaches in each region were also monitored during the rainy (April, May and June) and dry (August, September and October) seasons. Biological material was collected from the beaches and also from residents interviewed in the communities. Photographs taken by local residents were also considered. In all three study areas evidence of the presence of sea turtles was found including whole carcasses, shell fragments, skulls and bones. Seven nests (one in 2006 and six in 2007) of *Lepidochelys olivacea* was found on Maiandeuá Island, but it was confirmed that many others were taken by local residents. *Dermochelys coriacea* was recognized by 81% of the fishermen interviewed ($n = 21$), and apparently is the most common species. Most fishermen (95.23%, $n = 21$) did not identify the presence of *Eretmochelys imbricata*, but one of them donated a carapace of the species that was found on a beach on the island. Most of the records of fishermen records are of accidental capture by fishing gear and nesting females. This study identified the presence of all five sea turtle species known to occur on the Brazilian coast: *Chelonia mydas*, *Eretmochelys imbricata*, *Lepidochelys olivacea*, *Caretta caretta* and *Dermochelys coriacea*.

Theme:amazonia, seaturtles, reproduction, chelonidae, dermochelidae

Type of Presentation: poster

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Patterns Of Distribution Of *Rhinoclemmys funerea* And *R. pulcherrima* In Costa Rica: Geographical Barriers And Adaptive Divergence

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The distribution of *Rhinoclemmys funerea* and *R. pulcherrima* has been studied by several authors although most of them do not provide enough data to recover in detail the distribution patterns and habitat preferences in Costa Rica. We present a complete checklist of localities for both species based on 182 specimens (130 *R. funerea* and 52 *R. pulcherrima*) from scientific collections of 48 museums and universities all over the world. The localities were plotted on 20X20 km squared map of Costa Rica. Our results show that the distribution patterns of both species are strongly influenced by the existence of geographical barriers, as it has been described in other chelonians like *Rhinoclemmys annulata* and *Kinosternon scorpioides*. The Guanacaste, Volcánica Central and Talamanca mountain ranges divide Costa Rica from the Northwest to the Southeast creating two separate Great basins: “North and Caribbean” and “Pacific and Central Valley”. The distribution areas of *R. funerea* and *R. pulcherrima* do not overlap because of the presence of the mountain barrier, mainly responsible for the climatic and ecological differences observed on both sides. Continental turtles from the Pacific basin have been able to reach the Central Valley due to similarities in climate and habitat, but they are absent from the Caribbean basin. We confirmed the Caribbean distribution pattern of *R. funerea* in Nicaragua, Costa Rica and Panama, which is mainly related to rainforest streams. *R. pulcherrima* is almost restricted to deciduous dry forest in Costa Rica and south of Nicaragua. Differences in the distribution by habitat (rain forest and deciduous dry forest) together with conspicuous morphological divergences in these two species of *Rhinoclemmys* might represent an outstanding case of adaptive divergence to different ecological niches. Adaptive processes may explain the great diversity of morphotypes of *Rhinoclemmys*, which includes terrestrial characters commonly restricted to species of the Testudinidae family. In fact, adaptations

to terrestrially life are extremely rare in the aquatic families of turtles of the world.

Theme:reptiles, turtles, ecology, natural history

Type of Presentation: Oral presentation

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Biometric Studies As A Tool For Ecological Characterization: An Example With The Genus *Rhinoclemmys* In Costa Rica

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Biometric studies have been used for description of taxa, analysis of dimorphic sexual characters and differentiation among populations of single species. The present work is part of a long term field research about *Rhinoclemmys funerea* and *Rhinoclemmys pulcherrima* carried out in Costa Rica. Morphological measurements were taken on 78 individuals of *R. funerea* (19 males, 29 females, 30 immature) and 111 of *R. pulcherrima* (28 males, 72 females, 11 immature). Body weight and 30 linear measurements were compiled for each individual. We found a higher average size in males of *R. funerea*, even though the biggest individual for the whole set was a female. In *R. pulcherrima* the females size was higher than males, both the maximum values and the average one. We checked out the fitting of each measure to a normal distribution pattern and performed a logarithmic conversion in order to minimize body size effect. Correlations among variables of each species were detailed in a correlation matrix; all correlations were significant at $p < 0.05$. We transformed the general growth expression $Y = bX^a$ to get the linear equation $\log Y = a \log X + \log b$, where “Y” means any “dependant” measurement, “X” is the independent variable (in our study, the SCL-Straight Carapace Length), “b” is a parameter and “a” is the allometric coefficient. Tail measurements (TL-Tail Length and “PCL”-Pre Cloacae Length) showed the highest differences for allometric coefficients between genders of both species. Therefore, the most significant variations were found in *Rhinoclemmys pulcherrima*. We performed a Principal Component Analysis for all measurements of each species. We found a unique significant Principal Component for *R. funerea* (31 variables; %Variance=97.75; eigenvalue=30.30). On the other hand, we identified two significant Components for *R. pulcherrima*: Factor 1 (30 variables; %Variance=86.10; eigenvalue=24.97) explains the variability of all measurements except the Tail Length and Pre Cloacae Length, which are explained by Factor 2 (30 variables; %Variance=4.82; eigenvalue=1.40). We conclude that morphological quantitative differences between both species are probably related to differences between the habitats they occupy. *R. funerea* is a highly aquatic turtle that shows a “terrapin” morphological type, like most of the Bataguridae family. *Rhinoclemmys pulcherrima* might have modified its external characters towards a “tortoise” type, to become adapted to the more terrestrial habitat where it occurs as in many testudinids species. In addition, we found that the outstanding sexual dimorphic characters of *R. pulcherrima* (mainly those of the tail) are strongly related to differences between the two distinct morphotypes (terrapin/tortoise).

Theme:reptiles, turtles, ecology, natural history, morphology

Type of Presentation: Poster

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Morphology of the digestion tube of the loggerhead turtles, *Caretta caretta* (Linnaeus, 1758)

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The loggerhead turtles (*Caretta caretta*) is one of the five turtle species found in the Brazilian coast. It is a carnivorous species and its feeding involves a variety of invertebrate animals as crustaceans, jellyfishes, gastropods and hedgehogs of the sea. The morphologic parameters of the digestion tube allow understanding the physiology of digestion of the animal's organism and can supply data about the alimentary preference of the species; as a result, the purpose of the present study is to describe the anatomy of the digestion tube of the species *C. caretta*. Two died animals, found in the coast of the State of Rio Grande do Norte, have been used. The measurement of the length (LCC) and the width (WCC) of the curvilinear carapace of these animals were accomplished. Soon afterwards, to perform the necropsy the breastplate has been opened to retreat the digestive organs. The animals presented a LCC of 88.30cm and 93.00cm and a WCC of 82.00cm and 83.00cm. The esophagus showed to be a muscular membranous tubular organ (24.35 ± 6.57 cm). The esophageal mucosa showed horny sharp papillae directed in the caudal sense. Internally, the esophagus-stomach transition region was marked by a gastroesophagic sphincter. The stomach presented a tubular format slightly curved for the left, and one of the animals possessed two sacculations, one in the cranial region and another in the caudal, both with a mucous membrane without pleats, while the largest portion of the stomach was marked by longitudinal pleats. Those sacculations, probably, are associated to a larger storage capacity of the organ. On of the animal didn't possess sacculations, and showed longitudinal pleats throughout the extension of the mucous membrane, markedly more spaced (43.10 ± 1.55 cm). In the small intestine, reticular pleats in the duodenal mucous membrane have been observed, while the jejunum and the ileum showed rectilinear juxtaposed pleats (350.10 ± 154.00 cm). The large intestine was marked by the alternation of arched areas (haustra or sacculations) and narrowings (265.75 ± 55.50 cm). The results showed that the digestive tube adapts to the alimentary habit, however, variations in the stomach of this species were observed. Therefore, further studies with a larger number of animals will help for better understanding of the morphology and the digestive physiology in the loggerhead turtle.

Theme: Reptiles, Turtles, Morphology

Type of Presentation: Poster

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Morphology of the digestion tube of *Chelus fimbriatus* (Testudines: Chelidae).

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The observation of the of the animal's morphology could reveal the first details of their food habits, and the examination of its digestion tube provides a good indication on the type of food ingested. *Chelus fimbriatus* is a carnivorous freshwater turtle, which feeds by suction and swallow the whole prey. This study aims to describe the morphology of the digestive tube of *C. fimbriatus*. Biometrics measures of one male of *C. fimbriatus* were taken using a caliper. The rectilinear length of the carapace (CL) was 31.80 cm and rectilinear width of the carapace was (CW), 24.70 cm. The animal was sacrificed and the dissection was done by opening plastron for retrieval of the digestive organs. The morphological description of each organ (esophagus, stomach, small bowel and large intestine) was made taking into account the shape of the organs and mucous membranes, the presence of papillae, folds and sphincters. All material collected was preserved in formaldehyde solution at 10% and registered in the collection of Amphibians and Reptiles of the National Institute of Amazon Research - INPA. The esophagus showed a tubular shape, with much elasticity. Internally the mucosa was marked by folds. The stomach was located in the left antimer of the animal, with slight format of "J" externally simple, but the wall of the body was very thick. The mucosa was marked by internal folds and high arranged lengthwise. The first intestine loop (duodenum) came from the stomach and turned right, then descended where began the jejunum / ileum began and was coiled at the right side of the animal. The large intestine began as an dilation (cecum) and was followed by a tubular region (colon / rectum) towards cloaca. Internally, it has a mucosa with rectilinear longitudinal folds. The results showed an adaptation of the digestion tube to the feeding habit, presenting an elastic esophagus and a muscly stomach, since this species eat the whole prey. Therefore, future studies with a larger number of individuals can give great contributions to understanding of the digestive morphology and physiology of *C. fimbriatus*.

Theme: Reptiles, Turtles, Morphology

Type of Presentation: Poster

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Morphometry of digestion tube of *Kinosternon scorpioides* (Testudines: Kinosternidae)

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Kinosternon scorpioides is a semi-aquatic freshwater turtle usually found buried in the muddy bottom of small lakes and ponds. It is one of the smallest species of turtle from South America, adults only reaching 15 centimeters of linear length of carapace. It is an omnivore, that eatx leaves, fruits and small animals. The aim of this study is to describe the morphology of the digestion tube of *K. scorpioides*. Three females were collected in pools inside the forest, near Tucumanduba community, in the lower Amazonas river (S02°53.089' W057°03.049'). The straightline length of carapace (CL) and the maximum width of carapace (CW).were measured using a caliper. The animals were sacrificed and the dissection was done by opening plastron for the retrieval of the digestive organs. The measurement of each digestion organ (esophagus, stomach, small bowel and large intestine) were made with the digestion tube opened, taking in account the presence of papillae, folds and sphincters. All material collected was preserved in 10% buffered formalin and registered in the collection of Amphibians and Reptiles of the National Institute of Amazon Research - INPA. Mean size of CL and CW were 13.80cm and 9.46cm, respectively. The mean length of each organ was 8.16cm for the esophagus; 6.73cm for the stomach; 44.30cm for the small intestine and 6.33cm

for the large intestine. The knowledge of basic information concerning digestive processes in turtles is useful to add the conservation efforts. Studies using a large number of individuals, and analyzing physiology could be useful to provide more information about digestive processes in this specie and to provide insights into the species demands for food and habitats, in order to better understand the conservation issues involved.

Theme:Reptiles, Turtles, Morphology

Type of Presentation: Poster

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Distribution of Anuran Species with Aquatic Reproduction in Central Amazonia: Mesoscale Spatial Patterns

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In this study we investigated the effect of edaphic variables on the mesoscale distribution of frog species dependent on free water for reproduction. We evaluated the effects of soil texture, pH, slope, number of trees, and leaf-litter volume on the distribution of aquatic reproducing anuran species in the Reserva Florestal Adolpho Ducke, a 100-km² terra firme forest preserve in central Amazonia. Diurnal and nocturnal assemblages of anuran species were sampled in 72 plots systematically distributed across the reserve. We sampled the diurnal anuran assemblage by visual encounter in 250 x 1-m plots and the nocturnal assemblage in 250 x 20-m plots using both auditory and visual surveys. We detected twenty species of anurans: nine Hylidae, four Leptodactylidae and Bufonidae, two Aromobatidae and one Centrolenidae. Eight species were rare in samples, representing less than 2 % of all sampled individuals. Twelve species did not respond equally to environmental predictors. The majority of aquatic breeding anuran species were influenced by topographic and/or edaphic variables, such as slope, soil clay content and pH. Four species occurred throughout all environmental gradients and relationships with soil characteristics were subtle, indicating that these species occur in the majority of habitats in Reserva Ducke. Most species occurred in lower abundance in the reserve. The lower abundance can be reflecting the distribution of plots near to streams. Plots were distributed systematically on the study area (64 km²) and plots near to streams represent 25 % of the 72 plots, and mostly reveal terrestrially-breeding frogs. The lower abundance indicates that these species can be using the margins of streams as dispersion corridors, which reduces the probability of found these in areas distant to streams. Predictive models including edaphic and habitat structure characteristics were important predictors in a wide spatial scale and probably can interact influencing the habitat in more fine scales. The results in wide scales can reflect limitation in population level (e.g., presence of reproductive sites) and can be explained by the reproductive ecology of each species. The data of this study suggests that the use of edaphic and topographic factors can be appropriate to identify areas with high value to conservation in Central Amazonia.

Theme:Anurans, ecology

Type of Presentation: Poster

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Skeletochronology of two species of chelonians of the podocnemididae family of the amazônia.

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Chelonians have about 300 species distributed all around the world (for the exception of the Antarctic), 32 of them can be found in Brazil. Their among the easiest animals to find because of their caparace, being this a composition of bones covered by corneus escutes. Skeletochronology is the study that counts the growth rings. A growth ring marks the period where the growth was suspended, being this caused because of estivation factors during a rigorous winter, long dry season or heavy rains. The objective of this study was to compare the counts of growth rings of the carapace, bones and nails of the species *P. sextuberculata* (iaça) and *P. unifilis* (tracajá), and also to make a relation between the number of growth rings and the carapace size. Study samples were composed of 17 tracajás and 15 iaças from the collection of amphibians and reptiles of the Instituto Nacional de Pesquisas da Amazônia (INPA). The carapaces and nails were prepared and analyzed at the collection in INPA. The growth rings present at the first left costal escute were also counted. Nails were cut transversally with a circular saw. We didn't find growth rings in the nails. The growth rings on the carapace were observed only in the young individuals, because there were quite banished in the adult ones. We found growth rings in all humeri and femuri cuts. The relationship between the number of rings and the size of the carapace was tested using simple linear regression. We didn't find any relationship between the carapace length and the growth rings present on the carapace and the numbers of tracajás. We did find a relationship between the size of females iaças and the number of growth rings present on the carapace ($N=9$; $r^2=0,74$; $F=20,43$; $P=0,003$) and number of humeri ($N=5$; $r^2=0,90$; $F=25,9$; $P=0,015$). This relationship wasn't tested for males of iaça because of the small sample size. The absence of a positive relationship between growth rings and carapace length in humeri of tracajás explained by the loss of growth rings during the medullar absorption. Counting of growth rings in carapaces can only be made in young individuals, this is because the banishing of them in adults makes it really difficult to observe.

Theme:turtles, reptiles, morphometry

Type of Presentation: Poster

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Directions in Herpetological Conservation and Natural History

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The past two decades have seen a rejuvenation of interest in environmental issues within both the general public and the scientific community. Consequently, there is more media coverage and more papers being published on environmental issues in scientific journals than ever before. How has herpetological conservation and natural history fared within the current scientific literature? We addressed this question by analysing trends in herpetological literature over the past 15 years. We sampled papers published in two herpetological journals (Journal of Herpetology and Herpetological Journal) and two conservation journals (Conservation Biology and Biological Conservation) and compared the patterns observed between two time frames: 1991-1995 and 2002-2006. Within the herpetological journals, the relative number of papers published on amphibians increased in 2002-2006. Traditional natural history, notably systematics, ecology and behaviour featured strongly within the herpetological literature over both timeframes. Although there was a significant shift in the areas of publication for amphibians - with systematics showing a particular increase in recent years -

there was no change over time in terms of subject areas for reptiles. The conservation journals were dominated by papers on mammals, birds and plants over both timeframes, with relatively few papers on either amphibians or reptiles. However, the relative number of amphibian conservation papers doubled from about 3% in 1991-1995 to 6% in 2002-2006. In contrast, the relative number of papers on reptile conservation was stable over the two frames at about 5%. Population biology, species conservation and habitat change feature strongly in the conservation journals across both timeframes, with few studies adopting an interdisciplinary approach to conservation issues. The number of authors per paper has increased significantly in recent years within both the herpetological and conservation journals, reflecting an increase in collaboration. Recent amphibian conservation initiatives have probably resulted in an upsurge of interest in this area, and this is particularly reflected within the area of systematics. Otherwise most environmental research seems to be focusing on the traditional areas of ecology and behaviour with a strong population, habitats or species focus. Herpetological natural history therefore seems to be alive and well within the scientific literature.

Theme:amphibians, reptiles, natural history, conservation biology

Type of Presentation: Oral Symposium 8: Herpetological Conservation and Biology.

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RECENT ADVANCES IN CONSERVATION BIOLOGY AND MANAGEMENT OF BRAZILIAN CROCODILIANS

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Since 2003, Brazil has established a nationwide research and development programme, named Programme for Conservation Biology and Management of Brazilian Crocodilians. Brazilian ecosystems are viewed as large space-temporal management units and the goal is to bring benefits to local communities, based on the concept of conservation through sustainable use. Systematic surveys and the use of standard methodologies are the programme main feature. Accordingly, work has been focussed in the Amazon, Pantanal and Cerrado/Atlantic Forest ecosystems. In the latter ecosystem, wild populations of *Caiman latirostris* and *Paleosuchus palpebrosus* have been studied in the São Francisco and Paranaíba river basins. Preliminary results indicate non-fragmented populations distributed widely across both studied areas. In the Amazon ecosystem, efforts have been focused on consolidating the monitoring system in selected areas representative of different Amazonian river basins and, also, on developing sustainable use projects jointly with reserves' local communities. In the Pantanal wetland laws and regulations have been improved and new management concepts have been adopted in order to promote the organization and the development of different segments of the value chain, which are motivating stakeholders to implement effective conservation practices. The present paper describes the ongoing projects in each respective ecosystem, reporting on recent advances in conservation biology and management of Brazilian crocodilians. Overall, the programme has great potential to work in the service of conservation and to promote rural socioeconomic development.

Theme:crocodilians

Type of Presentation: Oral, Symposium 7: The biology and management of crocodilians.

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The Brazilian National Centre for Conservation and Management of Reptiles and Amphibious -

RAN

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The Brazilian herpetofauna is currently composed of 817 species of amphibians and 684 species of reptiles, which represents 15% and 8% of the world species richness of both groups, respectively. One of the first Brazilian official initiatives to conserve and manage herpeto biodiversity started in 1979, with the Amazonian Chelonians Project. Given that the project was highly successful, in 1991 it was extended to the status of centre – the Centre of Amazonian Chelonians, which 10 years later, provided the basis to the establishment of the National Centre for Conservation and Management of Reptiles and Amphibians – RAN. RAN main goal is to coordinate, to promote and to implement Brazilian strategic policies aiming at the conservation and management of endangered species, the species with economic potential (conservation dependent species) and the control of exotic introduced species. Research and development projects include the maintenance of a database on herpetological studies in Brazil, the development of species recovery action plans, particularly anura, squamata and one chelonian species and the development of programs for conservation through sustainable use of chelonians and crocodilians. Additionally, and transverse to each specific project, there is a strong emphasis on environmental education activities. The present paper describes RAN main projects in each respective ecosystem, reporting on recent advances in conservation biology and management of Brazilian herpetofauna.

Theme:RAN, conservation, amphibians, reptiles

Type of Presentation: oral presentation

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Hearing range and active tuning of the ear in frogs

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Hearing in frogs was believed to be restricted to low frequencies until Feng and collaborators (2006, *Nature*: 4416:333-336) showed that the Chinese concave eared torrent frog (*Odorrana tormota*, Ranidae) can hear ultrasound up to 32 kHz. We examined the mechanics of the middle ear in *O. tormota* and found that: 1) While previously studied frogs have shown eardrum vibration restricted to below 5 kHz, eardrum vibration in *O. tormota* peaks at 7 kHz and extends into the ultrasound; 2) The high frequency sensitivity detected at the tympanic membrane is also present at the stapes footplate, showing that high frequencies are transmitted to the inner ear; 3) *Odorrana tormota* can actively close its Eustachian tubes (ETs), contradicting the previous belief that anuran ETs remain permanently open; 4) ET closure is produced by contraction of the submaxillary and petrohyoid

muscles, which cause pivoting and bending of the anterior hyoid horn near its attachment to the skull, occluding the lumen of the ET; 5) The air volume behind the eardrums is drastically reduced by ET closure, increasing middle ear impedance, and shifting the tuning of the middle ear towards high frequencies. Such shift represents up to 20 dB gain in eardrum vibration at high frequencies (10 - 32 kHz) and 26 dB attenuation at low frequencies (3 - 10 kHz); 6) ET closure occurs in the field during calling and swallowing; 7) Comparative data obtained from *Lithobates pipiens* (Ranidae) failed to reveal the behavioral or anatomical features that allow for ET closure in *O. tormota*. ET closure is not, therefore, general to ranids. Several nonexclusive roles can be attributed to ET closure in *O. tormota*, such as protecting the inner ear from intense low frequency sound and high buccal air pressure during calling, or protecting the thin tympanic membranes from injury during swallowing of live arthropod prey. In addition, the shift in middle ear tuning produced by ET closure may unmask the high frequency calls of this species from the low frequency stream noise that dominates their environment.

Theme: amphibians, anurans, ecology, natural history, behavior, hearing, morphology, physiology, acoustic, ear, Eustachian tube.

Type of Presentation: oral, Symposium 3: Sensory Ecology of Anuran Communication

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Phenotypic Plasticity in Relation to Environmental Quality and Sperm Competition in Snakes

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Reproductive costs impose an adjustment of the reproductive tactics to local conditions and phenotypic plasticity is an important mechanism generating substantial intraspecific variation in reproductive traits (Shine, 2003). Since variations in the local environmental conditions influence the energetic costs and benefits balance, males of many species modify their reproductive behavior. Sperm competition (Parker, 1970) constitutes a major evolutive force imposing intense selective pressures on sperm traits related to fertilization efficiency (Snook, 2005). The objective of this work is to analyze the variation of reproductive and life history traits of males of *Boa constrictor occidentalis* in two environments of different qualities and to relate them to variations in seminal quality. Study areas, called Pocho and Loreto, were characterized using Landsat 7 ETM+ satellite images. Pocho was considered as a more suitable environment than Loreto since the forest habitat requirements of this species were more abundant in this location. Males were examined to obtain snout vent length (SVL), weight and body condition (BC). Reproductive structures were observed by ultrasound scanning (Sonosite 180 Plus, linear 5-10 Mhz transducer). For the males from Loreto curvilinear velocity (VCL), linear velocity (VSL) and motile cells proportion (MOV) of the ejaculates were examined at 25°C in culture conditions. Male reproductive frequency differed between populations being higher in Pocho. Also, reproductive frequency within SVL size classes varied since reproductive large males were more abundant in Pocho ($X^2=15.44$, $p=0.0796$). Males belonging to Pocho region had higher testicular volume. Testicular volume and SVL were correlated in Loreto ($p=0.01$, $R^2=0.42$) but not in Pocho ($p=0.25$, $r=0.19$). Positive associations were registered between sperm velocity and male SVL (VCL $p=0.0021$, $R^2=0.82$; VSL $p=0.0041$, $R^2=0.77$). These results show that low quality environments may decrease male reproductive potential. Since habitat loss difficult males dispersion (Cardozo et al., 2007) it would be possible that larger males display a less dispersive behavior because of their increased movement costs (Bonnet et al., 2000; Pearson et al., 2002). However, a higher seminal quality would counterbalance the loss of large males reproductive

success in sperm competition conditions. Phenotypic plasticity in reproductive and life-history traits would be an advantageous mechanism to adjust reproductive strategies to local conditions.

Theme:snakes, ecology, reproduction, behaviour, conservation biology

Type of Presentation: Oral: contributed

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Spatial and temporal distribution of five syntopic dendrobatid species in Castanho municipality, central Amazonia (Brazil)

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Dendrobatids are small, diurnal, ground-dwelling anuran species that are ubiquitous in Amazonian rainforests. Frequently two or more dendrobatid species occur syntopically. This study investigated how five dendrobatid species are distributed in time and space in an area of primary rainforest in the municipality of Castanho (Amazonas state, Brazil). *Colosthetus caeruleodactylus*, *C. nidicola*, *Colosthetus* sp., *Epipedobates hahneli* and *E. trivittatus* live and lay their eggs in leaf-litter, and males are territorial during the mating season. *C. nidicola* has direct development, while tadpoles of the other four species are carried to nearby water bodies by one of the parents to complete their development. Individuals of the five species were captured and marked by toe-clipping from 2002 to 2007 in a 60x20m-area, subdivided in 10x10m-plots by plastic tape. The location of vocalizing males was marked with colored plastic flags and mapped in relation to the sampling grid. The height of the location of vocalizing males was measured. A total of 112 individuals was mapped. *C. caeruleodactylus*, *E. hahneli* and *E. trivittatus* were more frequently captured in the higher and drier part of the sampling area, while *C. nidicola* and *Colostethus* sp. were more commonly found in the lower and more humid part. Mean height of male vocalization site varied from 8 to 17cm among species, and was highest for both *Epipedobates* species, which are larger in body size. *Colostethus* vocalized more frequently on litter leaves on the ground and in areas of low to moderate vegetation cover. *Colostethus* vocalized and reproduced exclusively during the rainy season, between october and march. Vocalization of *E. trivittatus* occurred year-round, but more intensively during the rainy season, while *E. hahneli* vocalized and reproduced during the dry season, from april to august.

Theme:amphibians, anurans, community ecology, reproduction

Type of Presentation: poster

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Genetic structuring in populations of *Podocnemis sextuberculata* (Testudines, Pleurodira) in the Brazilian Amazon

Maria das Neves Silva Viana

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While illegal, the sale of chelonians captured in nature is still highly common in the north of Brazil. This is not only due to local cultural practices of consuming these animals, but also due to the inefficiency of enforcement agencies. In the Amazon the most commonly consumed chelonians are of the genus *Podocnemis* and among them *P. sextuberculata* popularly known as iacá, pitiú or cambeua. Classified as data deficient (DD) by the International Union for Conservation of Nature (IUCN), this species is widely distributed in the Amazon basin of Brazil, Colombia and Peru, and is found in muddy waters, clear waters and in lakes. Because exploitation can cause grave changes in density and population structure of a species, the estimation and comparison of genetic variability within and between populations is of utmost importance for the diagnosis of the current state of a species, and for the elaboration of adequate conservation projects. The present study aims to characterize genetic structuring of natural populations of *P. sextuberculata* from the hydrographic system of the Brazilian Amazon with the goal of providing relevant data for management programs. The sampled localities were Terra Santa (rio Nhamundá-PA), Oriximiná (rio Trombetas-PA), Manicoré (rio Madeira-AM), Abufari (rio Purus-AM), Carauari (médio rio Juruá-AM) and Bota Fogo (baixo rio Juruá/AM). Blood samples of juvenile were collected by IBAMA under the auspice of their management program. A partial mitochondrial control region (605 base pairs) in a total of 108 samples was sequenced, resulting in 20 haplotypes. Levels of genetic variability were high in all localities analyzed. Results of AMOVA indicated that a major part of genetic variation was found within sampled localities (93.8 %) while variation between populations represented only 6.22%. The results indicated population structuring ($F_{ST}=0.0622$, $P<0.05$). The values of fixation index F_{ST} were significant in pairwise comparisons between the sampling locality from the lower Juruá with Manicoré, Terra Santa and Oriximiná. The lower Juruá locality also showed limited gene flow (low values of N_m) with all other localities. The fact that the lower Juruá sampling locality showed genetic structuring with respect to other localities suggests that it should be considered a Management Unit in future conservation plans. Financial support: CNPq/CT-Amazônia, CNPq/PPG7

Theme:reptiles, turtles, genetics, conservation biology

Type of Presentation: Poster

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Distribution, mortality and illegal pouching of the Amazon River turtle *Podocnemis expansa* (Testudinata, Pelomedusidae) in the Guaporé River, western Amazonia, Brazil.

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Spatial and temporal distribution and mortality of the arrau, *Podocnemis expansa*, were studied in the Guaporé River, Rondônia, Brazil from 1992 to 1998. Size structure of illegally pouched arrau were studied in the same area between 1990 and 1999. I recorded the presence of arrau in the vicinities of potential nesting beaches in 517 kilometers along the Guaporé River between August to December, 1998. Mortality rate was estimated for Praia Alta nesting site by 1) mark and recapture, 2) by collecting turtle shells found in local communities and 3) by analyzing records of *P. expansa* confiscated arrau by Brazilian Environmental Enforcement Agency (IBAMA). Female turtles were captured and marked during and after nesting period. Nesting was concentrated in three sites located far from human settlements and were protected by IBAMA. Beginning of nesting period was not associated with the water level of the river and the inter-annual variation was small. Most nesting occurred in September and adult females remained near the nesting beaches for at least four months.

Despite the fact that one female moved up to 235 km from its nesting beach, recapture data indicates that it nested in the same or neighboring beaches over the years. The estimated mortality rate of adult females based on recaptures was lower than based on the number of shells collected in the river communities. The differences in mortality rates may be due to different methods used in different periods and/or lack of protection of Alta Beach during 20 days in October 1998. The number of individual turtles confiscated by the enforcement Agency was small when compared with the number of turtle shells found in the communities. Active protection and distance from human settlements might explain the distribution of *P. expansa* nesting grounds along the Guaporé River. Other possible causes could be the social behavior of the species. Despite nesting site protection and hunting prohibition for the last 30 years, individuals of *P. expansa* are pouched regularly by local people, even in protected sites. In order to develop a more effective management plan of this species, conservation projects involving local communities are necessary.

Theme: reptiles, turtles, ecology, reproduction, behaviour, conservation biology

Type of Presentation: poster

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Comparing lizards surveying methods in a terra-firme forest in the Central Amazonia

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In order to choose a method for surveying fauna, the survey area, the study goals, the costs and the methods efficiency must be considered. This study compared the efficiency and the costs of two lizards surveying methods: the visual encounter plus the leaf litter search (AV + BL) against the pitfalls. The study was done in a terra-firme forest area at Reserva Florestal Adolpho Ducke (02°55'S, 59°59'W), periphery of Manaus, AM, Brazil, between May 2003 (end of the rainy season) and December 2004 (end of the dry season). Seventy two permanent and independent parcels were surveyed three times by AV+BL. Of those, 32 were surveyed by pitfalls (256 buckets of 30 liters each, connected by drift fence), opened for 21 days. A total of twenty three lizard species were registered. After the three surveys, 2179 lizards of 20 species were registered by the method AV+BL. The total effort was of 1512 men-hours. The pitfalls captured 206 individuals of 15 species with an effort of 926 men-hours. The capture rate was of 1,15 lizards/pitfall/month. The cost of the pitfalls was higher than AV + BL, since each survey of 32 parcels by AV + BL cost approximately R\$ 1.000,00 and by pitfalls cost R\$ 8.524,00. In general, the pitfalls yielded less species in lower abundance than AV + BL method, but proved better for capturing Gymnophthalmidae lizards. The cost of pitfalls was higher and needed more effort, but this method had the advantage of eliminating collector's bias. However, the pitfalls cannot be installed in swampy or rocky areas, creating a habitat bias in the survey area. This study suggests the priority usage of AV + BL method for lizard communities' rapid surveys in terra-firme Amazonian forests. The pitfalls should be used when there are resources available and especially in long term studies, when the costs can be defused over the study time.

Theme: lizards, surveying methods, Amazonia, pitfalls

Type of Presentation: Poster

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THE EFFECT OF ANTHROPOGENIC NOISE ON THE CALLING BEHAVIOR OF AMPHIBIANS IN URBAN AREAS OF PUERTO RICO

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Although studies have begun to understand the responses and consequences of noise for animal communities, most studies have focused on individual species and few have tried to understand the community level implications. The amphibian communities of Puerto Rico have high levels of diversity and endemism; providing an excellent opportunity to study how many species responds to anthropogenic noise. Although Puerto Rico has a very high density of roads and high levels of noise pollution, and is often thought to be a “concrete jungle”, presently 40% of the island is covered in forest. This combination of factors provides for an excellent opportunity to compare the responses of organisms in areas of high levels of anthropogenic noise with individuals inhabiting areas with low levels of noise. Furthermore, Puerto Rico has many different habitat types with different structural characteristics, which are likely to affect how noise travels and affects the organisms. Clearly, the diversity of organisms and habitats, plus a large urban center and many forested areas provide an excellent opportunity to expand our knowledge on the impacts of anthropogenic noise on amphibian communities. We collected sound recordings in areas of high levels of anthropogenic noise (<100m from a large road) and low levels anthropogenic noise (400m) in different habitats within and around the San Juan Metropolitan Area. We sampled sounds in four different habitat types (karst forest, moist forest, mangroves, grasslands). These habitats represent the most common habitats associated with roads with high levels of traffic in Puerto Rico. Within each habitat we sampled five areas with low levels of anthropogenic noise and five areas with high levels of anthropogenic noise, for a total of 50 sites. In each site, we will place a recording device that will make a 1 minute recording every 20 minutes for a minimum of two days for a total of 144 recordings. By sampling 50 sites, we will generate a total of 7,200 recordings. The technology used for sound recordings has been developed by our research group Automated Remote Biodiversity Monitoring Network (ARBIMON). Specifically, we have developed automated recording devices and software to manage and analyze the recordings. This level of detail will allow us to answer questions that could not be addressed by traditional monitoring methods. Currently, we are analyzing sound recordings for amphibian species.

Theme:Amphibians, Athropogenic Noise, Calling behavior

Type of Presentation: Poster, Symposium 3: Sensory Ecology of Anuran Communication.

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Mountain cloud forest herpetofauna in the Southwest of Colombia

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Amphibian and reptiles are important groups in the mountain ecosystems diversity. In spite of its important, the mountain ecosystems have been historically human impacted. Colombia has a high herpetofauna diversity, especially in mountain areas.. Nevertheless, few studies have documented the long term variations in the herpetofauna richness and abundances. The goal of this study was to identify changes in amphibians and reptiles communities during the last 40 years in a Colombian mountain cloud forest. We determined and compared the herpetofauna species richness for two fragments of forest, during three time periods: 1965-1981, 1982-1998 and 1999-2006. Additionally, climatic parameters and forest cover were analyzed to verify if these could be explaining possible variations in the species richness. We determined that the forest cover increased in one of fragments, while the other one has been maintained almost the same. For the climatic parameters, the most

dramatic changes was recorded to temperature which increased 1.65°C in last 20 years. Additionally, the period between 1995-1998 was unusually warm and dry. This period agrees with the first register to quitridium infection in Colombia. The herpetofauna data showed that both fragments had a noticeable decreasing in species richness between present period (1999-2006) and previous periods (1965-1981, 1982-1998). Richness decreased 17% in one of the fragment, while the other one decreasing was 43%. In general, the relative abundance of herpetofauna species decreased more of 35% in both fragments.

Theme:Amphibian, Reptiles, Colombia

Type of Presentation: Poster, 8. Herpetological Conservation an Biology

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New species and localities infected by *Batrachochytrium dendrobatidis* along an elevational cline at the Eastern Andes of Colombia

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Chytridiomycosis is an emerging infectious disease of amphibians caused by the pathogenic fungus *Batrachochytrium dendrobatidis* (Bd), which has been associated with population declines in endemic amphibian species in upland montane rain forests all around the world. This chytrid fungus has been reported in Africa, Australia, Europe and America since 1998. Despite of Colombia being one of the richest countries in amphibian species diversity (second only to Brazil in number of species), very few studies have been conducted to elucidate the nature of the amphibian population declines. We studied the taxonomic and ecological distribution of infected amphibian hosts along an elevational cline at the Eastern Andes of Colombia. Frogs were swabbed in the field, and a PCR protocol was standardized to test for the presence of Bd. Preliminary results from more than 170 specimens examined, showed that Bd was present at about half of the localities evaluated. About 25% of the frog species were positive for Bd presence, including species in the genus *Dendropsophus* (Hylidae), *Hyloxalus* (Dendrobatidae), *Pristimantis* (Brachycephalidae) and *Rheobates* (Aromobatidae). Importantly, most of these species are completely (*Pristimantis*) or partially (*Dendropsophus*, *Hyloxalus*, *Rheobates*) independent of water bodies for reproduction. In addition, although most infections were detected at middle-elevation localities, we added new records of Bd infections at elevations below 1000 m. Our results enrich generalized thoughts about the infection ecology of this pathogen fungus. The amphibian megadiversity of Colombia appear to be at a great risk, if the infection statistics we measured apply to other areas in the country.

Theme:*Batrachochytrium dendrobatidis*, chytrid, amphibians

Type of Presentation: Poster

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Evolution of Snakelike Body Form in Microteiid Lizards (Sauria, Gymnophthalmidae): Does Ecology Play a Significant Role?

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Limb reduction has occurred many times in the history of Tetrapods, and particularly in Squamates it is usually coupled with body elongation, which characterizes a snakelike body form. Evolutionary changes in morphological traits related to locomotion may directly affect the fitness of an organism, and therefore it is expected that such changes are associated with the environment where the organism locomotes. Lizards constitute one of the best models for studying the evolution of limblessness in Squamates because, differently from snakes and amphisbians, intermediate forms are abundant and range from pentadactyl lizardlike to limbless snakelike forms. Previous studies using phylogenetic statistical analyses suggested that body elongation in snakelike lizards evolves under two different ecological scenarios: while fossorial species exhibit longer trunks, surface dwellers exhibit longer tails. In this study we focus on tropical lizards that exhibit trends towards a snakelike morphology and test the hypothesis that fossorial species of Gymnophthalmidae lizards present trunk elongation, probably associated with loss of forelimbs, while species that locomote on the surface present tail elongation, possibly associated with hindlimb reduction. Moreover, we tested the hypothesis that evolution of limblessness in this family occurs following the sequence: 1) digit loss, 2) limb loss and 3) loss of girdle elements. We measured morphometric traits (snout-vent, tail, forelimb and hindlimb lengths, pelvic girdle height and width) in fixed specimens from 22 microteiid species available at the Museum of Zoology of the University of São Paulo (MZUSP). Additionally, x-rays were obtained to assess internal characters, as phalangeal formula and presence of limb bones and articulations. Data on the ecology and habitat of each species was obtained from literature. In order to remove body size effects, all variables were regressed against snout-vent length and residuals were calculated. None of the body-size corrected traits have shown statistically significant phylogenetic signal, which indicates that these traits may present increased evolutionary plasticity and are probably adaptive. Species from open habitats exhibit shorter tails when compared to species from closed habitats. Regarding the sequence of limb reduction, lineages where one of the limbs was reduced retain the girdle, limb bones and even phalanges in the other limb, suggesting that limb loss occurs gradually, rather than suddenly. Therefore, we conclude that evolution of snakelike body shape in microteiid lizards is strongly influenced by ecology and habitat, and a sequence of gradual reductions from distal to proximal elements cannot be detected simultaneously in hind and front limbs.

Theme: reptiles, lizards, ecology, natural history, morphology

Type of Presentation: oral, Symposium 4: Evolutionary Transitions of Body Shape in Extant Amphibians and Reptiles: Call for Integrative Approaches.

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Frog Conservation in Atlantic Rainforest of São Paulo (Brazil): A Comparative Study in Three Landscapes with Different Forest Cover

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Habitat loss and habitat fragmentation are considered as the major causes of species extinction and biodiversity loss, probably leading to amphibians population decline. Here we investigated the effect of habitat fragmentation per se and fragment size, on leaf-litter frog community in three fragmented landscapes (10 000 ha) with different percentage of habitat loss (50%, 70% and 90%), in the Atlantic plateau of São Paulo State, Brazil. Leaf litter frogs were sampled by a standardized protocol using pitfall traps at 50 forest patches, 15 to 20 patches in each landscape. For each landscape, six sites in adjacent continuous forests landscape were sampled. The fragmented and continuous landscapes have similar abiotic conditions. We used analysis of variance (ANOVA) and Tukey test to investigate if richness, total abundance and abundance of some frog species varied among landscapes, evaluating

also their variation among patch classes (continuous, large, medium and small fragments) in each landscape. Linear regressions were used to investigate the influence of patch size on frog community in each of the three landscapes. We captured 11838 individuals of 33 frog species; half of them occurred in all landscapes. Frog richness did not vary among three fragmented landscapes. Frog community seems to be sensitive to fragmentation in the two landscapes with elevated habitat loss (70 and 90%), because in these landscapes richness was higher in continuous forest than in fragments. On the other hand, frog richness did not vary between continuous and fragmented landscapes where habitat loss was 50%. Moreover, frog richness was not related with patch size (fragment area) in any of fragmented landscapes. In landscapes with higher habitat loss, frogs total abundance was smaller in fragmented than in continuous forest, but did not vary in the other landscapes. Linear regressions showed that frog total abundance was positively related to patch size in landscape with lower habitat loss, although there was no variation between its fragments and continuous forest. Our preliminary results highlight the importance of habitat amount for evaluating frog sensitivity to fragmentation and patch area reduction. Frogs seems to be particularly affected by fragmentation in those landscapes with lower forest cover. In these landscapes patches are usually more isolated and far from continuous forest, that could act as rescue source, increasing the effects of fragmentation.

Theme:amphibians, anurans, conservation biology

Type of Presentation: oral

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Material properties of the snake skin tested by nanoindentation

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The entire body of the Kenyan sand boa *Gongylophis colubrinus* (Squamata, Boidae) has to endure friction forces during locomotion in the sand. Such a continuous mechanical contact with a highly abrasive environment is presumably neutralized by some adaptations to wear resistance. It has previously been assumed that the integument of snakes consists of a hard, robust, inflexible outer surface (Oberhäutchen and β -layer) and soft, flexible inner layers (alpha layers). However, this hypothesis is entirely based on morphological and ultra structural data, whereas local mechanical properties of outer and internal integument layers have not yet been tested. The aim of this study was to compare material properties of the outer and inner scale surface of the exuvium of *G. colubrinus*, in order to test previous hypotheses about the contribution of the structure and chemical composition of the snake integument to its material properties. The nanoindentation experiments have demonstrated that the outer scale surface is harder and has a higher Young's modulus than the inner scale surface. The results obtained provide strong evidence about the presence of the a gradient in the material properties of the snake integument. This gradient might have the function of minimizing abrasion.

Theme:Snakes; Sand boa; Snake skin; Material properties; Nanoindentation

Type of Presentation: Poster

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Prynops geoffroanus thermoregulation behaviour in captivity

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Chelonians use basking behaviours to regulate their body temperature in many ways such as by choosing an environment with the appropriate level of solar intensity, remaining in or out of water, and adopting basking positions. Information about thermoregulation behaviour in Brazilian species is either not available or limited to qualitative data only. Quantitative observations are rare. This study verified the thermoregulation behaviour of 33 individuals of *Phrynops geoffroanus* at Fundação Zoobotânica de Belo Horizonte, in southwestern Brazil from February to November 2005, by quantitatively recording the behaviour of individuals during the day (from 8 am to 5 pm). We established four activity classes: 1) floating at the surface of the water, 2) submerged, in contact with the bottom of the pond, 3) on the edge of the pond, in a shallow area, or half outside the water, 4) out of water entirely. We also registered whether these activities occurred in direct sunlight or in shade. An animal was considered performing a basking behaviour when: it displayed its neck and/or limbs extended, rested its head on the shell of another animal, or stayed on the top of others shells. The behaviour displayed by each individual was recorded by scan sampling every 30 minutes. Pond water temperature, ground temperature next to the pond, air temperature, and the number of persons who visited the enclosure were also recorded to test if they disturbed the behaviours observed. We found that the number of turtles floating did not change during the day. The number of individuals that were basking increased with the air temperature throughout the day and in different seasons of the year. The number of basking individuals in shade was high; however this was probably due to poor solar radiance in the enclosure. The number of people visiting the area probably did not affect the proportion of individuals out of water or basking. These results indicate that captive *P. geoffroanus* try to increase their body temperature throughout the entire year in the enclosure by moving out of water at the hottest time of day when the temperature of the air becomes higher than the water.

Theme:reptiles, turtles, behaviour

Type of Presentation: _Poster_contributed_

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The Evolution of Caudal Autotomy and Displays in the Phrynosomatine Sand Lizards of the North American Southwest

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The North American sand lizards (the Phrynosomatinae of the family Phrynosomatidae, including *Uma notata*, *U. scoparia*, *U. inornata*, *U. exsul*, *Callisaurus draconoides*, *Cophosaurus texanus*, *Holbrookia maculata* and *H. propinqua*) are restricted to arid regions, share diurnal insectivorous habits, and are found in similar habitats. All of these lizards possess the ability to autotomize the tail as a defensive measure if attacked by a predator. However, only *Callisaurus draconoides* and *Cophosaurus texanus* exhibit an unusual wagging display of their ventrally banded tails, thought to deter predatory pursuit. Morphological data were taken from >2000 museum specimens representing all eight species, across their geographic ranges. Additionally, I conducted behavioral trials in the field, wherein *Callisaurus draconoides* were tested for response to predatory approaches and the populations surveyed to determine the local frequencies of caudal autotomy. The combined data

indicate that both tail bands and the tail wagging display correspond with high rates of caudal autotomy (22.5% of lizards in these species, compared to 8.7% in non-banded, non-displaying species). Based on the most recent and best-supported phylogenetic hypothesis, these data suggest that tail banding arose in the ancestor to the sand lizard clade, followed by the evolution of the tail display after the divergence of *Uma*. Both of these traits would have been subsequently lost within the *Holbrookia* genus after the divergence of this lineage from its sister clade, *Cophosaurus*.

Theme: lizards, desert, ecology, antipredator, evolution

Type of Presentation: oral contributed

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Population Structure, Morphometric Variation and Sexual Dimorphism of *Rhinoclemmys nasuta* (Testudines: Geoemydidae) from Two Localities on the Colombian Pacific Coast

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A population study of *Rhinoclemmys nasuta* was conducted in 2007 on Isla Palma and Playa Chucheros, two sites located in Bahía Málaga, along the Colombian Pacific coast (Fig. 1). Sexual dimorphism and morphometric variation between the two populations was evaluated based on 35 body measurements (Fig. 2). Three samples were made at each locality at monthly intervals by hand capture during intensive surveys of small streams. On Isla Palma, a 0.60 ha area was censused resulting in 203 individuals captured. Population size was estimated as 862 individuals (CI, 560 to 1368) with a density of 0.03–0.14 ind m⁻². At Playa Chucheros, a 0.28 ha area was sampled with 31 individuals captured for an estimated population size of 120 turtles (CI, 44 to 440) and a density of 0.011–0.043 ind m⁻². The structure of the population on Isla Palma was 38% juveniles, 36% females and 26% males; while at Playa Chucheros it was 29% juveniles, 45% females and 26% males. There were no significant differences in measurements between individuals from the two localities ($P > 0.05$). Although it was hypothesized that significant differences in the size of males and females between localities might exist due to selective exploitation by the inhabitants of Playa Chucheros (vs. no exploitation on Isla Palma), possibly the habitat use (small streams) and nocturnal activity period of *R. nasuta* significantly reduces the probability of capture for human consumption. Nevertheless, among the body measurements selected, significant differences were detected between males and females in all but the post-vent tail length (Mann-Whitney, $P = 0.32$). With a discriminant function analysis, 6 variables were found to be significant in distinguishing males from females (Table 1). This species is consistent with the pattern of females being the larger sex in aquatic turtle species, which can probably be related to the age of sexual maturity and different life history strategies between the sexes. The sexual dimorphism is accentuated in the structures involved in copulation and oviposition.

Theme: turtles, ecology, natural history, morphology

Type of Presentation: oral contributed

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The tails of two geckos tell the story of dispersal in a fragmented landscape

Although habitat loss and fragmentation threaten species throughout the world and are a major threat to biodiversity it is apparent that some species are at greater risk of extinction in fragmented landscapes than others. Identification of these species and the characteristics that make them sensitive to habitat fragmentation has important implications for conservation management. Here, we present a comparative study of the population genetic structure of two arboreal gecko species (*Oedura reticulata* and *Gehyra variegata*) in fragmented and continuous woodlands. The species differ in their level of persistence in remnant vegetation patches (the former exhibiting a higher extinction rate than the latter). Previous demographic and modelling studies of these two species have suggested that their difference in persistence levels may be due, in part, to differences in dispersal abilities with *G. variegata* expected to have higher dispersal rates than *O. reticulata*. We tested this hypothesis and genotyped a total of 345 *O. reticulata* from twelve sites and 353 *G. variegata* from thirteen sites at nine microsatellite loci. We showed that *O. reticulata* exhibits elevated levels of structure ($F_{ST} = 0.102$ versus 0.044), lower levels of genetic diversity ($H_e = 0.79$ versus 0.88), and fewer misassignments (20% versus 30%) than similarly fragmented populations of *G. variegata*, while all these parameters were fairly similar for the two species in the continuous forest populations ($F_{ST} = 0.003$ versus 0.004, $H_e = 0.89$ versus 0.89, misassignments: 58% versus 53%, respectively). For both species, genetic structure was higher and genetic diversity was lower among fragmented populations than among those in the nature reserves. In addition, assignment tests and spatial autocorrelation revealed that small distances of about 500m through fragmented landscapes are a barrier to *O. reticulata* but not for *G. variegata*. These data support our hypothesis that *G. variegata* disperse more readily and more frequently than *O. reticulata* and that dispersal and habitat specialization are critical factors in the persistence of species in habitat remnants.

Theme: lizards, reptiles, ecology, genetics, conservation biology, endangered species

Type of Presentation: Oral

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Southern African Reptile Conservation Assessment: Taking Stock of a Rich Reptile Fauna

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The Southern African Reptile Conservation Assessment (SARCA) is the first faunal project of the South African National Biodiversity Institute (SANBI). SARCA is a collaborative initiative between southern African herpetologists, the Herpetological Association of Africa (HAA), national museums, universities and various conservation bodies. The project was launched in May 2005, and will culminate in the publication of an atlas and revised Red Data book for the reptiles of South Africa, Lesotho and Swaziland in 2009. The main objective of SARCA is to update the conservation status of the region's reptiles by means of 1) a conservation assessment of all species according to IUCN criteria, to guide conservation effort in the region; 2) directed field surveys to improve our understanding of the diversity and distribution of the reptiles of South Africa, Lesotho and Swaziland; 3) public (citizen scientists) participation to assist with the atlas component by means of an online Virtual Museum; 4) collated distribution records from museums and literature to establish an exhaustive database that will serve as a baseline for future reptile monitoring. Here we report on the results after 80% completion of the project. A total of 300 days, spread over three summer seasons, were spent conducting field surveys in priority areas, with >4220 records accrued during this period. The surveys were conducted with the assistance of 58 volunteer field workers. Records from museums, conservation agencies, private collections and literature totals about 115000, and Virtual

Museum submissions from the public to date stands at 5000 records. Collectively this is the largest database of southern African reptile distribution records. Interim species distribution maps for each of the 420 reptile taxa from the region are available on the SARCA website (<http://sarca.adu.org.za>), and a group of authors is currently preparing conservation assessment species accounts for each of these.

Theme:reptiles, conservation assessment, atlas, South Africa, Lesotho, Swaziland

Type of Presentation: Oral, Symposium 8: Herpetological Conservation & Biology

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Frog Cocktail Parties

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The difficulty we experience in understanding speech in multi-talker environments is aptly named the “cocktail party problem”. The healthy human auditory system is able to ameliorate or overcome this problem by exploiting spectral, temporal and spatial properties of masking noise and interfering sounds. Compared to people with healthy auditory systems, however, both the hearing impaired and computer algorithms for automated speech recognition perform poorly in speech recognition tasks in noisy social environments. A better understanding of the evolved mechanisms for hearing in noisy environments might shed light on ways to improve hearing prosthetics and computer algorithms for speech recognition. Many non-human animals acoustically communicate in social environments that represent biological equivalents of the human cocktail party problem. Frogs are perhaps one of the best known systems in this regard. Male frogs commonly form dense aggregations from which they loudly call to attract mates; female frogs must detect, recognize, localize, and discriminate among males amid the cacophony of such a breeding chorus. Hence, frogs, might serve as particularly good model systems for investigating biological equivalents of the human cocktail party problem. In our lab, we are interested in understanding the mechanisms and biological implications of auditory masking and “release” from masking in North American treefrogs. In controlled laboratory studies, we have shown that masking by “chorus-shaped noise” (i.e., noise with the long-term spectrum of a breeding chorus) impairs signal perception in the following ways: (1) masking increases the signal-to-noise ratio (SNR) at which females first behaviorally respond to a male’s calls, implying a decrease in signal active space in a chorus; (2) masking impairs the ability of females to discriminate between conspecific and heterospecific calls, implying a disruption of acoustically mediated species recognition in a chorus; and (3) masking can attenuate and even reverse the direction of a female preference for longer calls, implying a reduction in the strength of sexual selection by female choice in a chorus. However, all is not lost! Like human listeners at a cocktail party, female treefrogs appear able to exploit spatial and temporal features of the “acoustic scene” of a breeding chorus to improve signal perception. In particular, our results support the hypothesis that, as in humans, frogs can exploit correlations in temporal modulations of masking noise and spatial separation between signals and noise to improve signal perception under noisy conditions.

Theme:amphibians, anurans, reproduction, behaviour

Type of Presentation: oral, Symposium 3: Sensory Ecology of Anuran Communication

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Phylogeny and Classification of Caecilian Amphibians

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Since Ronald Nussbaum's pioneering cladistic analysis based on morphological data there have been many advances in our understanding of caecilian phylogeny resulting from both the use of sequence data and surveys of additional morphological systems. I review this substantial progress and present a synthetic generic level phylogeny of caecilians, highlighting problematic taxa and areas most in need of additional work. I discuss the relationship between caecilian phylogeny and the higher, familial-level classification of caecilians. Sampling of caecilians for molecular phylogenetics is patchy, and although improving as a result of dedicated and targeted fieldwork, is likely to remain so at least in the short term. I discuss possible ways forward, including the use of supertree and supermatrix methods that could facilitate the synthesis of morphological and molecular phylogenetics that will be needed to produce a comprehensive species level phylogeny of caecilians. I also discuss the rate of discovery and description of new caecilian species and other taxonomic actions and the impact these are expected to have on our understanding of the caecilian tree of life.

Theme: phylogeny, taxonomy, caecilians

Type of Presentation: oral -contributed

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Evolutionary reproductive biology of caecilian amphibians

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Although it has been appreciated for a long time that caecilians have a high diversity of reproductive modes, recent discoveries based on dedicated fieldwork and studies in the laboratory have revealed new and distinctive reproductive strategies. Notable among these is the discovery that some oviparous direct developing caecilians have extended parental care in which the epidermis of attending females is hypertrophied and heavily invested with lipids and the young peel and eat the maternal stratum corneum. Here I summarise knowledge of caecilian reproductive diversity including many new observations. I present a simple model relating the different life history strategies and investigate the adequacy of this model by mapping reproductive diversity onto phylogenetic trees. I also discuss the ancestral caecilian reproductive mode and its significance for understanding the evolution of amniotes.

Theme: caecilians, behaviour, reproduction

Type of Presentation: oral, Symposium 4: Evolutionary Transitions of Body Shape in Extant Amphibians and Reptiles: Call for Integrative Approaches.

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Thermal Biology Constraints In Oviparous Lizards From Southern Patagonia, Argentina: Intraspecific Comparison of *Liolaemus bibronii* Populations.

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Geographic variation strongly influences the thermal ecology of terrestrial vertebrate ectotherms and, in particular, their body temperatures and activity levels. The quality of the thermal environment for ectotherms generally declines with elevation and latitude, and it is strongly influenced by maritime versus continental climates. In northwestern Patagonia, Argentina, the climate is dry and cold with intense westerly winds, snow in winter, and freezing temperatures most of the year with lizards found active during spring and summer. The thermal biology of one of the southernmost oviparous lizards, *Liolaemus bibronii*, was studied at high and low-latitude sites in Patagonia, Argentina, following the methodology of Hertz et al. (1993). For further comparisons, previously published data of field and selected body temperature of 33 oviparous and 22 viviparous populations of *Liolaemids* were analyzed. *Liolaemus bibronii*, as one of the southernmost oviparous lizards, showed the lowest field body temperature ($T_b = 28.11^\circ\text{C}$) among oviparous *Liolaemids*, but a higher T_b than the southernmost viviparous lizard in the world: *Liolaemus magellanicus* (27°C). In addition, the T_b of *L. bibronii* was lower than the selected body temperature (T_{sel}) in both populations. The micro-environmental and operative temperatures (T_e) were lower in the South showing that *L. bibronii* lives under thermal-environmental constraints especially at the higher-latitude site. There were differences in the average degree to which T_e matches the set-point range (central 50% of the distribution) of T_{sel} (d_e , southern= 12.15; d_e , northern= 9.62) indicative of a higher thermoregulation effort in the southern population. The analysis of the average degree to which T_b was included in the set-point range of T_{sel} (d_b), lower than the corresponding d_e , indicates an active selection of the microhabitats used by *L. bibronii* and confirms the presence of thermoregulatory behaviours in both populations. The effectiveness of temperature regulation [$E = 1 - (\text{Mean } d_b / \text{Mean } d_e)$] shows that *L. bibronii* behaves as a moderate thermoregulator. Comparison with the rest of the genus *Liolaemus* did not show differences in either T_b or T_{sel} between oviparous and viviparous populations suggesting a conservative character in the thermal biology for the genus. However, the comparative analysis of T_b versus T_{sel} of *Liolaemids* strongly suggests that oviparous species are poorer thermoregulators than viviparous species. Accordingly the low T_b and the thermoregulation effort of oviparous *L. bibronii* living at latitudes up to 50°S , suggest that southern species counteract the thermal constraints imposed at high latitudes, by being viviparous.

Theme: Lizards, *Liolaemus*, oviparity, thermoregulation, Patagonia.

Type of Presentation: Poster

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Measuring Temporal Variation of Calling Intensity of Anuran Choruses

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Large choruses composed by a large number of anurans produce a complex acoustic environment. Especially in tropical habitats the choruses of anuran communities can be induced by many species with a high differentiations in frequency, call structure, and loudness. The calling intensity of those frog congregations can be very high especially after heavy rain falls. However, aside from precipitation, calling activity and chorusing behaviour can be influenced by various factors (e.g. time of sunset, moon illumination, or water level of the breeding site), many of them still not well understood. In a case study, I measured variation in calling activity with a portable data logging sound level meter in a chorus composed of up to 10 species in the Chiquitania, Bolivia. Variation in sound level showed a diel temporal activity pattern consisting of specific phases with peak of activity

between about 20:30 h and 0:00 h, and sound pressure level of the full choruses was significantly higher after heavy rain fall. In combination with other instruments (e.g. temperature data logger), this easy technique has potential for field studies concerning various aspects of the biology of frog choruses, such as chorusing behavior, temporal variations, and its influencing parameters. Perhaps most important, data from that method can be used to develop standardized monitoring programs and to optimize effectiveness, e.g. in determination of the optimal survey window and times of day.

Theme: amphibians, anurans, behavior, community ecology

Type of Presentation: _Poster_contributed

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Species richness and composition of herpetofaunal assemblages in the Chiquitano region, Bolivia

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Bolivia is a megadiverse country whose territory extends across many of the major typical South American landscapes and eco-regions. Although the inventory and analysis of Bolivia's biodiversity has progressed substantially in the past few decades, the continuously high rates of new species discoveries and descriptions from this country show that our knowledge of its species diversity, let alone species distribution and zoogeography, is still fragmentary. To identify additional hotspots of biodiversity and endemism in Bolivia and to study the biogeographical affinities of their amphibian and reptile communities, I conducted field surveys and taxonomic studies in six major eco-regions. These include the first comprehensive herpetological surveys in endemic Tucuman-Bolivian Forest, endemic Chiquitano Dry Forest, and Bolivian Pantanal. The highest species richness was documented at two sites in the Chiquitano region in the eastern lowlands of Bolivia: San Sebastián with currently 37 amphibian and 58 reptile species, and Caparú with 43 amphibian and 45 reptile species. San Sebastián consists of endemic Chiquitano Dry Forest and Cerrado Savannas. Caparú is characterised by a complex overlap of diverse lowland ecoregions on a small geographic scale, such as Chiquitano Dry Forest, Amazonian Rainforest, seasonally inundated Pampa, and Cerrado with seasonally inundated gallery forest. The latter is the noteworthy habitat of the only endemic frog species recorded so far from this region, the recently described *Hydrolaetare caparu*. Preliminary analyses of the anuran communities of the Chiquitano region show a composition mainly of Savanna and Cerrado species followed by Amazonian, widespread and Chacoan species, both of the latter forming the smallest part of the assemblages. The results of my study highlight the great conservation value of the largely understudied Chiquitano region whose biogeographically outstanding location between the Amazonian region, the Gran Chaco and the Cerrado has resulted in highly diverse communities and peculiar habitat types.

Theme: amphibians, reptiles, community ecology, taxonomy

Type of Presentation: oral_contributed

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Molecular Phylogeny and Biogeography of Two Species of the Genus *Plestiodon* (Reptilia: Scincidae) from the Ryukyu Archipelago, Japan

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From Japan, seven species and one subspecies of the genus *Plestiodon* (formerly *Eumeces*) are recognized. Of these, the Ryukyu five-lined skink *P. marginatus*, forming the *latiscutatus* species group together with most other Japanese species, shows an extraordinary distribution, ranging in both the Central and Northern Ryukyus across the Tokara Tectonic Strait. This Strait is thought to have consistently been interrupting the dispersals of terrestrial animals since its initial formation in the Miocene, becoming one of the most distinct borders between the Oriental and Palearctic faunal realms in the Ryukyu region. Recent distance analyses of allozyme data yielded relationships among the *P. marginatus* populations that are not consistent with their geographic arrangement, or with generally accepted subspecific classification of the species. On the other hand, the Kishinoue's blue-tailed skink *P. kishinouyei*, the only Japanese member of the *chinensis* species group of the genus, is widely distributed in the Southern Ryukyus. For this species, nothing is known of variation in, or relationships among, its island populations. We attempted to infer phylogenetic relationships among populations in each of *P. marginatus* and *P. kishinouyei* by analyzing data for approximately 800 base positions of the mitochondrial 12S and 16S rRNA genes. The results indicated that *P. marginatus* populations of the northern Central Ryukyus, all assigned to a subspecies *P. m. oshimensis*, are collectively divergent from the remainder including other consubspecific populations of the Central Ryukyu (represented by Okinoerabujima) and Northern Ryukyu (Nakanoshima) populations. The Nakanoshima population was shown to be closest to populations of *P. m. marginatus* from Okinawajima of the southern Central Ryukyus rather than to geographically much closer consubspecific populations of the northern Central Ryukyus. These results are concordant with the results of the allozyme study and support an idea that the Nakanoshima population has recently originated through direct long distance dispersals from the southern Central Ryukyus, crossing the sea along the northern half of the Central Ryukyus, as well as Tokara Tectonic Strait. On the other hand, our results confirm close affinity of *P. kishinouyei* with *P. chinensis* from Taiwan and continental China, but failed to confirm monophyly of the latter species, which showed a considerable genetic divergence within Taiwan. In contrast, *P. kishinouyei* exhibited almost no genetic variation throughout its range in the Southern Ryukyus. Such almost thorough uniformity suggests recent occurrences of strong bottlenecks accompanying extreme confinement of the range and subsequent rapid dispersals in this species.

Theme: reptiles, lizard, Scincidae, *Plestiodon*, phylogeny, biogeography, East Asia, Japan, Ryukyu Archipelago

Type of Presentation: oral

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Status and causes of decline in heterochronic newts from Europe

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Although amphibian declines are well documented, almost nothing is known on the status of intraspecific variation such as polyphenisms. Facultative paedomorphosis is an obvious example of alternative developmental pathway in caudates with paedomorphs that retain gills at the adult stage and metamorphs that undergo metamorphosis from the larval or paedomorphic stage. Our aim was to compare past and present data of dimorphic populations of four newt species (*Mesotriton alpestris*, *Lissotriton vulgaris*, *L. helveticus*, and *Triturus macedonicus*) in the two main European hotspots for this process: Larzac (France) and Montenegrin karst region, but also to determine the possible causes of declines. Paedomorphs of the three most common species were extirpated after fish introduction. *T. macedonicus* in which the heterochronic pattern is rare, disappeared in one of the sites. Fish appears as the main determinant of paedomorph absence and extirpation when considering alternative possible environmental factors. The introductions occurred mainly in the largest water bodies, which used to be inhabited by the most important populations. This is the case for high altitudinal lakes originally occupied by paedomorphs of *M. alpestris*, including possible differentiated populations. In some sites, metamorphs remained present or reappeared after fish extirpation, but not paedomorphs. A second cause of the decline is habitat destruction or alteration. It was mainly documented in Larzac where some ponds were destroyed for urban projects or were not repaired, then unable to retain water. If urgent measures are not taken soon, an important kind of diversity will become anecdotic or even disappear. We strongly recommend the integration of polyphenisms into the legislation to help the conservation of rare morphotypes within common species.

Theme:amphibians, salamanders, ecology, natural history, conservation biology, predator-prey

Type of Presentation: Oral, Symposium 8: Herpetological Conservsation & Biology

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A review of diet and toxicity in a tropical poison frog

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Our research program has focused on understanding feeding in dendrobatid frogs and the links between toxicity and diet in this group. Daly and Myers observed variations in alkaloid profiles from single sites across time. Donnelly reported variation in feeding and variation in prey availability across space and time. Donnelly suggested that the variations observed by Daly and Myers might be associated with feeding. Daly rejected that argument because it was thought that the frogs manufactured alkaloids. The fact that captive animals lost toxicity, and captive animals could not be induced to produce an alkaloid-based defense led Daly to study the role of diet in toxicity in *Dendrobates auratus*. Frogs were divided into groups and fed two diets: a lab diet and a “natural” diet; the frogs eating “natural prey” had alkaloid profiles that were similar to that of wild-caught animals whereas the lab-diet animals did not. Daly and Donnelly traveled to Panama to try and discover the source of dendrobatid alkaloids. They found dendrobatid alkaloids in methanolic extracts of litter arthropods but were not able to identify conclusively the sources of the alkaloids. We refined our collection techniques and to date have discovered sources for a variety of alkaloids. We will summarize our major findings that describe variation in diet and alkaloid defense for *Oophaga pumilio* in lower Central America.

Theme:toxicity, diet, dendrobatid, *Oophaga pumilio*

Type of Presentation: oral, symposium 13: Sequestered Defensive Compounds and Other Defensive Tactics in Tetrapod Vertebrates.

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Preliminary data on the natural history of *Stenocercus quinarius* (Sauria, Tropiduridae) from Peruaçu valley, MG.

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Stenocercus quinarius is a recently described species from the Cerrados of Brazil. It was formerly known only from small patches of carrasco vegetation (a woody shrub like vegetation) within Cerrado domain and none was known of its natural history. Here we describe some aspects of the natural history of a population of *Stenocercus quinarius* from the Peruaçu valley, Minas Gerais state, Brazil, we also increase its distributional range, and the knowledge of its morphometrics and meristics data. Two new records of *S. quinarius* expand its distribution northwards to the northern portion of the “Chapadão Ocidental” of Bahia state, and eastwards to Peruaçu valley. At Peruaçu four habitats were sampled, with pitfall traps, between 6 and 25 January 2008: dry forest, sandy cerrado, rocky cerrado and carrascos. The carrascos accounted for 54% of the captures followed by rocky cerrado (23%), sandy cerrado (15%) and dry forest (0.08%). This shows that *S. quinarius* is widespread through all the sampled habitats, but much more abundant at the carrascos. This high capture frequency was higher than already reported, for other small patches of this habitat, probably due the large area covered by this habitat at this locality, which may harbor a larger population. Their body temperature was found to be correlated to that of air, slightly not correlated to that of soil, and slightly not different from both of them. But as the *n* is still very low, it is still difficult to have a robust conclusion on its thermal ecology. Sexual dichromatism and dimorphism are evident. Females are reddish and males yellowish; females also have a significantly larger SVL than males, all other morphometric and meristics measurements were not significantly different between sexes. We suspect that female body elongation may be associated with space to accommodate a high number of eggs, which occupy a large amount of its abdominal cavity. *S. quinarius* is a non aggressive species, hardly try to bite, and is a lazy runner. When handled they try to open space forcing with its “horns”. These preliminary results improve the knowledge on this poorly known species, we hope to achieve more robust conclusions on an additional year of field observations.

Theme: *Stenocercus quinarius*, natural history, “carrasco”, dry forests, distribution, lizards

Type of Presentation: Poster

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"Should I stay or should I go?" - Site fidelity and long-term movement in *Allobates femoralis*

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Territorial animals repeatedly have to decide whether the place they once chose for living is still the best place to be. Several factors, ranging from direct competition over reproductive success to habitat heterogeneity and costs for repeated territory establishment, influence these decisions. An extensive theoretical framework on the topic has been developed, mainly based on observations in birds. While territorial behaviour is well described in Dendrobatids, previous studies lack detailed analyses of long term movement and site fidelity over several reproductive seasons. Here we present the results of a 4-year study in a population of the pan-Amazonian species *Allobates femoralis* in the Nouragues Nature Reserve, French Guiana. In 1128 observations of 191 males and 68 females in a study area of

two hectares we could ascertain site fidelity of males and females during the reproductive season. Between years, recaptures of 28 males and 10 females revealed that females do not disperse after the reproductive season whereas males abandon their territories and have to re-negotiate them when reproduction starts again at the onset of the rainy season. Individuals recaptured in two consecutive years corroborate the conclusions drawn from the observations of one-year survivors. Observed male long-term movement corresponds with juvenile dispersal from known tadpole deposition sites and is influenced by the mechanisms that act during territory establishment at the onset of the breeding season. Long-term pair bonding was observed in some cases with the same partners occupying identical territories like in the year before.

Theme: Aromobatidae, *Allobates femoralis*, territoriality, site fidelity, movement

Type of Presentation: Oral, Symposium 11: Dendrobatoid Frog Biology.

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Infestation of (*Podocnemis unifilis*) Nests by Diptera Larvae

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During the reproductive season of (*Podocnemis unifilis*) (*Chelonia*, *Podocnemididae*) in 2007/2008, at the Biological Reserve of Trombetas River, Pará State, Brazil, we observed the presence of insect larvae in nests. Apparently these larvae were feeding on moribund and/or dead hatchlings and on non-fecundated or non-developed eggs. This kind of infestation, known to be caused by flies of the *Sarcophagidae* family (*Insecta*: *Diptera*) – and possibly by individuals of the *Phoridae* family –, has been registered in nests of other chelonian species, such as: (*Chelonia mydas*, *Caretta caretta*, *Rhinoclemmys pulcherrima* and *Graptemys pseudogeographica*). Despite these data, little is known about the pressure of predation by fly larvae on chelonians. Knowledge about Amazonian *Diptera* is still fragmentary and the published catalogues for the Neotropical region mention only a few records. The objective of this study was to register the predation frequency by fly larvae on the Amazonian chelonian species *tracajá* (*P. unifilis*) and identify the predatory species. The study was conducted at Gorda Beach (1º20'50"S; 56º41'30"W), located at Erepecu lake, Biological Reserve of Trombetas River, between September 2007 and January 2008. Larvae from several natural and transferred nests were collected for to rear to transformation; 168 adults emerged and they were sent to the National Museum of Rio de Janeiro for identification. From the day they were collected to the day adults emerged an average of 18 days elapsed. From the adults identified, 9,5% belonged to the *Sarcophagidae* family: 13 representatives of *Argoravina rufiventris* and three individuals of two unidentified species (*sp.1* and *sp.2*). The remaining individuals (90,5%) were identified as *Synthesiomyia nudiseta*, (*Diptera*, *Muscidae*). From the 58 natural nests sampled, 13,8% were infested (seven eggs, nine hatchlings predated in the egg, five hatchlings predated and killed, and seven hatchlings infested, but still alive). Among the 42 transferred nests, 83,3% were infested (25 eggs, 127 hatchlings attacked in the egg, 39 hatchlings preyed upon and killed, and 32 hatchlings infested, but still alive). The flies could have been attracted by the smell which female turtles expel during egg

laying as well as by the eggs during incubation period. Or the odor given off when hatchlings pip the eggs or sounds they produce after pipping. There might have been an effect of the nest aggregation on beaches due to nest transference and also by the annual variation of environmental conditions. With their identification specific studies about the biology and ecology of the predatory species, measures to mitigate and methods of control and minimization of infestation are possible, especially where nest transference occurs.

Theme: Chelonia, infestation, larvae, nests, hatchlings

Type of Presentation: Poster

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Reproduction In Reptiles: From Genes To Ecology - Introduction

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Now is the time to provide an integrative synthesis for the many independent studies on reproduction in reptiles, which is the aim of this symposium. Disparate disciplines in reproductive biology are rapidly being unified by molecular biology and ecology, all within a robust evolutionary framework. The 6WCH is one of the few conferences where presentations from across a range of disciplines can be made in a single symposium. By bringing together investigators who all work on different aspects of reproduction in reptiles, we hope that new research directions and collaborations will form directly from the symposium. Past symposia have focused on narrow aspects of reproduction (e.g. viviparity, TSD, morphology), but now is the time to bring them together in a way that may stimulate new ideas and research collaborations. A recent example is the linking of viviparity and temperature-dependent sex determination (TSD) with ecology, in the context of global climate change. Research on reproduction in reptiles is occurring widely, as indicated by the range of speakers in the symposium, with presentations based on work from ten countries on six continents and which encompass morphology, physiology, ecology, molecular biology, immunology and cell biology. As many of the presentations are already cross-disciplinary, their grouping into theme areas was difficult. At best, we have a loose arrangement running from molecular biology and temperature-dependent sex determination through detailed embryological studies and evolution of viviparity to broader ecological work. The symposium will conclude with a paper that provides a synthesis of reproductive biology which will help identify future potential cross-disciplinary areas of investigation.

Theme: Reproduction, lizards, snakes, turtles, molecular biology, cell biology, physiology, morphology, ecology, cross-disciplinary research

Type of Presentation: Oral, Symposium 1: Reproduction in reptiles: from genes to ecology

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Reducing the risk of herpetological invasion: creating incentives for private owners to do the right thing

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Non-native amphibians and reptiles are an increasing conservation, ecological, and economic challenge. One of the more urgent sources of new invasive herpetofauna is the pet trade, through both intentional releases and accidental escapes from private owners. How to create a system that gives private owners and pet stores incentives to behave responsively, without being so onerous that it curtails pet ownership, is a challenge. Many of the standard policies that can be employed for industries likely to create environmental hazards are not easily applied in this situation. Unlike the chemical industry, for example, herpetoculture typically involves relatively small and diffuse operations by enthusiastic laypersons, making adequate prevention and first response programs more difficult to realize at a uniform standard. We propose a two-prong program that 1) enrolls pet store operators and private owners to help reduce the risk; and 2) uses a targeted fee similar to an insurance program to finance an adequate first response protocol for escapes and releases. After an initial public expense to establish the system has occurred, a careful structuring of incentives encourages store owners and herpetoculturists to become part of an invasive species control system.

Theme: conservation biology; policy; invasive species; economics

Type of Presentation: Oral, Symposium 2: Invasive Reptiles and Amphibians: Global Perspectives and local solutions

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Geographical Variation in Egg-eating Snakes of the Genus *Dasypeltis* in Africa south of Latitude 12° S

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Geographical variation in scalation and colour pattern was investigated in a genus of egg-eating snakes (*Dasypeltis*) in Africa south of 12° S latitude, based on the examination of over 700 museum specimens. At least five currently recognized species of *Dasypeltis* occur in the region. *D. scabra* is widespread in sub-Saharan Africa and varies considerably with regard to colour and dorsal pattern. For example, although usually grey with darker rhombic markings, reddish, poorly marked individuals occur in Zimbabwe, Zambia and Malawi. In addition, ventral and subcaudal counts tend to decrease from north to south in this species. The recently described *D. confusa* from West Africa occurs much further south than previously documented, extending into Angola and adjacent Zambia. It is characterized by linked vertebral and lateral markings. *D. palmarum* occurs from Gabon to coastal Angola and has a plain or sparsely marked dorsum. Coloration in *D. medici*, restricted to the eastern part of the continent, is very variable and the occurrence of specimens with very low ventral and subcaudal counts in the South African province of KwaZulu-Natal means that the northern subspecies *D. m. lamuensis* is of doubtful validity. The long-tailed, plain brown *D. inornata* is restricted to Swaziland and eastern South Africa. A disjunct population of this species in Limpopo Province has low subcaudal counts and its status is under investigation. Grassland populations in the South African provinces of Free State, Gauteng and North West, previously identified as *D. scabra*, may represent a distinct taxon (Species A). Specimens are dwarfed, have reduced numbers of ventrals and subcaudals, and differ in terms of head scalation, with sympatric occurrence of rhombic and plain (grey-brown) specimens. A population in the Northern Cape Province of South Africa has evolved into a short- and round-snouted form with a reduced rostral scale, very low subcaudal counts and brown to reddish coloration (Species B). In most parts of their range egg-eaters mimic venomous snakes of the genera *Causus*, *Bitis* and *Echis*.

Theme:reptiles, snakes, Dasypeltis, taxonomy, morphology, Africa

Type of Presentation: Oral

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Assisted Reproductive Technologies for Endangered Amphibians

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The phenomenon of global amphibian decline has received widespread coverage, and it is now accepted that disappearance and declines of species and populations have occurred on several continents. Empirical evidence links the cause of these declines to a virulent pathogen and/or global climate and atmospheric changes. We have investigated the role of Assisted Reproductive Technologies to prevent loss of species and population genetic diversity because in the short-term it is not possible to mitigate these impacts. Our objective was to construct a genome bank and develop a range of technologies to reconstitute species and populations. Methods to non-invasively collect viable sperm and eggs using hormone injections were investigated for a range of species and standard protocols developed. Methods for the successful cryopreservation of sperm were also developed. Cryopreservation of eggs or embryos has not been successful, and we consider this barrier may not be easily overcome. This led to current investigations of means to cryopreserve diploid stem cells and options to reconstitute individuals without the female pronucleus. Two possibilities are being investigated. The first uses cloning. The second involves androgenesis which relies on reconstitution of a diploid individual from only the male germ cell line.

Theme:Endangered amphibians. Assisted Reproductive Technology. Cryobiology. Gene banking

Type of Presentation: Oral

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Vibrational Signaling in the Male-Male Agonistic Interactions of Red-Eyed Treefrogs

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Anurans have been extremely productive models for the study of animal communication. Most of this work has centered on acoustic signals. However, we are beginning to realize that frogs use a wide range of sensory modalities, often in conjunction, to convey information. The evolutionary trajectories of signaling systems are shaped by selective pressures unique to each modality. Therefore, in order to fully appreciate the structure, function, and evolution of communication systems, we must consider the full range of sensory modalities employed by signalers. Substrate vibrations have received particularly little attention, which is surprising given the remarkable sensitivity of frogs to vibration. We are exploring the use of vibrational information by the red-eyed treefrog, *Agalychnis callidryas*. Red-eyed treefrogs inhabit low to mid-elevation wet forests from the Yucatan through Panama. Males call to attract females from the vegetation surrounding ponds, and in dense populations, competition for mates is fierce. Males defend their calling sites using a wide variety of agonistic displays, including several putative vibrational signals. During one of these displays, males rapidly extend and contract their hindlimbs, shaking their bodies and the plant substrate. This tremulatory display excites strong, stereotyped substrate vibrations (~12 Hz, constant amplitude) that propagate to other males. Through a series of behavioral observations, staged contests, and vibration and visual playback experiments, we have demonstrated that the vibrational

component of this tremulatory display serves an important role in transferring information during aggressive encounters. While putative vibrational signals have previously been identified both in arboreal frogs and chameleons, this work represents the first clear demonstration of vibrational signaling by an arboreal vertebrate. The arboreal environment is rich with vibrational information however, and substrate recordings reveal that every movement made by an arboreal animal, predator or prey, excites vibrations that propagate through the plant. In addition, vibrations may be a relatively secure communications channel for signalers that do not wish to broadcast their presence to predators or competitors on nearby but noncontiguous plants. Thus, vibrational information likely plays important roles in the behavior of a wide range of arboreal taxa.

Theme: anurans, amphibians, behaviour, reproduction, ecology, natural history,

Type of Presentation: oral, Symposium 3: Sensory Ecology of Anuran Communication

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Multiple Pathways for Invasion of Anurans on a Pacific Island

Michelle Christy

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Since 1937, 13 species of non-indigenous anurans have made their way to Guam. Of these, at least six have established breeding populations. Various pathways led to the introduction of these species to the island. The only anuran intentionally introduced was *Chaunus marinus* (formerly *Bufo marinus*), which was brought to Guam as a biocontrol agent. *Kaloula picta*, *K. pulchra*, *Polypedates leucomystax* and probably *Litoria fallax* arrived as stowaways via maritime or air-transport vessels. *Eleutherodactylus coqui* and *Euhyas* (formerly *Eleutherodactylus*) *planirostris* appear to have entered Guam through the horticultural trade. Specimens of *Pseudacris regilla* were found among agricultural products and Christmas trees. Five species have been transported to Guam via the aquacultural trade. The importation of tilapia, milkfish and white shrimp from China (primarily Hong Kong and Taiwan) and the Philippines was associated with the introduction to Guam of *Fejervarya cancrivora*, *F. limnocharis sensu lato*, *Microhyla pulchra*, *Polypedates megacephalus* and *Sylvirana guentheri* (formerly *Rana guentheri*). Presently, no quarantine or containment guidelines have been established for Guam's aquacultural industry.

Theme: anuran, aquaculture, biological invasion, horticulture, Guam, pathways

Type of Presentation: Oral, Symposium 2: Invasive Reptiles and Amphibians: Global Perspectives and local solutions

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Frog concerts: a new herpetological education approach in Hungary

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Amphibian decline is usually caused by a combination of factors ranging from habitat destruction and pollution to disease and fish introduction. Some of these, such as deliberate killing, are directly related to the fact that frogs, toads, newts and salamanders form a hardly-known, unpopular animal group. As a consequence, education programmes are vital parts of conservation focussing on amphibians. As a new initiative in this field Frog Concerts have been performed in Hungary since the International Environmental Day, 2006. In accordance with their broad and changing target groups, they contained music ranging from Joseph Haydn's 18th century Frog quartet to Crazy Frog, a recent disco hit, folk music and (frog) chanson, poems and stories from La Fontaine to children rhymes and advertisements. Natural history, however, is a key element in Frog Concerts including the photos, sounds and short description of local and exotic species mixed with music improvised by a trumpet player for the different croakings. National as well as international award winning actresses and musicians participated in the presentation together with local schoolchildren to make it even more diverse and attractive for local people. The audience can also participate by entering a croaking competition near the end of the programme. As side events, a little zoo, frog object, frog fashion and frog book exhibitions are also arranged. Nine concerts were performed under different conditions so far ranging from a village of 140 inhabitants (plus many from four neighbouring settlements), a school with many children struggling with learning disorders to the central national ceremony of the International Water Day in the presence of highly ranked governmental officials including the Minister for the Environment and Water Management in 2007 and a festival on the River Tisza in 2008. The next concert will be held in the home of the famous composer, Béla Bartók. Frog concerts generated outstanding media attention, raising the number of people listening to frog-related conservation issues through the concerts to nearly two millions in a year, that helps to reach the goals of other conservation projects as well. As a result, they effectively help the conservation of local amphibians and nature in general by calling attention to amphibian decline and possible mitigation measures reaching a wider audience than usual herpetological education activities.

Theme: education, conservation, Frog Concert, Hungary

Type of Presentation: oral

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Amphibian mitigation measures under roads: fragmentation increasing money drains as at Parassapuszta or effective conservation alternatives as at Fertőboz, Hungary

Miklós PUKY - Zsolt Vogel

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The effects of road traffic on amphibians has been known for a long time. Besides habitat loss and alteration and the creation of edges, amphibians are also greatly influenced by pollution, road kill and the related barrier effect. To compensate these impacts, mitigation measures have been built since the late 1960s. Beginning in the mid-1980s it also became a topic in Central-European countries including Hungary. Parassapuszta is one of the best known sites for this activity, where *Bufo bufo*, *Rana dalmatina*, *Pelobates fuscus* and concomitant species migrate from the Börzsöny Mountains to the floodplain of the River Ipoly to breed, as international toad rescue operation has been organised there since 1987 including efforts by foreign professionals and volunteers from nineteen countries. Mitigation measures were first proposed to be built in the early 1990s at that site and the main crossing sections were mapped with a 50 metre accuracy. With the financial help of the European Union, in 2005 a road modification scheme was launched for the area including the construction of the largest amphibian tunnel system under a lower road in the region. However, no expert advice was taken. As evidenced by the mass mortality of amphibians on the roadway during the spring of 2007, planning, construction and maintenance problems have lead to a complete failure of this amphibian

mitigation project. By the 2008 migration period the situation has not changed, however, the evidence provided to the conservation and road authorities resulted in consultation and should lead to improving the system not only to general maintenance of the area such as cutting grass. There is also a positive example in this field in Hungary, at Lake Fertő/Neusiedlersee, where *Rana esculenta* c. is the commonest and the local national park directorate developed a well-functioning mitigation measure with a more than 90% efficiency. As road construction is a priority activity in new EU accession countries and regions elsewhere, it is of global importance to avoid mistakes described at the Parassapuszta site in the future and minimize the effect of new roads on amphibians. It should also be a priority to correct non-functioning amphibian passage systems and, where necessary, culverts to provide safe crossing sites for amphibians.

Theme: amphibian, road mortality, mitigation measure, conservation, amphibian tunnel, Hungary

Type of Presentation: poster as I have another, oral presentation but if possible due to available time, oral is preferred, symposium 8

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Accessing and Using the Leptodactylus clade (Adenomera, Hydrolaetare, Leptodactylus, Lithodytes) Bibliography: A Resource of 5,500+ References (and Counting).

Miriam H. Heyer

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The largest and most comprehensive bibliography for the Leptodactylid genera *Adenomera*, *Hydrolaetare*, *Leptodactylus*, and *Lithodytes* contains over 5,500 annotated citations. The bibliography can be searched in multiple ways, such as by author, species names including synonyms, and 1090 keywords in three categories that are found on the website. The bibliography is available to researchers at <http://learning.richmond.edu/Leptodactylus/bibliography.html> either as an EndNote® file or as a rich text file. Since April 2007, the bibliography web site page has been searched by 278 visitors (the majority of them either by accessing the web site directly or referred by Google searches); the two countries with the highest percentage of visitors are Brasil (36%) and the United States (29%).

Theme: Bibliography, *Adenomera*, *Hydrolaetare*, *Leptodactylus*, *Lithodytes*

Type of Presentation: Poster_contributed

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Effects of harvesting, disease and habitat loss on Indonesian amphibians

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Frogs are exploited in Indonesia mostly as protein source by local people and also for exported purposes. Other than that, a small number of amphibians are also exported for pet and skin trade. The highest level of frog harvested for food in Java is *Fejervarya cancrivora* which thrive in man-made

habitat. Research has shown that current harvest level of *F. cancrivora* is still within sustainable limit, but caution is needed to conclude sustainable limit of other species, especially the cryptic species under the *Limnonectes* group taken from other island. The current finding of *B. dendrobatidis*, a fungus suspected as a main disease causing global amphibian decline, in five species of wild frogs within a National park in West Java had raise the issue of the importance of amphibian management in Indonesia and control of trade of live specimen. Habitat loss is one of the biggest threats to amphibian diversity as many of Indonesian endemics are forest specialist. In general, amphibians are one of the neglected taxon in Indonesian's wildlife research. Most of the field works conducted is mostly consisting of biodiversity survey. While the work itself is valuable to create current list of amphibian in one area and often recorded new species, however, because of its short time nature, it does not reflect the population status and might only give a snap shoot view on the impact of threats to amphibian population.

Theme: amphibians, conservation biology, endangered species

Type of Presentation: Oral, Herpetological Conservation & Biology Symposium

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How much of herpetofaunal diversity fits into the current protected areas network in Bahia, Brazil?

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The single most effective way to conserve species is to maintain their habitats. Herpetofauna is an integral component of the coastal ecosystems in northeastern Brazil, and may constitute the highest fraction of vertebrate biomass in these habitats. Protected areas are considered to be adequate for protecting species'. It is assumed that species can be protected effectively in their range, regardless of habitat suitability, and of viability constraints. In practice, simple presence within an area is insufficient to ensure the long-term persistence of species', particularly those with demanding habitat requirements. Alongside, protected areas may not retain all of herpetofauna species if they are used intensively, such as the Environmental Protected Areas in Brazil. Here we analyze the importance of protected areas network to reinforce the conservation of herpetofaunal diversity in northeastern Bahia, Brazil. We conducted a five years survey (from 2003-2008) estimating how much of the herpetofauna fits into the network of protected areas in the region. We sampled 19 localities into the eight coastal municipalities from Salvador to Jandaíra, covering 220 km of the Atlantic forest, using visual search and pitfall traps along three transects each, during five day sample campaigns. There are 110 protected areas in Bahia, 32 on the coast, from those only seven are present on the north coast, whereas 72% are of direct use suffering from intensive habitat loss, and only two are of integral protection. Of the 46 amphibians', 28 lizards' and 31 snakes' covered species under IBAMA licensed programs, in 9256 captures, 16 species were not represented in any protected area, and 84% of species were not included into the integral protection areas. Our results demonstrate that if the conservation goal is herpetofaunal species representation, then the expansion and policies of the local network of integral protected areas must account for biodiversity patterns, rather than rely on general percentage-based targets that are formed largely by political considerations. Given the increasing threats to biodiversity, such as urban expansion should be made strategically by focusing on those regions that would contribute most to the local system and prioritizing, within those, the regions where the urgency for conservation action is greatest when considering herpetofaunal diversity. Conservation strategies must also address the complexity of natural ecosystems and mainly the herpetofaunal priority habitats, including diversity and ecological processes.

Theme:amphibians, anurans, caecilians, reptiles, snakes, lizards, conservation biology

Type of Presentation: Poster, symposium 8: Herpetological Conservation & Biology

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Genetic divergence in the frogs of the genus *Fejervarya* from Bangladesh and other Asian countries revealed by morphometric data, crossing experiments, and allozyme and mtDNA gene sequence analyses

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The present study was performed in order to elucidate the degree of genetic divergence and phylogenetic relationships within the genus *Fejervarya* from Bangladesh and other Asian countries by morphological observations, crossing experiments, and allozyme and mtDNA gene sequence analyses. Morphological observations revealed that *Fejervarya* species from Bangladesh were divided into four distinct groups; large, medium, small, and mangrove types, among which small and medium types were comparatively close to each other. Crossing experiments indicated three kinds of reproductive isolating mechanisms: gametic isolation between mangrove and large types, hybrid inviability between large and other two types, and hybrid sterility between medium and small types. Spermatogenetic observation showed extremely high degrees of abnormalities in the hybrid between small and medium types. These results imply that these four types of frogs should merit 4 different

species of the genus *Fejervarya*. Allozyme analyses were also performed with 28 loci encoding 20 enzymes and two blood proteins by horizontal starch-gel electrophoresis. When Nei's genetic distance was calculated, distinct divergence was found among the three types: mean genetic distance was 0.782 between the small and medium types, 1.458 between the large and medium types, and 1.520 between the large and small types. Molecular analyses based on mtDNA gene sequences showed that all Bangladeshi *Fejervarya* species were largely divided into 3 groups, mangrove type, large type, and the other group, and the latter was further subdivided into medium and small types. After comparison with other Asian *Fejervarya* species, we found that Bangladesh mangrove type was closely related to *F. cancrivora* from India, Thailand or the Philippines; the large type belonged to *F. iskandari* subgroup and was closely resembled to *F. orissaensis*; the small type was included in South Asia or Indian group, and closest to *F. syhadrensis* from India and Sri Lanka, whereas the medium type was closely related to *F. limnocharis* from Myanmar but not related with any described species of this genus. This comparison of Bangladesh *Fejervarya* with other Asian *Fejervarya* was also supported by allozyme analyses and crossing experiments. By all of the studies, it was established that there are four different species of the genus *Fejervarya* in Bangladesh, rather than a single species as reported in available literatures. This is also the first record of *F. cancrivora* from Bangladesh, and the medium type may be an undescribed taxon.

Theme: *Fejervarya*, Anurans, genetic divergence, morphology, crossing experiments, reproductive isolation, allozyme analyses, mtDNA gene sequence, Bangladesh

Type of Presentation: Oral

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Beyond Fst: a multidisciplinary approach to conservation genetics

Mollie K. Manier

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A portrait of genetic structure, when painted with several different brushes, becomes a multi-dimensional framework with which to implement successful management strategies. Components of this portrait can include spatial analysis of population genetics, an understanding of ecological correlates of genetic structure and diversity, and consideration of the differential evolutionary forces that positively or negatively affect diversification at neutral and adaptive loci. Any or all of these components can further be simultaneously considered for multiple interacting species that inhabit a common landscape. Such a multi-species approach to these types of questions creates a fuller picture of barriers to dispersal, source-sink dynamics and selective processes, all within the context of the metacommunity assemblage.

Theme: snakes, anurans, community ecology, genetics, conservation biology, predator-prey

Type of Presentation: oral, Symposium 10: Conservation Genetics of Amphibians and Reptiles in the 21st Century

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The Amphibians and Reptiles in The Serranía of the Mines Huila Colombia

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The work you development in the Serranía of the Mines Department of the Huila Colombia in the mark of the Project Biomacizo, with a duration of eight months through four expeditions with a duration of 25 days each one during which visited one another different towns. He/she intended to study the present herpetofauna in the Serranía of the Mines, elaborating a listing of species, to highlight those included inside some of the different threat categories, national or global and to know their ranges and distribution patterns, for the implementation of strategies of Conservation. By means of the employment of inspection transectos for visual encounter (IEV), free search and the elaboration of Transectos or quadrants in hours of the day and the night, they registered 28 herpetos species (6 snakes, 1 cecilia and 21 frogs) during the four realized expeditions of characterization, being shown a marked dominancia of the gender E!eutherodactylus. Until the moment three possible amplifications exist in the distribution ranges, a species inside the red list in the category of vulnerable, besides several species potentially new for the science, belonging to the family Leptodactylidae, being demonstrated that the Serranía of Mines possesses a biological value that should be conserved.

Theme:Herpetofauna, Serranía of the Mines, Reptiles, Amphibians, Extinction, Huila, Colombia.

Type of Presentation: Poster

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Interactions Among Egg Predators of Red-eyed Treefrogs (*Agalychnis callidryas*) and Consequences for Both Predators and Prey

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When multiple predators share a common prey, interactions among them can lead to altered interactions with their prey. For example, one predator may enhance or impede a second predator's foraging ability or prey consumption. Red-eyed treefrogs (*Agalychnis callidryas*) inhabit low to mid-elevation neotropical rainforests. They lay their eggs on vegetation overhanging ponds, and tadpoles fall into the water upon hatching. Red-eyed treefrog embryos have many natural enemies, including at least four species of snakes, three wasps, two flies and a pathogenic fungus. We are studying interactions among three common egg consumers in Gamboa, Panama: the social wasp *Polybia rejecta*, a pathogenic fungus, and a fly (*Phoridae*) whose larvae infest clutches. We monitored clutches at a natural breeding site to determine incidence and coincidence of different egg consumers on clutches. Fly larvae were present on most clutches, including those also attacked by other egg consumers. Wasp attacks and fungal infections partially damage clutches, but do not kill all eggs in a single clutch. This damage attracts adult flies; in choice tests flies preferentially laid eggs on damaged clutches and avoided undamaged ones. Dead eggs provide an initial food source for small fly larvae; in controlled inoculation experiments, flies were more likely to survive to adulthood on damaged than on intact *A. callidryas* clutches. Those flies were also larger, possibly increasing their fecundity relative to flies emerging from initially undamaged clutches. Positive interactions among predators, which are rare in the literature, may be an important feature of this system. Low densities of fly larvae merely scavenge on dead eggs, rarely killing healthy embryos. However, damaged clutches in the field often attract very high levels of fly infestation, and in those clutches fly larvae kill frog embryos. We are currently testing the hypothesis that fly larvae switch from scavenging to predation of frog embryos as their density increases. If this occurs, initially small amounts of egg mortality caused by wasp attacks or fungal infection of young clutches may be amplified by the subsequent effects of heavy fly infestation. An understanding of interactions among consumers may be necessary to accurately evaluate both predator success and the risk posed by each predator type to prey.

Theme:amphibians, anurans, behaviour, ecology, developmental biology, predator-prey

Type of Presentation: oral, contributed

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Attempts at Artificial Breeding and Analysis of Complete Mitochondrial Genome in an Endangered Species *Rana ishikawae* from Amami Oshima, Japan

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Rana ishikawae, recently known as *Odorrana ishikawae*, an endemic species whose habitat is Okinawa Island and Amami Oshima, is occasionally referred to as the most beautiful frog in Japan. The recent over-hunting and environmental destruction have devastated the population of this species; and so *Rana ishikawae* has been listed in the Red Data Book of the Ministry of the Environment as a class IB endangered species and designated as a natural monument in both Okinawa and Kagoshima Prefectures. In the present study, (1) we performed artificial breeding and tested farming technique in the laboratory to preserve this endangered species, and (2) we determined the complete nucleotide sequence of the mitochondrial DNA to survey usable genetic markers for elucidating the population compositions and phylogenetic position of this species. The artificial breeding was performed using four male and female pairs of Amami Oshima via artificial insemination. Among 3,078 eggs, 2,742 cleaved normally, 2,536 became normal tail-bud embryos, 1,761 metamorphosed normally, and 1,390 became 2-month-old young frogs. At present, approximately 400 four-year-old mature frogs produced by the artificial breeding are being raised in the laboratory. During this year's breeding season, second-generation offspring are being produced by the natural mating activities of these frogs. Next, we determined the complete nucleotide sequence of the mitochondrial DNA of this species. The *R. ishikawae* mtDNA was 21,020 bp in length and contained 37 genes typically encoded in metazoan mt genome. When the genomic organization was compared to those of other neobatrachian frogs (e.g., *Rana nigromaculata* and *Microhyla*, *Bufo*, and *Hyla* species), genomic positions of several genes were found to be modified from the typical neobatrachian type: the tRNA-His gene was translocated and the positions of the tRNA-Asn gene and the region of L-strand replication origin (OL) were exchanged. Furthermore, the OL motif was embedded in tandem repeat sequences; consequently, three OL motifs existed in this mt genome. Although the three copied OL motifs and the OL / tRNA-Asn exchange were unique in this species, the translocation of tRNA-His gene was also known from the *Amolopus tormotus* mtDNA. In addition, closely relationship between several *Amolopus* species and the genus *Odorrana* (sensu Frost et al. 2006) has been reported. Thus, the rearrangement of the tRNA-His gene seems to be regarded as a novel synapomorphic character of the genus *Odorrana* and related genera.

Theme:amphibians, anurans, genetics, conservation biology, taxonomy, endangered species

Type of Presentation: Poster

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Awareness and Education: the foundation of an invasive species program in the Commonwealth of the Northern Mariana Islands

The Brown Treesnake (*Boiga irregularis*) was accidentally introduced to Guam after World War II as a result of cargo movements. Brown treesnakes (BTS) have now become exceptionally abundant and pose a direct, significant, and growing threat to other areas outside of its historic range, including the Commonwealth of the Northern Mariana Islands, the State of Hawaii, the U.S. mainland and other sites regionally and internationally. The CNMI is a high risk extralimital site for a BTS introduction due to its close proximity to Guam and the type/amount of cargo received from Guam. Limited BTS awareness efforts between 1986 and 2002 in the CNMI resulted in an average response time of 126 hours, indicating that an increased public awareness effort was needed. Over the last 6 years, public awareness has been increased as a result of a multifaceted outreach program. This program includes media outlets (radio jingles, magazine inserts, etc), education (presentations in schools and to the public), and visible reminders of the awareness program (bumper stickers, custom paint jobs on project vehicles, customized backboards for basketball courts, etc.). The effectiveness of awareness campaigns is assessed via public surveys involving DFW staff and private advertising firms; as an example, a recent typical campaign included three phases: 1) baseline public survey, 2) ten month awareness campaign, and 3) re-evaluation survey. This campaign resulted in average response times to snake sightings improving from 126 hours to 1 hour 42 minutes (08/2002-present). The re-evaluation survey confirmed the success of specific campaign components and was used to direct additional awareness efforts. These public awareness and education programs in the CNMI have proven vital to early detection and rapid response for Brown Treesnakes. Investments in such programs also typically cost much less than control/eradication programs that may be necessary if invasive species become established.

Theme: Brown Treesnake, Saipan, Mariana Islands, outreach, education, invasive species

Type of Presentation: oral, symposium 2 (invasive amphibians and reptiles)

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Genetic divergences in *Fejervarya cancrivora* from Indonesia and other Asian countries inferred from morphological observations, crossing experiments, allozyme and molecular techniques

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Fejervarya cancrivora is known to be widely distributed in Asia, and the neotype of this species was collected at Cianjur West Java, Indonesia. In order to elucidate the genetic divergence in *F. cancrivora* distributed in Indonesia and other Asian countries, morphological observations, crossing experiments, allozymes and molecular analyses were carried out using a total of 147 frogs collected from 22 localities of Indonesia, Thailand, Bangladesh, Malaysia and the Philippines in the present study. Morphometric study using 31 parameters showed that *F. cancrivora* was roughly divided into two groups : large type from Indonesia and Malaysia and small type from Thailand and Bangladesh. The dominant parameters for divergence were 1FL (first finger length) and 3FL (third finger length) in male, and HLL (hindlimb length) and EL (eye length) in female. Crossing experiments showed that most hybrids developed normally, except Malaysia-Bangladesh hybrids showing possibly partial gametic isolation. Partial gametic isolation was considered to be caused by the combination between

male and female. Allozyme study was performed by analyzing 17 enzymes extracted from 95 frogs of 10 representative populations, and showed that *F. cancrivora* was divided into almost the same two groups as those found by morphometric study : large and small types. Molecular phylogenetic trees constructed by ML, MP and NJ methods based on nucleotide sequences of 16S rRNA and Cyt b genes showed that *F. cancrivora* examined in the present study was largely divided into three clusters; large, small and Java-Sulawesi types. Large type consisted of 13 localities from Indonesia and Malaysia including Cianjur, the neotype locality of *F. cancrivora*. The small type consisted of 5 localities from Bangladesh, Thailand and the Philippines. The other type, Java-Sulawesi type, consisted of 4 localities from West Java and South Sulawesi, Indonesia. Hereafter of the three types were possibly regarded as three different species. But further studies will be necessary for elucidating the taxonomic status of these three types.

Theme:Anurans, genetics divergences, morphology, crossing experiments, allozyme and molecular analyses

Type of Presentation: Oral

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Threatened Long-lived Species with TSD will rely on Management to Cope with Global Warming

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Global warming may result in biased hatchling sex ratios for species with temperature-dependent sex determination (TSD), with consequences for long-term population viability. However, negative impacts of global warming are not assured. Species with wide geographic ranges may exhibit local adaptations e.g. genetic variability in pivotal temperatures, different temperature ranges across which eggs hatch successfully, and/or exhibit behavioural responses to environmental signals e.g. nesting in open or shaded locations, allowing responsiveness to changing circumstances. In addition, reptiles thrived and diversified during warmer climates in the past. We investigated the effect of temperature on sex ratios of tuatara (*Sphenodon*), a lineage which emerged about 230 million years ago. Once widespread, tuatara are now limited to 38 offshore islands of New Zealand, with 9 of these populations resulting from repatriation efforts. Tuatara exhibit a rare form of TSD, where males result from incubation temperatures above 21.7°C, with 1°C separating production of 100% females from 100% males. The pivotal temperature does not appear to vary with latitude. In nature, warm years produce a male-bias in hatchlings. Adult sex ratios vary: Stephens Island has a 1:1 adult sex ratio (population size 30-50,000 tuatara), but the smaller population on North Brother Island has 60% adult males. Sex determination in tuatara takes place within the first third of embryonic development. In artificial conditions, shifting experiments demonstrate male sex is set by week seven of the ~20 week incubation period at 23°C, and female sex by week 11 of the ~30 week incubation period at 20°C. In natural nests, eggs are laid in October to December, sex determination is estimated to occur before the second week in February, and hatching takes place after an 11-16 month incubation period. Hatchling sex ratios vary among rookeries. Females return to nest in the same rookeries over a five year time span, but most rookeries currently used on Stephens Island were not suitable for nesting prior to 100 years (~2 generations) ago. Tuatara demonstrate the ability to respond to environmental cues but long-term viability is likely to be limited by low genetic variability, habitat constraints within their current distribution, and their k-selected life history characteristics with respect to the speed of global warming. The ability of long-lived species already under threat to respond to rising temperatures is likely to rely on management techniques, for example, translocation, to increase their climatic range.

Theme: sex determination, global warming, tuatara, conservation, ecophysiology

Type of Presentation: Oral, Symposium 1: Reproduction in reptiles: from genes to ecology

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Exotic Invaders and Reptile Traders: Risk Assessment for Alien Herps in South Africa

Nicola van Wilgen* DM Richardson, N roura Pascual, EWH Baard

Nicola van Wilgen MSc-Student: Risk Assessment for alien Herpetofauna in South Africa: models and perspectives DST-NRF Centre for Invasion Biology Department of Botany and Zoology University of Stellenbosch P/Bag X1 Matieland 7602 njvw@sun.ac.za Nuria Roura Pascual DST-NRF Centre for Invasion Biology Department of Botany and Zoology University of Stellenbosch P/Bag X1 Matieland 7602 nroura@sun.ac.za Prof. David M. Richardson Deputy Director DST-NRF Centre for Invasion Biology Department of Botany and Zoology University of Stellenbosch P/Bag X1 Matieland 7602 rich@sun.ac.za Dr. Ernst Baard CapeNature Assegaaibosch Nature Reserve Jonkershoek P/Bag X5014 Stellenbosch 7599 ebaard@capenature.co.za

Biological invasions are a growing problem in South Africa. Many alien species have been introduced for various reasons, through multiple pathways over the past few centuries. Though invasive alien reptiles and amphibians (herpetofauna) are not yet a major problem in South Africa, escalating problems with invasive species in these groups worldwide, and the almost 300 alien species being captive kept in South Africa, suggest a high risk of increased problems in the future. An effective species risk assessment to distinguish between benign and potentially invasive species has been called for. Such an assessment should ideally look at the likelihood and consequences of invasion. In some cases the impact a species will have if introduced may be very dramatic and therefore the risk of

introducing the species may be high even if the likelihood of its establishing is not that high. Here however, we focus on the likelihood of species establishment. To determine this, one should look to combine the habitat requirements of the species with ecological interactions. We have compared several approaches to climate matching analyses in order to determine the best approach to use when limited data on the species preferences are available. For each species a climate match score between its native range and region of introduction has been generated. This score can be incorporated into our more elaborate model which includes species life history traits to predict a probability of establishment success. The model is based on Bayesian statistics and run in Winbugs. We tested the model with 68 species which were introduced to the United States of America (due to a lack of established species in South Africa). Results will be presented. Our studies have also highlighted a handful of reptile families which are statistically more prevalent (popular) in the trade in South Africa (i.e. where the percentage of species imported in a given family is significantly higher than in others). It may be wise to focus risk assessment on these groups, as invasive species are likely to come from the pool of species that is commonly traded (i.e. where there is the highest propagule pressure).

Theme: amphibians, reptiles, risk assessment, South Africa

Type of Presentation: Oral, Symposium 2: Invasive Reptiles and Amphibians: Global Perspectives and local solutions

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Comparative Phylogeography and Taxonomy of Chilean Colubrid Snakes

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Chile is a peculiarly long country that is isolated from the rest of South America by the Andes Mountains in the east and the Atacama Desert in the north. Therefore, speciation has occurred and the Colubrids that are present in the Chilean territory are mostly endemic. Poor studies have been made of these species and even the taxonomy of Chilean Colubrids is not well understood. According to different authors from the years 1942 to 1992 in Chile between 2 – 9 species of Colubrids which belong to the genus *Tachymenis* and the genus *Phylodrias* can be found, but some authors debate the existence of a third or even fourth genus, *Alsophis* and *Dromicus*. To study the phylogeographic patterns and taxonomic status of the species we used mitochondrial DNA (control region and Cytocrome b) sequences. A total of 58 samples (carcasses and tail tips) were collected from northern (29oS latitude) to southern (38oS latitude) Chile, from the coast to the Andes Mountains. Most of the samples collected were morphologically and genetically recognized as *Phylodrias*, just 7 samples were recognized as *Tachymenis* which confirms the rare status of the genus in Chile. *Phylodrias* samples have an average total length of 89.6 cm \pm 11.9 (n=15), with a maximum of 117.2 cm, with few differences in scale numbers. *Tachymenis* showed an average total length of 50 cm \pm 5.3 (n=3), but presented great morphological differences in color and scale patterns. Analysis of 470bp mtDNA control region showed high divergence between *Phylodrias* and *Tachymenis*; however, only three polymorphic sites were found within *Phylodrias* sequences from 29oS to 38oS latitude, approximately 1000 km apart, and three polymorphic site and within *Tachymenis*. These results show the existence

of these two species between these ranges due to sample collection, but efforts still have to be made to collect samples farther north in the Atacama Desert where different snake species were described by different authors and therefore analyzing these species sequences with the ones already obtained.

Theme:Snakes, Genetics, Taxonomy, Chile

Type of Presentation: Poster

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Phylogeny of Near and Middle East Mountain and Blunt-nosed Vipers of the genera Montivipera and Macrovipera inferred by three mitochondrial markers

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The Mountain and Blunt-nosed Vipers are typical elements of Near and Middle Eastern fauna with numerous species. The current knowledge was inadequate to explain biodiversity, speciation and evolutionary history of this group. For this purpose we sequenced three mitochondrial genes (Cytb, COI, ND5) to reconstruct a robust phylogenetic framework. The samples of almost 200 specimens included multiple populations of all known taxa. Our data support the monophyly of the Asiatic genera Macrovipera and Montivipera, which together are the sister group of the Afro-Asiatic genus Daboia and the European genus Vipera. Within Montivipera our data identified two geographical lineages: the raddei group with the nominal species raddei, albicornuta and latifii and their westernmost counterpart with all remaining Montivipera lineages. The raddei group is characterized by very low genetic distances, indicating their historically young radiation. On the other hand the considerable nucleotide divergence between the mitotypes of Montivipera xanthina indicates a long-standing fragmentation of their refugia. The populations of the blunt-nosed-Vipers (Macrovipera) split into four major mtDNA lineages. Island populations from Cyprus and the Cyclades are nested within those from the Turkish south coast and have a common ancestor. Another cluster represents the subspecies turanica and contains samples from Middle Asia. Specimens from Trans Caucasus, Anatolia, the Levantine coast, and West Iran belong to the subspecies obtusa. A recently discovered population from south Iran is clearly placed at the base of the lebetina radiation. This endemic population might be the relict of a common Macrovipera ancestor and represents a new ancestral species.

Theme:snakes, taxonomy, phylogeny, Middle East

Type of Presentation: oral, contributed

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Phylogeography and conservation of wall lizards (Podarcis muralis) in Jersey, Channel Islands.

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Wall lizards (*Podarcis muralis*) on the British Channel island of Jersey are near the northern limit of their geographical range. Wall lizards have a wide distribution in continental Europe, occurring almost throughout France, Italy and northern Spain. The origins of the various wall lizard populations on the island are, however, currently obscure, though some populations are known to have been introduced from unknown sources. In order to assign conservation priorities to the various Jersey populations, it is important to elucidate their (possibly separate) origins, assess their total distribution in Jersey and investigate their genetic fitness. A phylogeographic study is underway to compare the genetics of known (disjunct) populations with others from nearby France, Switzerland and possibly England. Here, we discuss the species' known distribution on the island and how the results of genetic studies will facilitate positive actions for its conservation there.

Theme: reptiles, lizards, genetics, ecology, conservation biology

Type of Presentation: oral, Symposium 10: Conservation Genetics of Amphibians and Reptiles in the 21st Century

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Reproductive patterns in viviparous and oviparous lizards in Patagonia: convergent evolution in the Southern Hemisphere

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Reproduction in temperate climate reptiles is strongly constrained by environmental conditions. Synchronisation of the life cycle with the climatic cycle becomes critical. The timing of the reproductive cycle is an important aspect of the reproductive styles because there is a strong selection to maximize first-year growth in order to minimize winter starvation. Consequently, the reproductive mode, the timing of the reproductive events, and births in favourable climate conditions are of vital importance. In this study, we reviewed the reproductive biology of oviparous and viviparous lizards of the genus *Liolaemus*, *Phymaturus*, *Homonota* and *Microlophus* from Argentina and Chile and we compare their reproductive traits with lizards from the Southern and Northern Hemispheres. These species show two main female reproductive patterns which are congruent with the biogeographic zones resulting in the observed distributions of insects, fishes, fungi, and plants. Lizards from northern Chile and central Argentina show life history traits that resemble those of lizards from the Neotropical region and Holarctic Kingdom, characterized by multiple clutches/litters with short periods of gametogenesis and gestations, early maturity, large clutch size, clutch frequency, and mean annual reproductive output. In contrast, in the highlands of the Andes and the Patagonian steppe of Argentina, life histories traits are more similar to those found in the Austral Kingdom than with close related species at lower latitudes showing the relevance of environmental temperatures on life history traits. At high latitudes, in the Patagonia, a maritime climate provides reptiles with cool environmental temperatures in spring and summer, and long periods of hibernation. These climatic conditions mainly affect the timing of the reproductive events leading to long over-winter vitellogenesis, gestation in spring and summer, small clutch/litter sizes, and late sexual maturity. Viviparous lizards need an entire period of the activity season to perform vitellogenesis and another for pregnancy, whereas in oviparous lizards, vitellogenesis may proceed while development of the eggs continues in the nest, having thus more chances to have annual cycles. Temperate climates of the Southern Hemisphere seem to facilitate the dissociation of prolonged vitellogenesis and pregnancy into separate breeding seasons. Moreover low resources result in skipping of years and multiannual reproduction, especially in viviparous and nocturnal lizards. Males instead do not show a unique reproductive pattern, having high interspecific variation. The present review suggests a causal relationship among environmental factors, conditioned by the access to an appropriate range

of temperatures for reproduction resulting in evolutionary convergence among different lineages.

Theme: multiannual reproduction, temperate climates, Patagonia, evolutive convergences

Type of Presentation: oral

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Regressive Evolution of the Resistance to the Toad Toxins in the Colubrid Snakes of the Genus *Dinodon* in the Ryukyu Archipelago, Japan

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A toxic prey and its predator often provide an ideal model system to investigate organismal diversification through evolutionary interaction between species. In the studies of coevolution using this advantageous system, the major focus has been placed upon the effect of greater toxicity of prey species upon the progress of anti-toxic resistance in its predator: little attention has been paid to evolutionary consequences of secondary isolation from toxic prey in the predator's anti-toxic resistance. Can the resistance be maintained or lowered after the isolation? We investigated effects of secondary geographic isolation from toxic prey, the bufonid toads, on the resistance in the vertebrate-eating snakes of the genus *Dinodon*. The resistance was quantified by measuring decrements in locomotor performance of the snakes after ingesting toad toxins. *Dinodon* snakes of the Ryukyu Archipelago, *D. rufozonatum walli* from the Yaeyama Group of the Southern Ryukyus and *D. semicarinatum* from the Central Ryukyus, geographically isolated from the toads for at least 0.3 and 1.7 million years, respectively, showed much greater decrements than *D. r. rufozonatum* from Taiwan, which should have consistently been sympatric with, and preying on, the toads to the present. On the other hand, there were no significant differences in the extent of the decrement between those *D. r. walli* and *D. semicarinatum* populations. The inconsistency between the relative decrements among the three snakes and their phylogenetic relationships ((*D. r. rufozonatum* *D. r. walli*) *D. semicarinatum*) suggests that the resistance against the toad toxins in the Ryukyu *Dinodon* has degenerated selectively after their isolation from toads. Absence of significant differences in the extent of the decrement between *D. r. walli* and *D. semicarinatum* strongly suggests that a large part of degeneration of the resistance to the toad toxins in these *Dinodon* snakes occurred for no more than 0.3 million years after isolation from the toads. We then examined more in detail the effects of isolation from the toxic toads on the degree of resistance within each of the two subspecies of *D. rufozonatum* by adding data for populations currently allopatric (*D. r. rufozonatum* from Tsushima Island) and sympatric with the toads (*D. r. walli* from Miyakojima Island) to the analyses. In both of these subspecies, the resistance in populations sympatric with the toads was greater than that in the allopatric populations. Our results collectively suggest that in the snakes resistance to the toad toxins degenerates after isolation from the toads.

Theme: snakes, anurans, predator-prey

Type of Presentation: oral presentation

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Call temporal structure and call amplitude affect the phonotactic reaction of territorial males of *Oophaga histrionica* (Anura: Dendrobatidae)

The coding rules of communication signals determine the amount of information that could be extracted by receivers. In many territorial anurans, the auditory signals should allow estimating the distance to the sound source, as well as decoding the aggressive motivational state of the sender. Furthermore, a graded coding scheme could be important for territorial defence, because it allows behavioural adjustments in aggressive response towards intruders according to their distance and motivational state. Males of the dart-poison frog *Oophaga histrionica* are territorial and respond aggressively towards conspecific males that enter in their territories. Here, we aimed at understanding the auditory coding scheme of this species by studying the call temporal structure and sound intensity on male's phonotactic reaction. We simulated near and far intruders by manipulating sound pressure level (SPL) of the broadcast signal through playback experiments. In an attempt to simulate intruder males with variable motivational states, we further manipulated the micro and macrotemporal structure of the synthetic signals. Males responded through movements and vocally. Males were more active in response to stimuli with high sound pressure level and average number of pulses. Moreover, males increased call rate in response to stimulus call rate but not to SPL. The response to stimuli was not affected by resident body size (body condition). Our results suggest that under field conditions, males use temporal traits of auditory signals and SPL as a source of information potentially useful to adjust aggressive reaction. Simultaneous discrimination of both intruder's motivational state and distance could improve the efficiency of males during territorial defence.

Theme: coding rules, communication signals, *Oophaga histrionica*, territorial defence

Type of Presentation: Poster

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New Zealand Native Frog (*Leiopelma* spp.) Recovery Planning

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While there are only four extant indigenous (and endemic) species of frogs in New Zealand, all of these are threatened and have received a considerable amount of conservation attention during the last 12 years. The Zoological Society of London listed all four species in the top 100 Evolutionarily Distinct and Globally Endangered (EDGE) amphibians in January 2008, with Archey's frog (*L. archeyi*) being ranked as the number 1 EDGE amphibian (out of a total of 6240 worldwide species). Over the course of the first *Leiopelma* spp. Recovery Plan (Newman 1996) Archey's frog (*L. archeyi*) suffered serious declines (Bell et al. 2004) and Hochstetter's frog (*L. hochstetteri*) was shown to comprise a species complex of at least eight separate "conservation management units" (Bowsher 2000, Gemmell et al. 2003). The New Zealand Native Frog Recovery Group, through the New Zealand Department of Conservation (DOC), was formed in 1996 and produced the first national recovery plan for native frogs shortly thereafter (Newman, 1996) and is due to release a new plan this year (Bishop et al. in prep.). The NZ Native Frog Recovery Group provides technical advice to the Department of Conservation on all matters relating to the status, conservation, research and recovery of native frog species. The goal of the recovery group is to generate high quality technical advice to achieve the recovery of threatened native frog species across their historic range. The recovery group produces and reviews a recovery plan that sets the priorities for research, management and community relations that are necessary to reduce the threat of extinction and increase the likelihood of frog species' recovery. The recovery group is the major advocate of native

frog conservation and organises the production of educational videos, captive management protocols, hygiene protocols, and solicits sponsorship for frog research from the private sector. The recovery group consists of DOC regional representatives, frog-research experts from universities and captive breeding specialists and is highly respected by all involved with New Zealand frog conservation.

Theme:amphibians, anurans, conservation biology, captive breeding, endangered species, New Zealand

Type of Presentation: Oral, Symposium 14: Amphibian conservation.

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Herps from agricultural landscapes of Southern São Paulo, Brazil

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Most studies on biodiversity in Brazil focus on remnants of native vegetation. However, recent studies suggest agricultural landscapes support a considerable biodiversity. The state of São Paulo is located on the eastern region of Brazil. Cattle ranches are its most widespread land use type, but they are currently replaced being by sugar-cane and eucalyptus plantations. The former is widespread in the fertile regions formerly occupied by Atlantic Forest, whereas the later is concentrated on the Cerrado biome in the southern region of the state. This study was carried out at Fazenda Três Lagoas, a 3,642 ha former cattle ranch that was mostly replaced by eucalyptus plantations (approximately 2,200 ha) from August 2006 to November 2007 in Alto Paranapanema region. As a consequence there will be an increase in the native woodlands from 570 to 1,040 ha. In this study we surveyed reptiles and amphibians by pitfall traps (39 sampling unities each composed by four 100 L-buckets connected by a drift fence in Y-shape of 15 m each branch) from August 2007 to April 2008. The following environments were sampled with a total sampling effort of 1,920 day-traps: eucalyptus (27 sampling unities), native woodlands (7 sampling unities), and abandoned pastures (5 sampling unities). Total species richness was 16 amphibians (7 in the native woodlands, 15 in the eucalyptus and 6 in the abandoned pasture) and 5 reptiles (2 in the native woodlands, 1 in the eucalyptus and 3 in the abandoned pasture). The following species of Anura have been detected per environment: *Physalaemus cuvieri*, *P. centralis*, *Eupemphix nattereri*, *Leptodactylus fuscus*, *Rhinella ornata*, *Odontophrynus americanus* (woodlands), *Eupemphix nattereri*, *Physalaemus cuvieri*, *P. centralis*, *P. marmoratus*, *Elachistocleis cf. ovalis*, *Rhinella ornata*, *R. schneideri*, *Leptodactylus fuscus*, *L. mystacinus*, *L. mystaceus*, *L. ocellatus*, *L. labyrinthicus*, *Odontophrynus americanus*, *Chiasmocleis albopunctatus*, *Aplatodiscus cf. perviridis* (eucalyptus), and *Physalaemus cuvieri*, *P. marmoratus*, *Eupemphix nattereri*, *Leptodactylus fuscus*, *Elachistocleis cf. ovalis*, *Eleutherodactylus binotatus*, *Aplatodiscus cf. perviridis* (pastures). The following species of Squamata have been detected per environment: *Tupinambis merianae*, *Bothrops jararaca* (woodlands), *Mabuya sp1* (eucalyptus), and *Mabuya sp1*, *Lacertidae sp1* and *sp2* (pastures). Species incidence curve per environment did not yet reach an asymptote, what suggests that the current sampling effort was not yet enough to detect all species present in the study area. These results stress the relevance of agricultural landscapes for conservation efforts in the Neotropics.

Theme:amphibians, reptiles, eucalyptus, agricultural landscapes

Type of Presentation: Poster

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Insects predating eggs of the hawksbill turtle, *Eretmochelys imbricata* (Linnaeus, 1766) in Pipa beach, Tibau do Sul municipality, Rio Grande do Norte State, Brazil

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Nowadays, seven species are known of sea turtles, two of them found in state of Rio Grande do Norte, being *Chelonia mydas*, commonly known as the “green turtle” in reference to feeding areas and *Eretmochelys imbricata*, as “hawksbill turtle” with reproduction areas. This last has in some places of RN coast a very important nesting area that occurs from September to May. In the region of Pipa Beach were counted 813 nests between 2001/2002 and 2005/2006, 589 had their species identified and 581 were *E. imbricata* nests. The eggs of hawksbill turtle during the incubation are exposed to several vertebrates and invertebrates predators, including insects, such as Orthoptera, Diptera, Hymenoptera and Coleoptera, observed in worldwide. This study aims to identify the insects predators species in association with *Eretmochelys imbricata* eggs in the Tamar study area located on Pipa Beach, Tibau do Sul municipality, 60 km on south from the capital Natal. Shells of hatched eggs, no hatched eggs and dead hatchlings were transported to the Entomology Laboratory of UFRN, where are handling searching for insects. At this moment nearly 100 eggs coming from 8 nests had been analysed. Only Calliphoridae larvae (Diptera) were found feeding on dead hatchlings. Inside a hatched egg an aggregated pupa was also found. This research has just begin and in spite of these findings insects, larvae and pupa indicate that in any moment when the hawksbill turtle are laying eggs may be occurs the deposition of these diptera eggs and there, find appropriate conditions to develop.

Theme: Reptiles, Turtles, Ecology

Type of Presentation: Poster

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An Assessment of Amphibians Richness and Endemism in Brazilian Savanna (Cerrado)

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Cerrado is the second largest morphoclimatic domain in Brazil and it is considered a biodiversity hotspot due to its high levels of endemism and exceptional loss of habitat. In spite of this, its amphibian fauna remains poorly known. Recently published studies accounted for 113 and 131 anuran species in Cerrado, based on literature review and limited collection records. Here we provide a species list for Cerrado anuran amphibians based on the exam of 18.122 specimens from seven of the most representative Brazilian amphibian collections (MZUSP, MNRJ, CHUNB, MCN-PUCMG, MPEG, UFG, CFBH). Delimitation of Cerrado domain was based on IBGE vegetation map. We selected all “savanna” classes and drew a polygon including any class within the delimited area. We considered Cerrado enclaves in Amazonia, Caatinga and Mata Atlântica separately for all analysis. We recorded 166 anuran species, from which 80 (48%) are endemic. Twenty-two of the endemic species are known only from the type-locality. Despite the current belief that Cerrado anuran fauna is

composed by widespread generalist species, we found only 18 widespread species, and 28 were common to Cerrado, Caatinga, Pantanal and/or Chaco. Cerrado and Amazonia share 10 species, and eight are common to Cerrado and Mata Atlântica. Apart from the 166 species, other six are restricted to Cerrado enclaves in Mata Atlântica or Amazonia. From the 38 anuran genera known to occur in the Cerrado, six are represented by 10 or more species in the domain: Bokermannohyla (10 species), Dendropsophus (16), Hypsiboas (18), Leptodactylus (24), Rhinella (12) and Scinax (15). All of them present high endemism levels, especially Bokermannohyla, from which 90% of the species are endemic. The genera Dendropsophus and Scinax also show high endemism levels, respectively 56% and 53%. Finally, Rhinella and Hypsiboas presented respectively 42% and 39% of endemic species. Another emergent pattern refers to the distribution of widespread taxa through genera: only Hypsiboas had more than 20% of its species widespread, while Bokermannohyla had no widespread species, and widespread species from the other four genera represents 10 to 20% of the taxa. Fifty-one species are Cerrado endemics and restricted to one Brazilian state. This pattern is more common in Minas Gerais state (29 exclusive species), followed by Goiás (eight species), Mato Grosso (six species), São Paulo (three species) and Mato Grosso do Sul (two species).

Theme: amphibian, anurans, ecology

Type of Presentation: Poster

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Identifying Priority Areas for New Amphibian Surveys in Brazilian Savanna (Cerrado)

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Information on Cerrado amphibian diversity and distribution is scarce and bad distributed through the domain. Based on the exam of 18,122 specimens from seven of the most representative Brazilian amphibian collections (MZUSP, MNRJ, CHUNB, MCN-PUCMG, MPEG, UFG, CFBH) and literature records, we listed 490 localities where at least one species was recorded. We selected the 111 localities where at least 20 species were recorded and classified them as adequately sampled localities. These well sampled areas are concentrated on south and eastern Goiás state, along Tocantins river, along Espinhaço mountain range, northwestern Minas Gerais state and other few sparsely distributed sites through the domain. The poorest known areas are Maranhão and Piauí states, in Parnaíba river basin, Mato Grosso state, in the contact area between Cerrado and Amazonia, in Araguaia river basin and the headwaters of Xingu and Tapajós river basins, central portion of Minas Gerais state, in São Francisco and Paraná river basins, north and south São Paulo state and all Cerrado area in Paraná state, both in Paraná river basin. In order to identify priority areas for new amphibian surveys in Cerrado domain based on regional richness, we selected the 19 localities where at least 40 species were recorded, indicating best sampled areas, and modeled the distribution of potentially richest areas in the domain using GARP single run algorithm, implemented by Open Modeller Desktop version 1.0.6. We used the following environmental layers downloaded from WorldClim: mean temperature, mean precipitation, elevation and slope. In order to obtain the geographic distribution of each municipality's environmental features, we generated 200 random points inside each municipality, and one model for each 200 points, based on 20 runs, and used a threshold of 75% to obtain a presence-absence map for each municipality. We summed the 19 binary layers to generate a consensus map showing how many times each pixel was selected by the model. Areas were selected from 0 to a maximum of 7 times, and the most frequently selected areas were concentrated in south and eastern portion of the domain. We do not believe that unselected areas really represent poorer regions, since we did not obtain good quality data for central Mato Grosso state, and the west boundary of Cerrado. It is possible that the environmental features in these

regions are so particular that even a different fauna could be found there.

Theme:amphibians, anurans, ecology

Type of Presentation: Oral contributed

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Survey and management of chelonians for communities in the Medium and Low river Juruá - Amazon

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The River Juruá still possesses beaches of reproduction with great populations of chelonians conserved and managed for the local communities. In the areas of the extrativist Reserves of the Medium and the Low Juruá, 14 beaches had been protected. Ten species of chelonians in the region had been identified: *Podocnemis expansa* (tartaruga), *P. unifilis* (tracajá), *P. sextuberculata* (iaçá), *Peltecephalus dumerilianus*, *Rhinoclemmys punctularia*, *Platemys platycephala*, *Geochelone denticulata*, *G. carbonaria*, *Chelus fimbriatus* and *Phrynops raniceps*. The production of beaches in the Resex of Low Juruá, was estimated in 130,011 fingerlings/year (1.30% *P.expansa*, 6.79% *P.unifilis*, 91.92% *P.sextuberculata*) and at Medium Juruá is of 250.000/year, an increase of about 1.648% in 16 years of protection (1990-2006). The monitoring of chelonians, therefore, objectified to evaluate the populations of *Podocnemis* in the Resex of the Medium and Low Juruá, through the capture and marking of individuals, where they had been gotten given biometrics, sexual reason and other information on the population structure of these species. One applied questionnaires. It has greater abundance of iacás (*Podocnemis sextuberculata*) in the river Juruá. In the period of full of the rivers, the chelonians was concentrated in the lakes and flooded forest, for the biggest one it offers of foods and protection against predators. At Medium Juruá, the weight of captured animals was: tartaruga= 4355-7635 g, age=6.78-8.76 years(máx=30 anos) and 81.12%F; tracajás=2018-2703,6g, age=2.63-2.13 years and 84.05% F; and iacá=612.1-1324.2g, age=5-11.5 years and 65% F. Optimum adjustment of curve of individual growth of turtles was for the model of Von Bertalanffy, $Y_t = 52.98 (1 - 0.632 \cdot e^{-0.0039 \cdot t})^3$. At medium Juruá, tracajás costed R\$18.12±5.9, tartarugas =R\$90.0±40.8, iacá= R\$3.75±2.6. At Low Juruá, iacás 16.42% had been female with length of carapace average (CC) of 15.67±3.6 cm, average weight of 0.49±0.29 kg and age of 3.8±2.3 years. In the Low Juruá, the maximum production of fingerlings was estimated at 540.507, with a annual rate improvement ($r = 0.09125$). The model of production of fingerlings for the region was the following one: Production of fingerlings in the Low Juruá Resex ($t = 540.507 \cdot (1 - 0.09125 \cdot t)$). It must be considered, in 5,74% the survival rate up to 12 months. These natural values of conscription, disable the extration of quelônios of rational form while still alive exempt.

Theme:Chelonians; growth;Podocnemis;survey;model

Type of Presentation: Poster

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Pé-de-pincha Program - Nine Years of Sustainable Management of Chelonians (*Podocnemis unifilis*, *P. sextuberculata*, *P. expansa* and *P. erythrocephala*) for Communities of Medium Amazon River

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“Pé-de-pincha” it comes being developed for the Federal University of Amazon (UFAM) since 1999, stimulating the conservation of chelones through of participative management. UFAM and IBAMA come working in 86 communities of Medium Amazon and Negro river, in the cities of Nhamundá, Parintins, Barreirinha and Barcelos/AM and Terra Santa, Juruti and Oriximiná /PA. The program aims at the sustainable management of chelones for the communities. In the region, 13 species of chelonians had been identified: *Podocnemis expansa*, *P. unifilis*, *P. sextuberculata*, *P. erythrocephala*, *Peltocephalus dumerilianus*, *Rhinoclemmys punctularia*, *Phrynops nasutus*, *Kinosternon scorpioides*, *Geochelone denticulata* and *G. carbonaria*, *Chelus fimbriatus*, *Platemys platycephala* and *Phrynops nasutus*. From 1999 to 2008, the program returned to the nature 721,589 fingerlings of chelonians (74.4%, *Podocnemis unifilis*; 7.6% *P. expansa*; 10.9% *P. sextuberculata*; e 7.1% *P. erythrocephala*), proceeding from managed nests, with hatchling rate of $81.97 \pm 7.76\%$ against $54.51 \pm 16.27\%$ of natural nests. The mean temperature in transplanted areas was equal to $32.55^\circ \pm 3.17^\circ \text{C}$, whose result was the birth of $50.55 \pm 12.3\%$ of females. In social programs, 405 teachers of the schools had been enabled in environmental education; carried through lectures on alternatives for the development for more than 67,606 listeners; qualification of 101 environmental agents; more than 1,021 people had participated of courses of alternatives for income generation; e had been installed more than 31 units of communitarian breeding with 12,963 animals(2003-2007). Since 2004, had been marked 28,303 fingerlings (10% with microchips) for monitorament through recapture (CMR) and estimate of the survival and growth rate. The biggest recapture rate was of tracajá with 6.19%. The survival rate of tracajás managed, up to 12 months of age, was estimated in $17.76 \pm 10.23\%$. The annual improvement of females in the reproduction areas increased $37.11 \pm 55.83\%$. The average cost of the fingerling produced in this system of management communitarian was of R\$0.71 \pm 0.06. If to increase the number protecting areas we would reach a population balance in 13 the 15 years of protection. The communitarian farming was monitored being that the chelones created in tank-net had demonstrated to a daily weight gain (DWG) superior (0.49 ± 0.20 g/day) than to the animals in other tanks, concrete or fiber (0.18 g/dia). The best density for this system was of 40-65 chelones/m³, being that the survival rate was of $89.42 \pm 10.56\%$. The total production was of 866 kg/36 months, with net income estimated in R\$1.559/tank/year.

Theme:Chelonians, *Podocnemis*, manegement, Communities, farming

Type of Presentation: Oral, Symposium 15: Development and Implementation of Recovery Programs for Endangered Chelonians.

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Evaluation of the growth, survival rate and sexual reason of tracajás (*Podocnemis unifilis*)

under management in the nature and in tank-nets at medium Amazonas river

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The consumption of chelonians is a habit at Amazonia, it is necessary that a management program is developed to prevent the predatory exploration of these populations. It was objectified to evaluate the growth, sexual reason and survival rate of tracajás (*Podocnemis unifilis*) managed in the nature and tank-net in the region of medium Amazonas river -AM. The monitorament was carried through of marking of fingerlings of chelones. Its has been marked 7.960, in 2004, 1.291, in 2005, 3.500, in 2006 and 10.490 fingerlings in 2007, with carapace bore code system, and in 1.114 were marked with microchips (transponders ISSO FDX-B 12mmX2mm, Animall Tag). The fingerlings were released in six areas of naturals lakes. The monitorament was maked, every two months, through recapture and biometry of fingerlings marked. The capture was maked with nets (100 m), trammels-nets and diving fishery. The fishery effort was 251 hours/fisher/area. The recapture rate varied of 3,5% -12,35%. The survival rate for fingerlings maintained in wards (captivity) for a period of 3 months approximately, before released in nature, was $5,57 \pm 5,13\%$ (mín=0,57%; máx=12,35%) more than the rate of fingerlings borns in nature, with $0,99 \pm 0,49\%$, what it demonstrates the viability of the manegement of chelones while still alive exempts. The tax of survival of these managed animals varied at the different localities enters $0,57 \pm 10,64\%$ to $12,35 \pm 9,57\%$, considering the intensity of exploration of the natural resources and the amount of predators that occur in each area. The survival average rate of tracajás in nature, untill 12 mounths, was estimated in $17,76 \pm 10,23\%$. The biggest growth was in water black lake more than in the várzea or water white lake. The daily weight gain (DWG) of *P.unifilis* fingerlings, marked with microchips and free in nature, was $0,62 \pm 0,44$ g/day. In tank-net, tracajás (*P. unifilis*) improvement varied about the environment and the water system. In black water, with 12 mounths of age, was obtained a average weight of 87- 103 g, with DWG= 0.25 g/day. In white water or floodedlands, was obtained a biggest weight of 108-125 g, with DWG= 0,3 g/day. The survival in captivity until one year was $89,42 \pm 10,56\%$. The daily weight gain of the tracaja untied in the nature kept similar values between all the localities, with a band of $0,07 \pm 0,11$ à $0,30 \pm 0,095$ gram/day.

Theme:Chelonians, manegement, survival, sustenaible, Podocnemis

Type of Presentation: Poster

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Predation on one species of amphibian and two lizards by the Queenless Ant *Tocandira Dinoponera quadriceps* Santchi (Hymenoptera:Formicidae) in Northeast Brazil.

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Vertebrates are known to be prey for Ponerine ants, although the knowledge of this relationship is well known, there is a lack of published reports about the predation of vertebrates by those ants. *Physalaemus cuvieri* is a small leptodactylid frog with wide distribution in South America, ranging from northern Brazil, to Argentina, eastern Paraguay, Bolivia and possibly the lowlands of southern Venezuela. This is a very common species in different habitats and ecosystems, breeding in temporary and permanent ponds. *Tropidurus hispidus* is popularly called the “Lava Lizard”, the genus *Tropidurus* includes around 14 species distributed within South America. *T. hispidus* is recognized by its grey color and keeled scales, it is probably the most well known lizard in the northeast region of Brazil. *Cnemidophorus ocellifer* is a lizard very active during the hottest hours of the day, it lives in the ground, where it dig some holes to hide, rest and to lay eggs. Its size vary from 30mm to 150mm. Some specimens have a bright green color. Between 21 and 23 May 2007 in the “RPPN Ambientalista Francy Nunes”. State of Ceará. Ponerine ants of the species *Dinoponera quadricipes* (approximated length 3cm) were observed preying on three frogs *P. cuvieri*, two lizards *T. hispidus* and one lizard *C. ocellifer*. All of the preyed frogs were observed on May 22 and 23. They were trapped in pitfall traps and were photographed. One of the *T. hispidus* was preyed in a pitfall trap, for this one was observed the exact moment of the ant attack (15h20). While the other *T. hispidus* was sighted already dead being carried by a *D. quadricipes* in an area of Caatinga biome with stony soil. The *C. ocellifer* was identified only by its back legs and part of the tail, because the rest of the animal had already been eaten. There was no method to certificate if *D. quadricipes* preyed that animal directly or if it was just behaving like a scavenger catching an already dead prey. Scavenger behavior is reported as common to that species.

Theme: reptiles, amphibians, lizards, behaviour, predator-prey

Type of Presentation: Poster

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Nesting Site and Incubation Duration of *Caretta caretta* in Southeastern Brazil

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On the 2006/2007 reproductive season, the influences that geological characteristics of the nest area due on the incubation duration of *Caretta caretta* (Loggerhead Turtle) were evaluated in four beaches of Espírito Santo state, Brazil's southeastern region. Povoação and Pontal do Ipiranga are open sea beaches and are under influence of coastal currents that redistribute the quartz sediments originated from Doce River's mouth. The sandy sediments from these beaches are composed basically of quartz with some iron oxides contributions. The average content of bioclasts is less than 1%. Mole and Jacaraípe beaches receive a great contribution of bioclasts from the beds of coralline algae that exists next to them. The average content of bioclasts at Mole beach is about 62% and at Jacaraípe beach about 48%. Samples from 106 nests originating from the four beaches were submitted to mineralogical and grain size analysis, and the sand albedo was measured. To test the existence of differences between the geological characteristics and the incubation duration, between the beaches, the one-way ANOVA on Ranks was used, and multiple regression analysis was used to test the relation between the environmental factors and the incubation duration. When each beach is evaluated individually, the characteristics of the nest site (grain size, albedo and bioclast content) do not influence the incubation duration. However, when beaches are evaluated together, the mineralogical composition and the size of the sediment affect the incubation duration. Nests located at sandy quartz sediments and at coarsest sands present a shorter incubation duration. Results indicate that the local geological variations are not sufficient to affect the nests' thermal

environment, but regional variations, between the beaches with sedimentologic differences, affect the incubation duration. In conclusion, the protection of nest areas must extend to areas that are geologically different, which guarantee a thermal diversity with a huge importance in the balance of sea turtles population.

Theme:Sea turtle, ecology, nesting

Type of Presentation: Poster

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Reproductive monitoring of *Podocnemis expansa* and *Podocnemis unifilis* in captivity at the Balbina Hydroelectric Power Plant, Amazonas, Brazil

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The aquatic Turtles Preservation and Research Center (CPPQA) / Manaus Energia S. A. has been in operation since 1989 in order to attenuate Balbina Hydroelectric Power Plant impact on the environment at its influence area, downstream the Balbina dam, on Uatumã River basin, Amazonas. At CPPQA functions a scientific turtle breeding, its facilities consists of two round tanks with beaches, and two artificial beaches built in the 80's nearby the dam downstream the river. Nowadays the bank of reproducing turtles of the CPPQA comprises 100 females and 30 males of Amazon-turtles (*P. expansa*) and, 120 females and 40 males of yellow spotted sidenecked turtle (*P. unifilis*). The nests are monitored daily from 5:30am through 8:30am during the reproductive season, which is from July through November for *P. unifilis* and from September through December for *P. expansa*, the nests are marked with wooden bars and transplanted when necessary. During nine years of monitoring, 323 nests of Amazon turtles and 322 nests of yellow spotted sidenecked turtle were recorded, and a posture mean of 32 and 31 nests per year with an average of 101,92 and 25,00 eggs per nest, respectively, being the mean incubation period of 56 days for *P. expansa* and 64 days for *P. unifilis*. The hatch of 36,097 *P. expansa* and 5,483 *P. unifilis* hatchlings was guaranteed summing up 41,580 offsprings born at CPPQA, with a yearly mean of 4,020 *P. expansa* and 609 *P. unifilis* hatchlings. The hatchlings were released upstream and downstream the Balbina dam, but only downstream Uatumã River in the last years. At birth, the carapace of *P. expansa* and *P. unifilis* hatchlings measure an average of 45.69 mm and 41.6 mm and present a mean weight of 20.43 g and 16.8 g, respectively. 70% was the rate of egg hatching found in the tanks of CPPQA, which was lower than the hatching rate of nests at artificial beaches that was around 86%. It was also noticed an increase in hatchlings presenting some carapace deformity, and in 2007 an albino *P. expansa* was born at CPPQA

Theme:reptiles, turtles,reproduction,conservation biology,Podocnemis

Type of Presentation: Poster

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Uncovering the distribution of cryptic diversity in the bright-tighed poison frog, *Allobates femoralis*: mtDNA phylogeography and evolutionary insights.

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Several studies addressing molecular systematics and phenotypic divergence of *Allobates* frogs have pointed to the taxon *Allobates femoralis* as being composed of multiple evolutionary lineages, which may represent distinct taxa. These studies only sparsely sampled the widely distributed *Allobates femoralis* throughout its Amazon basin distribution. In the current study, we investigate the phylogeography of *A. femoralis* in the Brazilian Amazon, focusing on the Madeira River basin, and we make the first attempt to map the distribution of genetically differentiated lineages within this taxon. Analysis of a 506 bp fragment of the 16S rRNA mitochondrial gene from a total 370 *A. femoralis* individuals sampled in 33 localities, pointed out the existence of two very distinct lineages of *A. femoralis* (pairwise distance between lineages = 5%), corresponding to western and an eastern clades. The western clade is formed by samples from the Brazilian state of Acre, reaching the left bank of the upper Madeira River, in the state of Rondônia. Samples from the vicinities of Puerto Maldonado (obtained from published sequences deposited in GenBank) indicate that this group is distributed at least down to the middle course of Madre de Dios River, in southeastern Peru. The eastern clade is composed of individuals from both sides of the middle to lower course of the Madeira River, and by additional samples from the Tapajós river basin and other localities in Rondônia. Along the upper Madeira River, this clade occupies the entire right bank, but its distribution is interrupted on the left bank, where it reaches a contact zone with the western clade. Thus, large rivers such as the Madeira, Tapajós and their tributaries may work only as secondary barriers to major lineages that diverged elsewhere. Both western and eastern clades present geographical variation in advertisement calls, morphology and color pattern of thigh patch, suggesting high phenotypic plasticity within these groups. In at least one case – populations in the contact zone on the upper Madeira River – phenotypic divergence in calls and morphology of individuals belonging to the western clade (which present a distinctive 2 note advertisement call and reddish coloration on posterior region of the belly) can be related to character displacement following secondary contact with populations of the eastern clade.

Theme: anurans, genetics, evolution

Type of Presentation: Poster

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***Allobates femoralis*: a handy fellow for Amazonian biogeography.**

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Studies addressing the distribution of poison-dart frogs and their divergence patterns in Amazonia provided many interesting biogeographical hypothesis, but only a few of them used members of the taxa now recognized as belonging to the family Aromobatidae. Previous works on molecular systematics and phenotypic divergence of aromobatid frogs have pointed to some *Allobates* taxa as being composed of multiple evolutionary lineages, which may represent distinct species. We present new evidence obtained from the mtDNA phylogeography and phenotypic differentiation patterns of *Allobates femoralis* in Brazilian Amazonia, providing some new insights into the evolutionary history of this group and discussing them in the light of current hypotheses on the origin of Amazonian biological diversity. In addition, we advocate the using of *Allobates* species as potential models for further studies on the biogeography of this region.

Theme:amphibians, anurans, genetics, evolution

Type of Presentation: Oral, Symposium 11: Dendrobatoid Frog Biology.

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Hemipenial Morphology of Gymnophthalmid Lizards I: The Subfamily Cercosaurinae

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The family Gymnophthalmidae is a Neotropical taxon of small lizards currently composed by 43 genera and more than 180 species. This group presents a complex taxonomy and two recent and very similar phylogenetic proposals, both based on molecular data (Pellegrino et al, 2001; Castoe et al, 2004). Nonetheless, these proposals show some disagreements and 17 genera are missing in both analysis, with uncertain position or being tentatively rooted among the other gymnophthalmids. Some genera of the family present convergent morphological adaptations to specialized habitats like limb reductions, body elongation, lost of eyelids and/or external ear, providing some difficulty on the elaboration of a consistent morphological phylogenetic hypothesis for this group. The hemipenial morphology has been traditionally used in snakes systematics and taxonomy for more than one century, though it is very poorly explored in the other squamates. Currently we are describing and analysing the hemipenial morphology of all the gymnophthalmid genera, and searching for phylogenetic information in order to find a better resolution to the existent phylogenetic proposals and to try to clarify the position of the 17 missing genera on the supra generic arrangements proposed by Pellegrino et al (2001) and Castoe et al (2004). In this poster we present some preliminary results of this work, focusing the subfamily Cercosaurinae. This taxon includes two tribes: Cercosaurini and Ecpleopini. The first group presents, in most genera, series of flounces that may be organized in a single column (e.g. the *Neusticurus* spp, some *Anadia* and some *Bachia*), or in two columns, one positioned on the ventro-lateral face and the other on the dorso-lateral face of the hemipenes (e.g. *Cercosaura* spp., *Leposoma* spp. and *Placosoma* spp). Most of the Cercosaurini genera also present rows of little spines associated with those flounces, though some taxa lack these structures (e. g. *Neusticurus* spp.). In contrast, the rows of spines are lacking in most of the Ecpleopini species, which present hemipenes with flounces entirely nude or bearing isolated large spines. There are some exceptions to this pattern, such as *Dryadosaura nordestina* and *Arthrosaura reticulata*, both presenting these rows of spines. Additionally, there are few taxa of Cercosaurinae lacking any kind of ornamentaion, like some *Bachia* species (*B. bresslaui* and *B. scolecoides*) and *Ecpleopus gaudichaudii*. Those species present a completely nude organ, without any kind of spines or flounces. This work has been suported by FAPESP (proc. number 2007/000811-8)

Theme:Gymnophthalmidae, Cercosaurinae, Morphology, Hemipenis, Lizards

Type of Presentation: Poster

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Behavioral observations associated with reproduction in Brown Treesnakes

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Behavioral observations associated with reproduction in Brown Treesnakes Reproduction of Brown Treesnake (BTS) may involve profound modifications to behaviors such as feeding and change of habitat use, and physiological modifications such as body fat storage. Between January and April of 2007-2008, observations of BTS have been made in and around Tarague basin, Guam. The history of Brown Treesnake trapping has yielded a capture rate ratio of 50% female and 50% male. We discovered that at Tarague basin during the study periods that trap capture ratios were more than 80% female. This leads us to believe that female BTS could be attempting sexual migration and therefore be more trappable in this location during specific times of the year. Most of these BTS travelers have a high percentage of fat content. Currently, we are experiencing a high capture incidence of pregnant female BTS whose eggs are in an early stage of development. We have captured five female BTS over the past two weeks who have been pregnant. These females are generally all at the same reproductive stage. This leads us to believe the BTS will lay the eggs in the same place and possibly this is the peak for laying eggs in this area. In the same period and same place we captured three female BTS in very pure condition, totally exhausted, and with no body fat. These individuals were checked for parasites with none being observed. The assumption is that these cases could be snakes that have already laid eggs. Most of the BTS in this area do not have dissolved prey items within their digestive tracts, possibly due to a cessation of feeding brought on by reproductive stage. In two cases we did find in the stomachs part of snakes' tails leading to the assumption of cannibalism. Additional studies in this and other areas on Guam should be continued. DAWR is expecting to continue examining.... Over the next.....

Theme:Brown Treesnake Guam

Type of Presentation: oral

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Chloramphenicol is Active Against Chytridiomycosis in Frogs

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Treatment for chytridiomycosis, a severe disease of amphibians caused by the chytrid fungus, *Batrachochytrium dendrobatidis*, is difficult owing to low safety and effectiveness of treatments. We demonstrate that the antibiotics chloramphenicol and thiamphenicol kill *Batrachochytrium*

dendrobatidis in vitro at 20 mg/L, concentrations suitable for therapy. Safety trials in tadpoles of *Litoria ewingii* demonstrated no negative effect of continual immersion in chloramphenicol at 20 mg/L, with growth to metamorphosis being normal. Immersion in thiamphenicol at 20mg/L for 21 days was also without adverse effects on *L. ewingii* tadpoles. Safety of chloramphenicol was demonstrated in an additional seven Australian frog species; five *Litoria* spp and two *Pseudophryne* spp. Adults of *L. ewingii* and *L. raniformis* were experimentally infected with *B. dendrobatidis* and used in two controlled unblinded therapeutic trials. Therapeutic trial 1 used 60 frogs to determine the optimum exposure regime to eliminate *B. dendrobatidis*. Continual immersion in 20 mg/L of chloramphenicol was more effective than immersion in 10 mg/L or application of chloramphenicol ointment. Therapeutic trial 2 confirmed that *B. dendrobatidis* was eliminated from all infected frogs by immersion in chloramphenicol solution (20 mg/L) for several weeks. In a re-challenge experiment, 10 adults each of *L. ewingii* and *L. raniformis* that had been cured of *B. dendrobatidis* were re-exposed to *B. dendrobatidis* zoospores. All *L. ewingii* and 40% of *L. raniformis* became infected compared with 95% of naïve frogs. However, all infected untreated frogs eliminated *B. dendrobatidis* within 6 weeks. We suspect that acquired immunity may be responsible for the self-cure.

Theme:Chytridiomycosis, *Batrachochytrium dendrobatidis*, antimicrobial compounds, chloramphenicol, thiamphenicol, amphibian declines, *Litoria*, *Pseudophryne*, therapy, thiamphenicol

Type of Presentation: Oral, symposium 6: Disease and amphibian declines - where do we go from here?

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Biology, Distribution and Conservation of *Rana johnsi* in China

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Rana johnsi is one of the wood frogs living under forest hiding among defoliation in no-reproductive period and rare to survey. It distribute in South Asia, including South China, Vietnam, Lao and Thailand. In China, it was known from Mt. Dayao of Guangxi in 1960s. After our recent Surveys it has been found from other province, such as Sichuan, Yunnan, Hainan as well as Guangdong and Hunan, where it limited in narrow areas of mountains. All specimens have the characters with yellowish to reddish back and distinct dark to black temporal triangle, distinct and continuous, narrow dorsolateral glandular ridgw and a V-shaped and anteriorly pointed fold between shoulders, as well as several distinct transverse folds with dark bands on the legs. The relationship of the frog from such provinces is under molecular analysis and new species or subspecies maybe classified. In reproductive period (from September to February of next year), the frogs fall to the water pools or streams and act in the wetland nearby in daytime. The tadpole is similar in appearance to and larger than those of the brown frogs. Labial tooth row formula is I:5-5/1-1:IV and I:4-4/1-1:IV taken overwintering and completed metomorphosis in the summer. The froglets appear in May to June. The frog has been threaten mainly by the artificial and natural factors, such as use of the water pools as fishing stew and water pollution. The protective measures and management was suggested to the local reserves after the surveys.

Theme:Anurans,*Rana johnsi*, Distribution, Biology, Conservation, China

Type of Presentation: Poster-amphibian conservation

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Effects of estradiol -17 β on liver vitellogenin gene expression in immature male frogs, *Hoplobatrachus rugulosus*.

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Estrogen induces liver vitellogenesis as well as liver vitellogenin (Vtg) gene expression in adult female and male frogs. We aimed to investigate if estrogen can induce Vtg gene expression in immature male frogs. Immature (5 months old) male *Hoplobatrachus rugulosus* reared in a farm were used. Primers designed from the Vtg sequence of *Gullus gullus* were used for RT-PCR amplification of the liver Vtg gene. The frogs were intramuscularly injected daily with estradiol -17 β (E2) at the dose of 0, 50, 500 or 5000 μ g/kg body weight (hereafter abbreviated E0, E50, E500 and E5000 respectively) for 5 days. Results showed that Vtg gene expression tended to increase in E50 (0.70 ± 0.05) and E5000 (0.74 ± 0.05) while it was significantly increased in E500 (0.80 ± 0.06) compared with that of E0 (0.61 ± 0.04). Only E5000 increased liver- somatic index (LSI) compared with that of E0 (5.56 ± 0.53 Vs 4.43 ± 0.30) while no differences were found in E50 and E500. Gonadal -somatic index (GSI) was decreased only in the E500 compared with that of E0 (0.12 ± 0.01 Vs 0.14 ± 0.01). High doses of E2, i.e. E500 and E5000, significantly reduced testicular weight of the frogs. Overall results indicate that E2 can induce liver Vtg gene expression as well as LSI and decrease GSI in immature male frogs. Hence, it would be possible that exogenous E2 such as xenoestrogen in the environment may cause the impairment of sexual development in the immature male frogs.

Theme: Anurans, Amphibians, Reproduction, Physiology

Type of Presentation: oral

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Experimental fishery of *Podocnemis unifilis* in a River Community in Santarém, Pará, Brazil.

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This study is part of the Project “Conservation and management of chelonians and alligators in River Communities of the Lower Amazon River Basin”. One of the project’s goal is to assess the population structures of the species that are consumed by local human populations in river communities in Santarém, Pará, Brazil. The samples were taken at two locations indicated by the local people, the Água Preta Lake and the “Igarapé do Lago”, in November and December of 2007. There is no physical barrier separating these places, so chelonians can easily migrate from one to the other. The sample was taken after the reproductive period had finished, in accordance with local people’s suggestion not to disturb the nesting females. We used “puçá”, a type of trawl net, to catch the animals. It is tied at the lateral of the motor-boat and it’s kept underwater as long as wanted or until it gets too heavy. We captured and marked 990 individuals of the species *Podocnemis unifilis*, and recaptured 19 individuals (1.88%) one time. The total fishing effort was 772 minutes, resulting in a average captures of 1.6 individuals per minute (sd ± 1.473 ind/min). Captures from “Igarapé do Lago” were higher than captures from Água Preta Lake (Teste T, $p=0.01$). Male’s carapace length varied from 18.2 to 46.1 cm (mean 34.12 ± 5.03 cm, $n=214$), and weight between 0.5 and 4 kg (mean 1.65 ± 0.67 kg), resulting in a biomass of 352.2kg ($n=214$). Female’s carapace length varied from

18.2 to 46.1 cm (mean 34.12 ± 5.03 cm, $n=773$), and weight from 0.5 to 10.5 kg (4.98 ± 2.01 kg), resulting in a biomass of 3,851.5 kg ($n=773$). Female's carapace length and weight were significantly larger than the male measurements (T Test, $p<0.001$). We found a sex ratio of 1:3.61 to females, probably due to the proximity of the sampling location from a big nesting beach located in the community area. The high rate of captures we had using puçá in this community, reaching 4,203.7 kg of yellow-spotted Amazon River turtle caught, may be due the Água Preta's people historical concern about their fishery stock. They signed the Community Fishery Act in 1984, which includes protection of the main nesting beaches and seasonal restrictions on fishing in their lakes.

Theme:turtles, conservation biology

Type of Presentation: poster

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Conservation overview of herpetofauna in the United Arab Emirates

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The United Arab Emirates (UAE) is a federation of seven Emirates located in the northern part of the Arabian Peninsula with a landmass of approximately 89,000 km² (including offshore islands) with a hyperarid climate. The UAE's herpetofauna can be broadly divided into the following: 1) toads, 2) marine turtles, 3) lizards, 4) geckos, 5) skinks, 6) snakes (both terrestrial and marine), and, 7) amphisbaenid species. The conservation of herpetofauna is becoming an important issue in a region which is seeing rapid economic growth coupled with rapidly expanding urban infrastructure. This puts pressure on species which are specially adapted to live in such a hyperarid climate where there are many challenges for their survival.

Theme:amphibians, reptiles, turtles, snakes, lizards, ecology, natural history, conservation biology, endangered species

Type of Presentation: oral

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Planning re-introduction programs with an emphasis on herpetofauna

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This presentation will give an overview of the IUCN Re-introduction Specialist Group with reference to the terminology on the IUCN Re-introduction Guidelines e.g. re-introduction, supplementation, conservation introduction including other terminology such as substitution and introduction. The different sections of the IUCN Re-introduction Guidelines will be discussed with relevant examples from herpetofaunal re-introductions.

Theme:reintroduction IUCN guidelines herpetofauna

Type of Presentation: oral

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Conservation of Amphibians and Reptiles in the United States: The

Priya Nanjappa Mitchell, Ernesto R. Garcia

Priya Nanjappa Mitchell; Amphibian & Reptile Coordinator, and State Liaison to PARC; Association of Fish & Wildlife Agencies; 444 N. Capitol St., Suite #725, Washington, DC 20001, pnanjappa@fishwildlife.org Ernesto R. Garcia; PARC Federal Agencies Coordinator, US Fish and Wildlife Service, Trinity River Restoration Program, 1313 S. Main St., Weaverville, CA 96093 USA.

Scientists engage in research with the intention of influencing on-the-ground conservation, but they are infrequently able to see their recommendations through to implementation. Government natural resource and land management agencies are often under pressure to implement conservation management decisions or policies, even when the science is uncertain. In addition, public education is an important component of conservation success. Recognizing the need to bridge these gaps and foster communication and collaboration, Partners in Amphibian and Reptile Conservation (PARC), a multi-disciplinary effort that forges partnerships among scientists, resource managers, educators, policy makers, and private citizens, has developed a model for applied conservation biology which is inclusive of the various facets of conservation. This model is a flexible adaptive management process built on the following steps: 1) Identify and prioritize issues; 2) Engage stakeholders; 3) Develop and distribute tools, products, incentives and other resources for implementation; 4) Monitor success; and 5) Adapt previous steps based on monitoring results and emerging science. Following identification of a high priority issue for conservation action, multi-institutional, interdisciplinary task teams are impaneled to execute the remaining steps in the process. The size, composition and life span of each task team varies according to the skill sets and resources required to thoroughly address each issue. The sequence, relative emphasis and investment of resources may also be adjusted to optimize the impact of conservation actions on the targeted taxa. Results of this model range from informational fact sheets and pamphlets to comprehensive literature syntheses, inventory and monitoring techniques, trainings, and strategic workshops. Specific examples of products to address habitat loss and fragmentation as well as invasive species and unsustainable use (collection, trade, etc.) will be presented.

Theme:amphibians, anurans, salamanders, conservation biology, captive breeding, endangered species, adaptive management, applied conservation, conservation biology, partnerships, reptiles, United States, wildlife management

Type of Presentation: Oral, Symposium 14: Amphibian conservation.

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High Diversity of Reproductive Modes in Frogs of Kaieteur National Park

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The rationale for this study was prompted by the question—why are frogs with fishlike, unprotected eggs so successful at exploiting terrestrial landscapes with their constant risks of desiccation for eggs, larvae and adults? Fifty species of frogs from Kaieteur National Park (KNP) were assigned to reproductive modes which encompass the site of egg deposition, and type of larval development and

nutrition. One KNP species, *Leptodactylus rugosus* did not fit any of the 39 modes defined by Haddad & Prado (2005), so we created a new mode, 40. Only 47 of the 50 species of frogs of KNP could be assigned and totaled 17 reproductive modes or comprised 42.5% of the World's diversity. Comparisons of modes among KNP, the Atlantic Forests of Brazil, Amazonian forests, the Neotropics, and the World indicated that mode diversity of the fast disappearing Atlantic forest of Brazil is highest with 67.5% of the World's mode diversity. Yet the ratio of modes to species is higher for KNP (0.36 versus 0.29 for the Atlantic forest). The families Hylidae and Leptodactylidae were responsible for the high diversity of modes in KNP. We concluded that the complex interplay of topography, prevailing winds, and mist from the gigantic falls augmenting an already high humidity, probably reduced the risks of desiccation, and facilitated the evolution of reproductive strategies with eggs and/or tadpoles that develop without standing water.

Theme:Anurans, community ecology, reproduction, behavior

Type of Presentation: Poster contributed

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To Kill or Not to Kill: Introduced bullfrogs exemplify the complexities of invasive Vertebrate Management

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The need to design effective management strategy for invasive alien species (IAS) is now considered a conservation priority. Prevention of arrival and establishment, eradication of incipient populations, and control and containment of established populations are sequentially the best management strategies for IAS, going from most effective to less beneficial. However, management is often not initiated until invasive populations are well established and most efforts are focused on the last option of the above sequence. This is the case of the introduced bullfrog (*Rana catesbeiana*) in western North America. Introduced bullfrog populations were well established in the early part of the 20th Century but were not recognized as a potential threat to native amphibians until almost half a century later. In most cases, control efforts were not initiated until the 1990s. Using population matrix models, I examined how changes in vital rates brought about by the control efforts affect growth rate of bullfrog populations. Prospective demographic perturbation analysis showed that bullfrog population growth rate (λ) was most influenced by the proportion of tadpoles metamorphosing early (tadpole development rate), and by early post-metamorphic survival rates. The modelling showed that some control efforts might not be very effective due to compensatory responses in these two vital rates, making eradication of bullfrog populations close to unfeasible. This poses a challenge to environmental agencies charged with conserving native biodiversity. Bullfrog populations have been expanding rapidly over the past decade in British Columbia, Canada. The province is under tremendous public pressure to respond to this threat. In response, we have developed a management strategy that incorporates prevention, containment and control, and habitat restoration to maintain native amphibian diversity at the landscape level in the continued presence of bullfrogs.

Theme:amphibians, anurans, ecology, community ecology, natural history, endangered species, conservation biology

Type of Presentation: Oral, Symposium 2: Invasive Reptiles and Amphibians: Global Perspectives and local solutions

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Investigations into the synchronous calling behaviour of the hip-pocket frog *Assa darlingtoni* (ANURA: Myobatrachidae)

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Competition among males is seen in many frog species. Many males use 'advertisement calls' to attract females and to compete with other males. Each species' typically has a distinctive advertisement call. Conspecific males generally compete by calling for females at the same time and in the same habitat. Further still, neighbouring conspecific males often change the timing of their calls when competing for females in choruses. In the majority of anurans, males alternate their calls in relation to that of nearby males, so that their call is distinctive and thus avoid acoustic interference. In a smaller number of cases calling appears to be random. Numerous investigations have demonstrated that females choose these alternating or random males based on the 'quality' of the calls. In contrast, only a small minority of species, nine in total, have been reported to call synchronously. This may be because synchronous calling is rare among anurans, or because this behaviour has not drawn the attention of biologists. While distinctive calls enable females to compare and choose among males, it is postulated that this is not possible where calls of neighbours are synchronous. Three postulates have been proposed to explain synchronous calling; 1) predator avoidance behaviour, 2) co-operative behaviour and 3) competitive behaviour via acoustic interference. However, there few tests of these alternative explanations. We investigated the occurrence of synchronous calling among males of the Australian Myobatrachid frog, *Assa darlingtoni*. In this species, the male cares for his offspring (tadpoles) by carrying them in pouches on his body. Reproduction in this frog is not reliant on permanent or temporary water bodies, the egg mass is laid among moist leaf litter on the rainforest floor and the embryos enter into the males pouch at the time of hatching. As males are not restricted to the location where advertisement calls are conducted, as are those species that rely on ponds and rivers, males may potentially call anywhere on the rainforest floor. Males were found to call in aggregated groups (nearest 1st and 2nd neighbour measure, $P < 0.01$). Within these aggregations, recordings of neighbouring males reveal synchronous timing between calls. Furthermore, synchrony was also observed between the pulses of pair of calls. Reasons for this synchronous calling behaviour and that of other species will be discussed.

Theme: Synchronous calling behaviour, ANURA, Myobatrachidae, hip-pocket frog, *Assa darlingtoni*

Type of Presentation: oral, Symposium 3: Sensory Ecology of Anuran Communication

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Cutaneous Ulcerative Disease in Chelonians from Peninsular Malaysia

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Cutaneous ulcerative disease or shell rot is often a chronic and contagious pathological condition of aquatic and semi-aquatic chelonians in captivity. This study investigates the aetiology of this disease in two species of chelonians, namely the Malayan Box Turtle (*Cuora amboinensis*) and the Southeast Asian Narrow-headed softshell turtle (*Chitra chitra*). Both turtles were apparently healthy when

caught from the wild and the lesions developed while they were maintained in captivity. Grossly the lesions appeared as ulcerated foci with necrotic and caseous tissue. In certain areas the pits extended deep into the bony carapace. Following a sterile collection procedure, the carapace and plastron were rinsed thoroughly with sterile normal saline. The lesions on the carapace and plastron were sclerotized with a sterile blade, and superficial caseous material and debris were flushed. Materials for bacteriological and fungal cultures were then taken from lesions using commercial sterile swabs. Bacteriological samples were routinely cultured under aerobic and anaerobic conditions on blood and McConkey agar, while material intended for fungal culture was inoculated on Sabouraud's dextrose agar containing chloramphenicol. The bacteria isolated from the lesions on *C. amboinensis* include *Actinobacter* sp., *Aeromonas masancida*, *Moraxella* sp., *Pseudomonas aerginosa*, *Staphylococcus aureus*, *Citrobacter freundii*, *Fusobacterium nucleatum* and *Clostridium* sp. Bacterial cultures of the samples from *C. chitra* yield colonies of *Citrobacter freundii*, *Klebsiella pneumonia*, *Aeromonas* sp. and *Staphylococcus epidermitis*. No fungus or virus was isolated from the dermal samples. Histological samples of the tissue differentiated with Grocott's stain were also negative for fungal hyphae. Histopathology of samples taken from *C. chitra* showed severe coagulative necrotizing myositis with massive infiltration of the polymorphonuclear cells that was suggestive of bacterial infection. In addition, there was a loss of normal muscle tissue and infiltration by fibroblasts. It is highly likely that the causative agent for the cutaneous ulcerative lesions in the turtles is *C. freundii*, corroborating previous reports on the aetiology of this disease in temperate chelonian species. *Baneckea chitinovora*, another incriminating agent of shell rot in chelonians, was not identified from lesions on the turtles. The isolation of *C. freundii* from cutaneous ulcerative lesions in tropical chelonians will facilitate proper control and treatment of this common disease in captive specimens.

Theme: reptiles, turtles, captivity, bacteriology, disease

Type of Presentation: poster contributed

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CHELONIA RICHNESS AND ABUNDANCE AT THE SÃO FRANCISCO DRAINAGE BASIN

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This study is the compilation of the activities for characterizing of chelonia richness and abundance at the São Francisco drainage basin, as a part of the Project of Diagnosis of the São Francisco's Herpetofauna, accomplished by the Brazilian National Center for the Conservation and Management of Reptiles and Amphibians / Chico Mendes Institute for the Biodiversity Conservation (RAN/ICMBio), in partnership with Biodiversitas Foundation (FBIODIVERSITAS), in 2006 and 2007. The aim was to evaluate the preservation condition of the chelonia species, equitably cataloguing areas in the high, medium, under medium and low São Francisco, embracing the following States: Minas Gerais, Bahia, Sergipe and Alagoas, according to the sample places selection criteria in fitofisionomics, geographic and fauna aspects appropriated to the occurrence of the aimed

species. The collecting methodology consisted on daily and nightly active search, passive search through funnel trap, fishing, diving, and per interviews with environmental agencies technicians, fishers and riparian communities (Table 2). 15 towns placed at São Francisco River and its tributaries were sampled, totalizing 29 principal referential points researched. It were captured 31 *Phrynos geoffroanus* individuals, nine *Batrachemys tuberculata*, three *Geochelone carbonaria*, three *Kinosternon scorpioides*, two *Acanthochelys radiolata* and one *Bufocephala vanderhaegei*. 54 individuals of *P. geoffroanus* were visually sampled; six specimens of *G. carbonaria* and one of *B. tuberculata* were recorded by interview, totalizing 110 chelonia individuals (Table 1). *P. geoffroanus* and *G. carbonaria* had the higher occurrence in the basin and they are widely disposed in the Brazilian Savannah (Cerrado) and Caatinga. *B. tuberculata*, *A. radiolata*, *A. spixii* and *K. scorpioides* are the most restricted disposed species. The sexual ratio of the *P. geoffroanus* throughout the basin was 1:1 (Table 3). This study contributed for the São Francisco Basin herpetofauna knowledge through the distribution and abundance data of some chelonia species. The investment on chelonian research is necessary for dynamic population knowledge and its related habitats, vital for chelonia conservation through gathering prioritarian areas and performing long lasting monitoring programs.

Theme: São Francisco drainage basin, chelonia richness and abundance

Type of Presentation: Poster

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Structuring factors in a snake community: Does stream distance really matters?

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Observing species responses to environmental gradients allows us to detect distribution patterns over habitats. Knowing the factors that influence these distribution patterns is crucial for planning conservation and management strategies. Recent studies in the Amazon have found that communities distribution patterns for different taxa are determined by stream distance gradients. Based on these patterns, some authors have inferred about the importance of water bodies in structuring communities. This study determines the influence of stream distance on the distribution patterns of snake communities. We covered a 25 km² area of dry-land rainforest at the Reserva Florestal Adolpho Ducke, Manaus, Amazonas, Brazil. There I used 46 plots of 250 x 1 m spread over different distances of first, second and third order streams. We made five visits to each plot searching snakes through Time Constrained Search (TCS) during day and night periods. Distance of each plot to the nearest stream margin was measured in six points (every 50 m) along the 250m plot. The distance used was an average of those six values per plot. We found 27 species of snakes, belonging to five families, which corresponds to 65% of species known to the Reserve Ducke. Data was analyzed generating a dissimilarity matrix among plots using the Jaccard index and applying presence or absence data. A Principal Coordinates Analysis (PCoA) over the dissimilarity matrix was performed to reduce dimensions. Scores obtained by the two PCoA axes were used in a multivariate regression model, with the stream distance gradient as independent variable. Snakes responded significantly to the stream distance gradient ($R^2 = 0.35$), which could mean a replacement of species (beta diversity) as stream distance increases. With the exception of aquatic species, snakes are apparently not-dependent on water bodies, as amphibians, for example. However, this study shows streams as important factors influencing snake community structure at Reserva Florestal Adolpho Ducke.

Theme:snakes, community ecology, Amazonia

Type of Presentation: poster

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Sexual and ontogenetic changes in the use of resting sites by *Uranoscodon superciliosus* (Squamata: Iguanidae) in Central Amazonia.

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Uranoscodon superciliosus is an arboreal species that inhabits the edges of water bodies such as lakes, creeks and streams in forested areas, using trees and bushes along the margins as sites for foraging, reproduction and refuge. Escape behavior of *U. superciliosus* is characterized by diving or sprinting on water when threatened. Thus, it is expected that the location of perches used as resting sites is an important factor structuring the spatial organization of *U. superciliosus* populations. This study aimed to determine the occurrence of sexual and ontogenetic changes in the use of resting sites by *U. superciliosus*. We conducted active visual searches for *U. superciliosus* individuals on ten 250 m X 1 m transects placed along water streams in the Reserva Florestal Adolpho Ducke, in Manaus, Brazil. Transects were distributed at least 500 m far from one another. Searches were carried out at night and we visited each transect once. Individuals were collected manually, sexed, measured (snout-vent length) and released. For each individual found, we measured perch height from ground-level at the moment of capture, horizontal distance from perch to the stream, and the stream's width and velocity at the point closest to the perch. A total 30 specimens were found (9 females, 11 males and 10 juveniles). Regression analyses showed a significant relationship between individual body-size and perch height from ground ($R^2 = 0.44$, $P = 0.001$). We observed a stratified pattern of habitat use in relation to sex. Generally, males used higher perches and females occupied intermediate positions, while juveniles used lower perches. We found no relationships between lizard body-size and distance from perch to stream ($R^2 = 0.44$, $P = 0.82$), or between body-size and stream characteristics ($R^2 = 0.02$, $P = 0.81$ stream width; $R^2 = 0.02$, $P = 0.55$ stream velocity). At least half of the captured individuals (53%) were found on perches located immediately above water streams. The species dependence on water for outrunning predators may lead to a fast saturation of available perches above water. We hypothesize that size-related vertical distribution of lizards may also be due to predator avoidance, because more dense vegetation is present in lower strata, where juveniles are usually found. Size constraints can also keep small individuals from climbing higher trees, with larger diameters.

Theme:lizards, ecology, Amazonia

Type of Presentation: poster

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An integrated view on the metabolic and cardiorespiratory consequences of feeding in the South American rattlesnake, *Crotalus durissus*

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The feeding biology of some snake species can be characterized by the occasional ingestion of large meals interspaced by prolonged periods of fasting. As a consequence, meal ingestion by these species is usually followed by a period (many days) during which aerobic metabolism is markedly elevated. For example, in the South American rattlesnake, *Crotalus durissus*, metabolism is elevated by 7-folds above the fasting level, whenever animals are fed with meals equaling 50% of their body mass. Such large metabolic increments obviously imply in concurrent adjustments in the gas transport cascade in order to match demand and supply. We, therefore, followed the changes in selected cardiorespiratory parameters during meal digestion in the South American rattlesnake. Gas exchange and lung ventilation were both increased after feeding, although the increase in ventilation was less than proportional to the change in metabolism. Thus, as reported for other reptiles, digestion was accompanied by a relative hypoventilation, perhaps to retain CO₂ and help the maintenance of acid-base equilibrium despite the large secretion of acid to the stomach. Blood oxygen affinity increased at 24 hours post-feeding, with P₅₀ values decreasing independently of arterial pH. Such change in Hb-O₂ affinity ensures an adequate level of oxygen extraction in the lungs and it is important to support the postprandial metabolic increase aerobically. The content of organic phosphates relative to hemoglobin ([NTP]/[Hb]) were unaffected by feeding indicating that the changes in Hb-O₂ affinity were entirely caused by the (modest) alkaline tide taking place during digestion. Feeding in rattlesnakes is, therefore, accompanied by the orchestrated change of many interacting cardiorespiratory variables.

Theme:reptiles, snakes, physiology

Type of Presentation: Oral, Symposium 12: Ecophysiology of Reptiles

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Effects of Feeding on the Thermoregulatory Behavior of the Green Anaconda, *Eunectes murinus* (Serpentes, Boidae)

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The feeding habits of some snake species can be characterized by the infrequent ingestion of relatively large prey, which, as usual for snakes, are ingested whole. Such features, combined with the relatively low metabolic capacity typical of ectotherms, make the digestive process of snakes to be physiologically challenging. Indeed, meal digestion in snakes is associated with considerable investment of energy and time. One way to facilitate digestion is through increasing body temperature (T_b) after feeding, the so called postprandial thermophilic response. Therefore, in the present study, we investigated the effects of feeding on the thermoregulatory behavior of the green anaconda, *Eunectes murinus*, trying to identify the occurrence and proximal determinants of a possible postprandial thermophilic response. To register T_b, we used dataloggers (TidBit, Hobbo), surgically implanted and programmed to take temperature measurements at every 16 minutes, during one year. During this time, snakes (n=6) were kept in an outdoor arena (5 x 10 m) exposed to the natural climatic conditions of Rio Claro municipality, São Paulo state, southeastern Brazil. Snakes were regularly fed with guinea pigs and rats and at the final of the experiment, the dataloggers were removed from the animals and the data retrieved. Thereafter, we compared the thermal profile of fed and fasting individuals before and after the feeding episodes. In total, we analyzed 17 feeding episodes, all occurring during the local hot season and with a mean meal mass of 15.4%. Green anacondas exhibited a circadian variation in T_b, minimum values (~22°C) were recorded just before sunrise (~ 08:00h), then T_b start to increase until reaching the highest values (~28°C) at around 14:00h, from there T_b slowly start to decline until the next morning. This circadian pattern of T_b variation and the daily values for mean and maximum T_b did not differed significantly between fed

and fast animals. Similarly, heating and cooling rates were not affected by feeding. Daily values for minimum Tb of the fed group were greater than that recorded for the fasting group, but this difference was not caused by feeding. The postprandial thermophilic response in snakes is a common occurrence found in experiments performed indoors using thermal gradients. However, under more natural conditions when animals are faced with other factors/constraints besides temperature, this response seems to be much more complex and less widespread. Our results on green anacondas seem to confirm this pattern.

Theme:reptiles, snakes, physiology, behavior

Type of Presentation: Poster

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Geographical barriers and their implications on the genetic structure of populations of irapuca (*Podocnemis erythrocephala*).

Rafaela Cardoso dos Santos

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Of the four species of the genus *Podocnemis* found in the Brazilian Amazon, the kind that gives more restricted distribution is irapuca (*Podocnemis erythrocephala*), who occupies black and clear waters. The irapuca is highly exploited and in small towns there is little or no control over this operation. In order to determine the genetic differentiation of *P. erythrocephala* as an effect of the performance of waterfalls and / or rapids and rivers as geographical barriers, ten localities distributed along the Brazilian Amazon basin were studied using a marker of maternal lineage. Two hundred and forty-six specimens were sequenced for the mitochondrial control region and the analysis of molecular variance revealed high levels of population subdivision ($\Phi_{ST} = 0.27931$, $P < 0.001$). Values of fixation indexes Φ_{ST} were significant for the localities of Jaú National Park, São Gabriel da Cachoeira and Barreirinha, that also showed limited gene flow (N_m) in comparison with other localities. This demonstrates that these populations are distinct from each other, that is, they are genetically differentiated. However, isolation by distance does not explain this pattern, because there is no association between geographic and genetic distance using the Mantel test. In this case, the genetic differentiation is explained by the presence of water falls and rapids that separate the Jaú National Park and São Gabriel da Cachoeira localities from other areas. In the case of Barreirinha, genetic differentiation gives credence to the hypothesis that the Amazon River is a barrier. These geomorphological structures (water falls and/or rapids in the Negro River and the Amazon River) appear to be physical barriers that efficiently limit gene flow of individuals of *P. erythrocephala* between these and remaining localities. Comparisons between other localities showed low nonsignificant Φ_{ST} values and contrasted with high N_m values. These results indicate these localities represent one large panmictic population and form part of a large stock that occurs in the Brazilian Amazon. However, among populations of irapuca analyzed in the Amazonian region exist demographically distinct subpopulations (Jaú National Park, São Gabriel da Cachoeira and Barreirinha), and these should be treated as separate management units in the sense of monitoring of these populations and the implementation of conservation measures that maintain the viability of these populations and of the species.

Theme: *Podocnemis erythrocephala*, mitochondrial control region, genetic structure, population genetics, Amazonian region

Type of Presentation: Poster

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Chemical Ecology of Dendrobatids: A Review of Dietary Arthropods and Their Contribution to Chemical Defense

Ralph A. Saporito

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Alkaloids in the skin glands of dendrobatid poison frogs serve as a chemical defense against predation, and most appear to be sequestered from dietary arthropods. Over the past 30 years, more than 500 alkaloids, comprising 24 different structural classes, have been identified in dendrobatids, a number that appears to reflect the diversity of alkaloids present in arthropods. Identifying the dietary arthropods responsible for this diversity of alkaloids has been a challenge for the past 15 years. To date, a putative arthropod source has been identified for approximately 60 alkaloids, representing 14 of the 24 structural classes. Alkaloids common to dendrobatids have been identified in siphonotid millipedes, melyrid beetles, coccinellid beetles, myrmicine ants, formicine ants, ponerine ants, and most recently, oribatid mites. In most cases, specific alkaloids have been identified in one arthropod taxon, however there are some more recent examples in which identical alkaloids (or alkaloids from similar structural classes) are shared by multiple arthropod taxa. On the basis of early dietary and chemical studies, myrmicine ants were proposed as the major source for alkaloids; however, more recent studies suggest that oribatid mites are the largest and potentially most important dietary source

for alkaloids in dendrobatid frogs. I will review the most significant findings on dietary sources of alkaloids from the past 15 years, present recent findings on the importance of dietary mites, and discuss the challenges and future directions of research on the link between diet and chemical defense in dendrobatid frogs.

Theme:alkaloids, ants, arthropods, beetles, chemical defense, coccinellid beetles, dendrobatid frogs, diet, formicine ants, melyrid beetles, mites, millipedes, myrmicine ants, oribatid mites, ponerine ants, sequestration, siphonotid millipedes

Type of Presentation: Oral, Symposium 11: Dendrobatoid Frog Biology.

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Leech infestation of *Podocnemis erythrocephala* in one River of Middle Rio Negro, Amazonas, Brazil.

Rayath Melina Lima Silva 1 Bernhard, Rafael 2 Vogt, Richard C 2

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Leeches are ectoparasites commonly found attached to freshwater turtles. Probably they can affect negatively the fitness of their hosts and can also be intermediate to host hemoparasites of turtles. Infestation frequencies of leeches can change when natural conditions of the water bodies are altered. Infestation frequencies of leeches can be a measure of the health of the freshwater turtle habitat. The main goal of the present work was to investigate the occurrence of ectoparasites in the freshwater turtle, *Podocnemis erythrocephala*, in one clean and well preserved river in the Middle Rio Negro. Turtles were collected in Ayuanã River (0°32'46''S, 64°55'08''W) by trammel nets in January and February of 2008. Turtles were sexed and measured at maximum linear carapace length (CL). Leech presence/absence on carapace, plastron, head and limbs was observed and frequencies estimated. Leeches were collected and preserved in 10% formalin to be identified later. 17 males (160 – 233 mm CL; mean = 208 mm), 149 females (125 – 302 mm CL; mean = 250 mm), and 3 non identified sex (110 – 117 mm CL; mean = 114 mm) were captured. 37 of them have one to four leeches. Leech infestation frequencies were greater in males (29.41%) than females (21.48%). No leech was found on three other undefined sex turtles. The months when this study was conducted represents the dry season in Rio Negro. New data of leech infestation from other seasons must be taken to understand seasonal changes in pattern.

Theme:turtles, natural history, parasitism, leeches, *Podocnemis erythrocephala*, Amazonia

Type of Presentation: poster

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Reproducing In Ecological Gradients: Strategies Of Oviparous Lizards

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As a consequence of the high water conductance of their eggshells, parchment shelled lizard eggs are extremely sensitive to the microclimatic conditions of the nests. However, it is known that related species within the same lizard genera may reproduce in either environments as contrasting as arid

areas and tropical forests. This scenario suggests that the sensitivity to physical factors is variable among the eggs of related species of lizards. Even so, it is not clear what are the morpho-physiological traits favoured in such contrasting environments, and how lizard eggs of related species may vary in this context. In Brazil, *Tropidurus* lizards constitute a good system to explore this problem and to test hypothesis about differences on humidity tolerance, as the genus is widespread on almost all Brazilian environments. We hypothesized about several characteristics that may have been favoured by natural selection across ecological gradients from dry to humid environments. Drier environments should favour (1) thicker eggshells; (2) extended egg retention; (3) a reproductive season coupled with the beginning of the rainfall. So far we have data for two sister species (1) *Tropidurus hispidus*, from Caatinga, a hot semi-arid natural environment; and (2) *Tropidurus torquatus*, ancestrally from the Cerrado (Brazilian plains) but currently common also in urban parks of São Paulo the city. According to Dufaure and Hubert (1961) table, the embryonic developmental stage in which eggs are laid is 32. In relation to the eggshell morphology, the basic structure seems to be conservative for squamata. *Tropidurus* eggshell is composed by: (1) a calcareous layer, (2) a system of shell membranes and (3) an amorphous layer (innermost). The structure, arrangement and interlacement of the shell membranes, and the thickness of all layers probably affect water conductance. The number of layers of shell membranes differs for the two species, *T. torquatus* has five layers and *T. hispidus* has only four. The thickness of the eggshell is also different, and *T. torquatus* has a thicker eggshell than *T. hispidus*. Given that these two species are closely related from a systematic point of view, the same developmental stage at oviposition suggests that these lizards do not use the strategy of egg retention. The difference observed in eggshell morphology could be interpreted as related to nest ecology, and offers some support to our first hypothesis. We are adding more species to this analysis and collecting additional data on reproductive season and rainfall periods.

Theme: lizards, reproduction, physiology, developmental biology, morphology

Type of Presentation: _oral;_ contributed

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Endangered Species And Land-use Conflicts On Islands: A Case Study Of The Virgin Islands Tree Boa (*Epicrates monensis granti*) In The Caribbean

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In situations where land is limited, such as on islands, wildlife conservation often takes a back seat to economic development. This is particularly the case in the Caribbean, where critical coastal resources are frequently converted into resorts, exclusive condominium complexes, and marinas. The US Virgin Islands have experienced intense and unmitigated development pressures in recent decades, resulting in the loss of considerable habitat for the endangered Virgin Islands tree boa (*Epicrates monensis granti*), the distribution of which is restricted to the eastern end of St. Thomas, one of the three main islands. This species is cryptic and near-impossible to locate, and as such previous efforts to protect this species have been limited to captive breeding, introduction onto insular reserves, and regulations for land owners to hand-clear vegetation. With uncontrolled habitat loss within the range of this species, there was a distinct need to identify locations where this species is likely to occur and to develop habitat conservation measures appropriate for developers. Using geographical information systems and ad hoc observations collected over 25 years, we created a habitat suitability model for *E. m. granti* that allowed for the prediction of presence in any particular area on St. Thomas (Figure 1). In conjunction, we developed a habitat delineation protocol, based on published accounts of habitat use for this species and other similar species, for identifying appropriate habitat within a particular

location. The habitat suitability models are being used by government agencies to determine where mitigation might be required in a given development project, and the habitat delineation protocols are being used by developers to identify areas within a proposed site that may require mitigation measures. The local planning and wildlife agencies have successfully utilized these applications to negotiate several habitat easements within major construction projects, although the process is still in its infancy and not yet widely applied.

Theme: reptiles, snakes, conservation biology, endangered species

Type of Presentation: Oral, Symposium 8: Herpetological Conservation & Biology

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Stress physiology and immunocompetence in three species of Brazilian toads differing in habitat levels of specialization

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Although many amphibian species show dramatic population declines in response to habitat destruction (i.e. habitat specialists), some species seem less sensitive to changes in their habitat, and a few species can even secondarily invade such modified habitats (i.e. habitat generalists). The latter species generally inhabit open, native areas and exhibit wide geographical ranges and large population numbers. The impact of stress physiology on immunocompetence has been recently proposed as a possible mechanism to explain interspecific differences in sensitivity to habitat modifications. Elevated levels of glucocorticoids in response to stressors can cause immune depression.. We hypothesize that habitat generalists should exhibit lower baseline levels of glucocorticoids and a higher innate immunocompetence than habitat specialists in the field. Additionally, generalists should have lower adrenal response to a generalized stressor in order to maintain higher innate immunocompetence to better cope with new challenges associated with habitat modifications. To test these hypotheses, we compared plasma corticosterone levels and bacterial killing capacity of three species of toads from Botucatu/SP/Brazil: *Rhinella icterica* and *R. ornata*, two species tightly associated to preserved Atlantic Forest, and *R. schneideri*, a generalist species from open areas, more commonly found in modified habitats. Baseline plasma samples for corticosterone and bacterial killing assays were collected in the field, within three minutes of capture. Additional plasma samples for corticosterone were collected after 60 minutes of stress restriction for *R. icterica*, and after injection of 10 µL/g of ACTH (10 µg/mL of saline) or the same volume of saline for *R. icterica* and *R. schneideri*. According to expectations, *R. schneideri* exhibited significantly higher plasma bacterial killing capacity (i.e. 46,22% and 62,74% higher, $P=0.0002$) than *R. icterica* and *R. ornata*, respectively. Although mean baseline corticosterone levels of *R. schneideri* were 42% lower than that found for *R. icterica* and *R. ornata*, species did not significantly differ. There were no difference between species in extent of elevation in corticosterone levels after the ACTH challenge. Surprisingly, there was also no difference in response to saline vs. ACTH injection in either challenged species. Restriction stress significantly increased corticosterone levels in *R. icterica* over baseline, and to a level comparable to that observed by the injections. As *R. schneideri* is primarily active during the summer in Botucatu, while the other two species are mainly active during the winter, additional studies need to be conducted to rule out a possible effect of season on these results. FAPESP: JP-06/54699-1, IC-06/06759-5.

Theme: anurans, physiology, ecology.
Type of Presentation: poster
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Do Translocations Work? A Ten-year Study of a Translocated Slow-worm (*Anguis fragilis*) Population in England

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Translocations often focus on threatened species with restricted ranges or specialist habitat requirements and are carried out to improve conservation status. An alternative role for translocations is that of removing animals from areas where they come into conflict with humans. When the species concerned is protected by conservation legislation, such translocations may also take on a conservation role. In the UK, the slow-worm (*Anguis fragilis*) – a legless lizard – is protected by law against deliberate killing or injury. However, habitats where the species occurs usually receive no legal protection. As the species is widespread, it therefore frequently comes into conflict with development. If slow-worms are present on a site scheduled for development, the habitat can be destroyed provided every effort is made to avoid the killing or injury of any resident lizards. This can be achieved by removing as many slow-worms as possible from the development footprint and releasing them into alternative habitats. However, the ecology of slow-worms remains poorly understood and there are few long-term follow-up surveys of translocated populations. In 1995, 103 slow-worms were translocated from a development site in Canterbury, Kent, to a newly-managed nature reserve located 1 km away on an island bounded by the River Stour. Over the next two years the population declined, the slow-worms failed to breed and displayed low body condition. The translocation site was re-surveyed 10 years later. Although the body condition of slow-worms has recovered and breeding is now occurring, the population seems to have declined further and may now be less than half the size of that present 10 years earlier. There was an unusually high recapture rate of slow-worms under artificial refugia, and despite ongoing management of the site, there may be a shortage of suitable habitat available. It may take a further ten years of survey to determine whether or not this translocation has been successful in establishing a self-sustaining population. Widespread species such as the slow-worm often pose significant challenges to translocation practitioners. Identifying suitable receptor sites that are not already occupied – or likely to be colonized naturally – by the species remains problematical. Equally, the cost-effectiveness of translocations of widespread species relative to alternative actions to mitigate development impacts remains an ongoing source of debate.

Theme: reptiles, lizards, ecology, conservation biology
Type of Presentation: Oral, Symposium 5: Herpetofaunal Reintroductions, Translocations, and Supplementations
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Niche position, rather than niche width, differs in two coexisting amphibians having contrasting trends in Europe

Riinu Rannap*, Lars Briggs, Asko Lõhmus

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We explored alternative habitat-related explanations (niche breadth versus niche position) to explain the contrasting status of two coexisting amphibian species – the rare and declining crested newt (*Triturus cristatus*), and the more widely distributed smooth newt (*T. vulgaris*). These closely related species having similar life-history traits provide an excellent opportunity to study those methodologically challenging hypotheses, and it is also the first such study on amphibians. We derived multivariate habitat models from 27 characteristics of 210 Danish ponds and their surroundings, and their occupation by newts. Altogether, the crested newt was found in 47% and smooth newt in 65% of ponds but both species avoided ponds with fish (8% and 25% being occupied, respectively). In 140 ponds without fish, multivariate habitat models comprised three variables and classified correctly 74% of observations for each species. A diverse fauna of invertebrates and shorter distances to other ponds inhabited by conspecifics were positive for both species, while the surrounding habitat (notably natural grasslands with forests) was extremely important for the crested newt and the sediment type of the pond for the smooth newt only. Hence, in an area of frequent coexistence, habitat requirements of the species differed in key variables (niche position) rather than the extent of specialization (niche width). We suggest that degradation of (semi)natural terrestrial habitats (mosaic of open land and forest) in combination with suitable water bodies is a major factor why the crested newt is more vulnerable than the smooth newt in many countries on the North European Lowland. The results also confirmed that general pond management is most beneficial to common, not rare, species, and knowledge about the distribution of viable amphibian populations is vital for efficient pond restoration.

Theme: Caudata, conservation management, habitat degradation, rarity, threatened species

Type of Presentation: oral

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Spatial and Thermal Ecology of three *Lacerta* species Living at Different altitudes in Lebanon

Riyad Sadek, Souad Hraoui-Bloquet and Makarem, Rayan Presenter: Riyad Sadek

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Lacerta laevis laevis, the common wall lizard of Lebanon, occupies habitats ranging in altitude from sea level up to around 1500 meters. *Lacerta kulzeri* is found between 1400m and 2100m while *L. fraasii*, an endemic species, is observed at altitudes between 1900-2400m. The latter two montane lizards are active mainly during the warmer months, depending on weather conditions and snow cover. Field studies were conducted on the three *Lacerta* species regarding their habitat use, microhabitat preferences, predator avoidance, diet and thermal ecology. Although found at different altitudes, no significant differences were observed in their body temperatures. This could be partly due attributable to the smaller sizes of the high-altitude *Lacertas* compared with the lower-altitude *L. laevis*. *L. fraasii* is ground-dwelling, seeking refuge inside vegetation and is most likely to hide under stones. Both *L. laevis* and *L. kulzeri* are scansorial and seek refuge in rock crevices. *L. kulzeri*'s habitat comprises rocky slopes with sparse vegetation and cedar trees in a few locations. *L. laevis* is found in a variety of habitats than those of the other mountain *lacertas*. Other aspects related to microhabitat preferences and activity patterns will be discussed.

Theme: lizards, ecology, behaviour, endangered species, *Lacerta laevis*, *lacerta fraasii*, *lacerta kulzeri*, temperature, Lebanon, mountains, habitat use, high altitude, levant

Type of Presentation: Oral

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The genetic structure of common toad (*Bufo bufo*) populations under long-term, natural isolation

Robert Jehle

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Pond-breeding amphibians congregate annually to reproduce in confined aquatic sites, and are thus particularly suited for studies at the level of populations. In landscapes which are severely affected by human-induced habitat fragmentation, genetic erosion and increased between-population differentiation as well as reduced growth and survival rates have been reported. However, it is often difficult to assess whether such negative genetic effects are caused by increased isolation, adverse environmental conditions, or both. In order to shed light into the interplay between the standing amount of neutral genetic variation and habitat fragmentation, we used microsatellite markers to characterise the genetic architecture of common toads (*Bufo bufo*) in a situation where populations are naturally isolated from each other over geological timescales despite relative geographic proximity. This is achieved by our study area south of Bergen (Norway), which includes mainland populations and an archipelago of marine islands which are naturally inhabited by *B. bufo* and situated at distances of between 0.2 km and 70 km from each other. Island sizes range between 1 and 80 km², and only part of the islands are inhabited by humans; the time of isolation of each island can be accurately reconstructed since the last glacial period. Genetic samples were collected using buccal swabs from adults and/or sacrificed larvae at early stages; toad population census sizes ranged from a few to about 50 adult individuals. The genetic differentiation between islands is partly high ($F_{st} > 0.2$), including private alleles for neighbouring islands. Nevertheless, the standing amount of genetic variation on islands is not markedly reduced compared to mainland populations, as well as compared to populations elsewhere in the species' distribution range. In addition to presenting patterns of genetic variation under long-term fragmentation, our study provides insights into potential incidences of more recent gene flow (introductions and/or natural dispersal across marine barriers). Taken together, this study should contribute to our understanding of the interplay between genetic isolation, genetic diversity, and long-term viability of amphibian populations.

Theme: amphibians, anurans, ecology, natural history, genetics, conservation biology

Type of Presentation: oral, Symposium 10: Conservation Genetics of Amphibians and Reptiles in the 21st Century

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Why Do People Release Exotic Reptiles and Amphibians?

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Successfully reducing the high number of introductions and invasions among amphibians and reptiles requires an understanding of how and why individuals of exotic species end up in areas outside their native range. Various authors have examined relative pathway importance in transporting reptiles and amphibians and the risks that these pathways pose for establishment. Other authors have assessed the risks of selected species becoming established in a given ecosystem or country, based on ecological, commercial trade, and other variables. Ultimately, however, reducing the rate of species invasions requires changing human behavior, especially because many herpetofaunal introductions are undertaken intentionally. This presentation attempts to identify the diversity of human motivations for releasing exotic reptiles and amphibians. We surveyed the scientific literature and popular media outlets, and spoke to individuals in the academic, regulatory, law-enforcement, and herpetoculture communities to compile a list of possible motivations for release. We identified at least 15 different motivations for release of exotic amphibians and reptiles. We were able to broadly categorize these into: (A) Release of individuals without the intention to establish a population (via negligence, accident, religious fervor, etc.); and (B) Release for establishment (for food, profit, biocontrol, misguided biophilia, etc.). The surprising variety of motivations for release indicates that effective regulatory management of herpetofaunal introductions must address a wider range of human behaviors than has hitherto been the case.

Theme: introduced species, amphibians, reptiles, invasive species, establishment, exotic herpetofauna

Type of Presentation: Oral, Symposium 2: Invasive Reptiles and Amphibians: Global Perspectives and local solutions

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Potential and limitations of translocations in restoring the herpetofaunal community at Gateway NRA

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Urbanization reduces herpetofaunal diversity and species distribution, often limiting populations to habitat remnants. Such remnants, and patches created or enhanced by restoration projects, are often the only available habitat for urban herpetofauna but, because of isolation and limited dispersal abilities, these patches are often depauperate, limiting their contributions to regional conservation. Translocation has been proposed to salvage doomed populations and overcome the demographic and genetic constraints of limited dispersal in urban areas, and may also help to better realize the potential of isolated patches of restored habitat. Yet, translocation success can be low and at best is an experimental strategy of last resort. Beginning in 1980, I began a program of habitat improvements and herpetofaunal translocations to Gateway National Recreation Area, 10,522 ha managed by the National Park Service in the New York Metropolitan Area. Much of its disjunct upland habitat was created in the early 20th century from dredge spoil, and although well known for its significance to birds, dispersal barriers inhibited colonization by amphibians and reptiles. Although the goals of this program were to use these faunally impoverished habitats to salvage local populations and restore/recreate, to the extent possible, the herpetofaunal community historically native to the area, the results of this work also provide a test of herpetofaunal translocations in an urban landscape. The species translocated were historically native to the park and immediate area. From 1980 to 1995, I translocated 20 species to one or more sites, for a total of 40 translocations. I began with lower trophic levels and depending on species, used different life stages. Data from 2002 and 2003 found evidence of persistence in 29 of 40 translocations and recent reproduction in 26 of 40. Based on 7 to 22 yrs of monitoring, 19 translocations appear successful, 7 probably are, 4 are uncertain, and 10 appear failed. As a result of this program, the park now supports a greater proportion of the area's original native herpetofauna. However, most of the success with translocations has been with generalist species that remain fairly common outside of large urban areas. Errors of judgment led to

failed translocations. These results illustrate the potential and limitations of translocation as a management tool in urban areas, and suggest ways to improve the success of future efforts.

Theme: Gateway National Recreation Area, Herpetofaunal Conservation, Herpetofaunal Restoration, Relocation, Repatriation, Restoration Ecology, Translocation, Urban Herpetology

Type of Presentation: Oral, Symposium 5: Herpetofaunal Reintroductions, Translocations, and Supplementations

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Cryptic species and their impact on estimations of biodiversity and conservation

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The current biodiversity crisis is impacting amphibians and reptiles on a global basis. Conservation, in the form of laws, usually takes two forms: protection of taxa or habitats. Some nations have one form of protection or the other, and some have both. The protection of habitats often depends on accurately determining the composition of species, and the number of endemic taxa. Cryptic species often lead to two consequences. First, they underestimate biodiversity within areas and within geographic areas. Second, the documentation of cryptic species may lead to a greatly reduced distribution of a formerly widespread species. For example, the desert tortoise in North America is comprised of at least two species, and possibly three; the status of each taxon is now in need of reassessment. Similarly, many widespread species of amphibians and reptiles in Southeast Asia are now known to be complexes of cryptic species, some with very small geographic ranges. Given the current biodiversity crisis, there is a need for international cooperation and a rapid means of detecting potential groups of cryptic species. DNA barcoding is one rapid way to identify widespread species that might be a group of cryptic species.

Theme: amphibians, reptiles, biodiversity, conservation biology

Type of Presentation: oral, symposium 8.2

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Ecology and control opportunities for *Natrix maura* on Mallorca

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The Mediterranean island of Mallorca has suffered from numerous introductions of invasive species for several thousand years. The island's endemic midwife toad (*Alytes muletensis*) is particularly threatened by the viperine snake (*Natrix maura*) which is widespread across the island. Until recently, the snakes were actually protected on the island and some conservation groups argued that the snakes could be native. However, mtDNA analysis comparing snakes from Mallorca with those from mainland Europe confirmed historical evidence that suggests a recent anthropogenic introduction of snakes about 2000 years ago. Although the snake is widespread, the Mallorcan midwife toad is confined to a few torrents within the mountains in the northern part of the island. A landscape level

analysis revealed that the presence of toads is positively associated with steep slopes, while the presence of snakes is negatively associated with elevation. Toad populations may therefore persist in steep-sided, high altitude gorges because these areas are suboptimal habitats for snakes. The widespread distribution of the snakes across the island may itself be a result of another introduced species. The Spanish marsh frog (*Rana perezi*) was introduced to Mallorca about the same time as the snakes, and there is a strong correlation between the distribution of snakes and marsh frogs. It is therefore possible that high densities of introduced snakes are a result of high densities of the introduced frogs, and that snakes start to impact on the native midwife toad when they move into the montane areas that support the latter. Because it is extremely difficult to control either introduced snakes or frogs on the island, midwife toad populations are managed in a way to reduce – rather than eliminate – the impact of alien predators. Such measures include reintroductions of toads into areas that are suboptimal for predators, protecting sites with predator-proof barriers, and constructing artificial breeding pools that make access for predators difficult. Habitat management coupled with reintroductions has resulted in an increase in the number of midwife toad populations on the island. The conservation programme has therefore shown that it is possible to enhance the status of the species without eradication of one of their principle threats.

Theme: Alytes, amphibians, anurans, endemic, exotic, introduced, island, Natrix, Natrix maura, snake

Type of Presentation: Oral, Symposium 2: Invasive Reptiles and Amphibians: Global Perspectives and local solutions

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Phylogenetic patterns in the reproductive biology of chameleons

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Chameleons exhibit substantial intra-family variation in reproductive biology. About 20% of species are viviparous. Lengths of incubation vary from those typical for other lizards to extremely long periods that include several months of embryonic diapause. The range of sexual size dimorphism (SSD) includes species in which males are larger than females (male-biased SSD) and in which females are larger than males (female-biased SSD). We determined the evolutionary history of these reproductive features by conducting a survey of the literature to determine the distribution of life history traits within the Chamaeleonidae. We constructed a cladogram for species for which we were able to obtain life history data and for which evolutionary relationships have been previously reported. We determined evolutionary patterns by mapping characters on a composite phylogeny. Oviparity—with developmental rates comparable to those of other squamates—and parity of male and female body size are ancestral traits exhibited by the basal genera *Brookesia*, *Rhampholeon*, and *Rieppeleon*. These clades have embryonic developmental rates similar to those of other squamates, while all other oviparous chameleons exhibit slower rates of embryonic development. Embryonic diapause has evolved a minimum of three times: the *Kinyongia fischeri* clade, one clade in *Chamaeleo* (subgenus) *Chamaeleo*, and the genus *Furcifer*. We also identified two independent origins of viviparity: the genus *Bradypodion* and one clade in *Chamaeleo* (subgenus) *Trioceros*. Male-biased SSD characterizes *Kinyongia* and *Furcifer* and has either had multiple origins in *Calumma* and *Chamaeleo* or a single origin in the common ancestor of these groups with subsequent reversals to no SSD or female-biased SSD. While we will determine the association between climate and reproductive biology in future studies, we predict that highly male-biased SSD and embryonic diapause will be associated with climates that are characterized by strong seasonal variability and relatively short periods favorable for hatching, mating, and oviposition. A concentrated mating

season may enhance competition for mates leading to selection for larger body size among polygynous males. Embryonic diapause and an associated long incubation period preclude hatchling emergence during unfavorable conditions.

Theme: reptiles, lizards, natural history, reproduction, physiology, developmental biology

Type of Presentation: Oral, Symposium 1: Reproduction in reptiles: from genes to ecology

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The Amphibian Specialist Group's role in the future of amphibians

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A lethal cocktail of threats has been driving amphibian declines and extinctions around the globe. Since the scale of the problem was recognized some two decades ago, the scientific community has risen to the challenge of advancing our understanding of the threats. We now know the prime culprits in many previously 'enigmatic' declines and have begun to unravel the manner in which certain threats may interact. There has not always been consensus among the scientific community: but such scientific debate is a necessary prelude to any significant advance in understanding. It is important that such debate does not distract the conservation community into inaction, however. Amphibians present us with an immense conservation challenge and we cannot always afford the luxury of waiting until we have perfect knowledge and consensus on which to base all of our decisions. What is clear is that threats to amphibians are numerous, rarely act in isolation and vary both spatially and temporally. There is no one-size-fits-all solution. The Amphibian Conservation Action Plan (ACAP: available for download at www.amphibians.org) outlines the most pertinent threats to amphibians, with proposed solutions, and provides a guide that can be tailored according to prevailing circumstances. By supporting efforts to translate the ACAP into Regional and National Action plans that are context-specific, the ASG is working to catalyze conservation action in those regions where amphibians are in most need of help. Addressing the amphibian extinction crisis will require us to cut across disciplines and work together: it is an opportunity to translate cutting edge scientific knowledge into urgent conservation action.

Theme: Action Plan, amphibians, global declines, response

Type of Presentation: Oral, Symposium 14: Amphibian conservation.

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Management of caiman in the Brazilian Amazon: A case study

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During the '80s the black caiman was considered an endangered species and was listed under Appendix II of CITES. Some recent studies have provided an updated view, where the species appears as fairly common in areas such as the Japurá, Juruá, Purus and Madeira rivers. Nevertheless,

its status throughout the Brazilian Amazon is unknown. Similar situation is being recorded for other countries of the species' range. Crocodilians have a direct value to the local populations as food and cash income, and the sustainable use of caimans is an important alternative towards the conservation of the species and the implementation of habitat preservation. Therefore, in the current management alternatives, it is paramount to establish programs with concrete possibilities of sustainable use, based on economic benefits to the local communities and as a stimulus for in situ conservation, one of the most realistic approaches to ecosystem conservation. By the end of 2004, the government of the state of Amazonas implemented the first experimental management program of the Brazilian Amazon. The Mamiraua Sustainable Development Reserve was the site chosen for this experimental process, mainly due to 2 factors: a) very high abundances of black and spectacled caiman recorded during a 10-year research on the biology and population dynamics by Ronis da Silveira and collaborators; and b) advanced process of social organization of some communities, already involved in sustainable use of natural resources - notably fisheries management - coupled with basic infrastructure available. In the present context of legal utilization of caiman in sustainable development reserves, and of initiatives by the state government of Amazonas to implement activities to use caiman resources, the caiman conservation and management program of the Mamiraua Institute for Sustainable Development is supporting the participation of communities of the sustainable development reserves of Mamirauá and Amanã in the generation of information for the decision-making process.

Theme: reptiles, crocodilians, ecology

Type of Presentation: Oral, Symposium 7: The biology and management of crocodilians.

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HELMINTHS OF LIZARDS FROM CENTRAL BRAZIL

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Brazil holds a vast diversity of lizards, including 11 families and 228 species. Although these lizards have been the subjects of various ecological and biological studies, our knowledge of lizard biology still reveals gaps that need further examination, including parasitism on these reptiles. The current literature on this subject shows that studies have mainly been concentrating on the lizards occurring from Atlantic forest and Restinga regions. Herein we investigate the presence of helminth parasites in lizards (previously collected and housed in the Coleção de Vertebrados da Universidade Federal de Mato Grosso, Coleção Zoológica de Referência do Campus de Corumbá, Coleção Zoológica da Universidade Federal de Mato Grosso do Sul e Coleção Arlindo de Figueiredo Béda) occurring in three biomes of central Brazil: Cerrado (savanna-like vegetation), Pantanal (floodplain) and Amazonia (rainforest). We look for helminths within the body cavity, esophagus, stomach, lungs, small and large intestines of each specimen under a stereomicroscope. Nematodes were cleared in phenol; Cestoda, Trematoda and Acanthocephala were stained in carmine, dehydrated in graded alcohols and cleared in creosote. Following their identification, we deposited all helminth specimens in the Coleção Helmintológica do Instituto de Biociências da Unesp de Botucatu, Brazil. We assessed a total of 739 individuals from 56 species of lizards representing 9 families, wherein 48.78% displayed helminthes. For specimens collected in the Cerrado region, we evaluated 335 individual lizards from 32 species and concluded that the prevalence was 42%. For specimens the Pantanal region, we examined 204 individuals representing 26 species of lizards, with a prevalence of 54%. And finally, for the Amazonian region we examined 193 individual lizards from 25 species and concluded that the prevalence was 46%. The most parasitized families of lizards were Tropiduridae, Teiidae and Scincidae. The Gymnophthalmidae, on the other hand, has the most depauperate helminth fauna. In conclusion, our studies provide data for the registration of more than 60 new host records in

lizards and evidence for the expansion of the geographical distribution of 26 helminth species.

Theme:reptiles, lizards, ecology, natural history

Type of Presentation: poster

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Reproductive Biology Of *Argenteohyla siemersi pedersenii* Williams And Bosso, 1994 (Anura: Hylidae) From Corrientes, Argentina, With Comments On Their Taxonomic Status

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Since their original description, the taxonomic status of *A. siemersi pedersenii* has been controversial and their conspecificity with *A. siemersi siemersi* discussed. The available biological data of both subspecies are scarce. We studied the reproductive biology of *A. s. pedersenii* in Corrientes, Argentina, on September 2007. We compared the reproductive features of both subspecies with the aim of providing data to help clarify their taxonomic status. Throughout the year 2007 weekly samplings were carried out in the study area. The courtship call of 3 males of *A. s. pedersenii* was recorded 26 September, 2007 between 2120 h-2240 h with an Audio-Technica ATR55 directional microphone and a Panasonic RQ-L31 tape recorder. We held the microphone in front and approximately 60 cm above the calling male and 3 m away. Recordings were analyzed with a PC computer using Adobe Audition 1.0; by FFT with 2408, at a sampling rate of 44100 hz and 16 bit precision. A total of 11 different call variables were considered for the analysis: call duration (s), intercall interval (s), call period (s) (call duration + intercall interval), call rate, call-group duration (s), number of calls in call-group, maximum number of calls per call-group, minimum number of call per call-group, inter call-groups intervals (s), dominant frequency (Hz), and fundamental frequency (Hz). The sonograms and oscillograms were produced with a PC computer using Syrinx 2.2 b (burt 2001). The reproductive activity of *A. s. pedersenii* occurred only once throughout 2007 and lasted only three days. This happened after heavy rains fell in mid September. They used a semi-permanent pond for reproduction and males called while floating from the water surface near the emergent vegetation. The advertisement call of *A. s. pedersenii* was short and repeated at regular intervals in a relatively fast succession, forming groups of multiple calls. The call have a fundamental frequency range between 340-990 Hz and a dominant frequency range between 1700-2070 Hz approximately. *A. s. pedersenii* laid its eggs in a jelly ribbons interspersed within the submerged parts of mixed mats of *Oxycaryum* sp. and *Rynchospora corymbosa*. The eggs were black, with a diameter ranging between 1.67-1.83 mm. The eggs number per clutch fluctuated between 2638 and 8987. The similar reproductive features found between both subspecies of *A. siemersi*, would reinforce the hypothesis that both forms are geographical races of the same species.

Theme:Amphibia; Anura; *Argenteohyla siemersi pedersenii*; Call description; Reproductive mode; Taxonomic status

Type of Presentation: Poster

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Reproductive cycles in water snakes of the Hydropsini tribe from South America (Colubridae, Xenodontinae)

Reproductive strategies are highly variable among Neotropical colubrids. Xenodontinae snakes are widely distributed in South America and show seasonal or continuous cycles in many areas. We describe interspecific variation in female reproductive cycles in ten Hydropsini snakes of the genus *Hydrops*, *Pseudoeryx* and *Helicops*. We analyzed around 2.500 preserved specimens from several collections in Brazil. Literature data also provided information for some species. The samples included snakes from Amazonian regions, northern Brazil (*Hydrops triangularis*, *H. martii*, *Pseudoeryx plicatilis*, *Helicops hagmanni*, *H. angulatus*, *H. polylepis*), from Pantanal region, southwestern Brazil (*H. leopardinus*), and from Savanna and Atlantic forest, southeastern Brazil (*H. carinicaudus*, *H. modestus*, *H. infrataeniatus*). For each preserved specimen the following data were taken: date of capture, sex, snout-vent length (mm), and diameter of the largest ovarian follicle, oviductal embryos or eggs (mm). Reproductive cycles of females were seasonal in nine species, but continuous in *H. angulatus*. Broadly seasonal cycles were recorded for the Amazonian species and for *H. leopardinus* from Pantanal. Vitellogenesis and gestation in the Amazonian species occur throughout dry season and in the beginning of the rainy season (June-July to January-February). Although *H. angulatus* reproduce continually, there is a large number of reproductive females from May-June to January-February. However for *H. leopardinus* the vitellogenesis started in the end of the dry season and gestation is extended to the beginning of the dry season (August to May-June). Females *H. carinicaudus*, *H. modestus* and *H. infrataeniatus* from southeastern Brazil present highly seasonal cycles. Vitellogenesis and gestation in these three species are limited to the rainy season (September-October to March-April). These differences in the time of reproduction observed in some Hydropsini snakes may be related to the climate in the occurrence areas of each species. The dry season in most Amazonian region is a warmer period than dry season in other biomes. In southeastern Brazil, the dry season is a cool period (minimum temperature attains less than 10° C from June-August). Minimum temperature in the Pantanal rarely attains less than 15° C during the dry season. The more elevate temperature in Pantanal may explain the more broadly reproductive cycle in *H. leopardinus* than those of southeastern species. The reproductive patterns may be constrained by phylogeny in some Xenodontinae lineages, but climate can also influence the reproductive cycle of tropical and subtropical species.

Theme:snakes, Hydropsini, natural history, reproduction

Type of Presentation: Poster

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Amphibians of the Mucuri River Valley, Minas Gerais, Brazil: Long Term Surveys as Tools for the Knowledge Increase of the Biodiversity

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Brazil is a high biological diversity country with great mineral and energy potentials, resulting in a constant environmental transformation in function of the utilization of these resources. The sampling effort generally utilized to analyze environmental impacts and to create conservation strategies have not been treated appropriately in environmental assessments, dispensing the opportunity to increase the knowledge of the biodiversity. The hydroelectric power plan (UHE) Santa Clara is located at Mucuri river (17°53'S, 40°11'W), municipalities of Nanuque and Serra dos Aimorés – Minas Gerais, in Atlantic Forest and represents one of the priorities areas for the conservation of the herpetofauna

in state. The region is under strong human pressure mostly due cattle ranching and sugar cane culture. Fourteen expeditions for inventorying and monitoring herpetofauna were carried between 2001 and 2007. Specimens were recorded by visual surveys and also by captures in pit fall traps with drift fences, attempting to sampling a great number of habitats and microhabitats. A total of 28 species of amphibians was registered, belonging to 8 families and 2 orders: Anura: Brachycephalidae (1): *Eleutherodactylus binotatus*; Bufonidae (3): *Rhinella granulosa*, *R. pombali*, *R. schneideri*; Cycloramphidae (1): *Thoropa miliaris*; Hylidae (14): *Dendropsophus nanus*, *D. anceps*, *D. branneri*, *D. elegans*, *D. minutus*, *Hypsiboas crepitans*, *H. faber*, *H. semilineatus*, *Pseudis bolbodactyla*, *Scinax fuscomarginatus*, *S. fuscovarius*, *S. alter*, *Sphaenorhynchus prasinus* and *Trachycephalus nigromaculatus*; Leiuperidae (4): *Physalaemus aguirrei*, *Physalaemus* sp., *P. cuvieri* and *Pseudopaludicola mystacalis*; Leptodactylidae (3): *Leptodactylus fuscus*, *L. ocellatus*, *L. mistacynus*; Pipidae (1): *Pipa carvalhoi*. Gymnophiona: Caeciliidae (1): *Siphonops anullatus*. Although many species registered are generalists, some elements observed are strictly related to the Atlantic Forest, indicating the importance of the maintenance of forested areas still presents in the region. Some records are relevant, for example *Physalaemus aguirrei*, the first record in Minas Gerais state. The richness obtained can be considered significant, but, however, still underestimated, therefore the species accumulation curve did not stabilize. This illustrates the importance of the adequate sampling effort, especially in long term surveys throughout different phases of UHE implementation. The continuity of this study can provide rich data about the amphibians of the Mucuri basin, a poorly known region. Long term studies are rare in Brazil and when it performed systematically, can provide important zoological information, helping in the solution of gaps in knowledge actually observed at Brazil.

Theme: amphibians, hydroelectric power plan Santa Clara, Mucuri river valley, sampling effort, long term surveys, environmental impacts, conservation

Type of Presentation: Poster

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Clutch size can be used as an accurate estimate of the size of nesting *Podocnemis expansa* in the Rio Trombetas, PA/Brazil.

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We captured 26 postnesting *Podocnemis expansa* in November 2007, in Reserva Biológica do Rio Trombetas, on Farias and Jacaré beaches. Our objective was to compare the carapace length and weight of the female to the number, diameter, and weight of the eggs to test whether these clutch characteristics would be useful in estimating the size of the nesting females from all of the nests on the beach. After a female had finished nesting she was taken to the reserve base and measured (carapace length, width and height, plastron length), weighed, marked and released. Each nest was marked immediately after the female was captured and opened the following day at 0700 h to count, measure, and weigh the eggs. It was possible to correlate the nests with the higher number of eggs to the larger females. 90% of the females weighing more than 23 kg laid more than 80 eggs. Only one female weighing less than 23 kg did not lay more than 60 eggs. The smallest female weighed 20 kg, suggesting that this is the minimum size for reproduction in this population. 85% of the females larger than 65cm carapace length laid more than 80 eggs. In summary it is possible to say that nests that have more than 80 eggs are most likely to have been laid by females larger than 23 kg and 65cm carapace length. It is necessary to capture a larger number of post nesting females from these and other nesting beaches to be able to test the feasibility of using such estimations of size of female in relation to clutch size before this measure can be used with confidence to monitor the demographic

changes in size structure of nesting females in this population and monitor recruitment of newly mature females.

Theme:turtles, clutch size, *Podocnemis expansa*, size of nesting

Type of Presentation: POSTER

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***Xenopus laevis*, a new exotic amphibian in Portugal: distribution, population structure and feasibility of eradication**

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Several individuals of the African clawed frog, *Xenopus laevis*, were found in 2006 inhabiting a stream at Oeiras, about 15 km W of Lisbon, Portugal. Although the place and time of introduction are not clearly identified, there are reasons to believe that this may be a >30 yr-old introduction proceeding from laboratories located nearby. *Xenopus laevis* is native from South Africa, and introductions of this species and its adverse effects are already documented in other Mediterranean climate-type regions, particularly in California and Chile. Starting in 2007, the Oeiras municipality is promoting research on the distribution and abundance of this species in Lage stream, in order to design an effective eradication program. While being locally abundant, the adults of *X. laevis* are clearly smaller than those from other areas where the species was introduced; in spite of an abundant production of egg masses, no tadpoles were found at advanced developmental stages. Until now, most individuals were found downstream, in a heavily urbanized area that should constrain the ability of individuals to cross overland to other water bodies. An eradication program may be feasible, but the recent sighting of adults on a second stream clearly indicates that the species may be expanding, despite of the highly humanized urban landscape.

Theme:amphibians, anurans, ecology, reproduction, conservation biology

Type of Presentation: Oral, Symposium 2: Invasive Reptiles and Amphibians: Global Perspectives and local solutions

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Genetic and Morphological Analyses of a Putative Hybrid Population of *Chinemys reevesii* and *Mauremys mutica* (Reptilia: Geoemydidae) in Japan

Ryo Fujii* and Hidetoshi Ota

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There has recently been an increasing notion that artificially introduced organisms deliver various unfavorable effects to the native biodiversity. Such effects include one in the form of genetic introgression to indigenous species from their exotic relatives through hybridization. This type of effect is theoretically relatively well discussed, but suffers paucity in actual examples detected especially in terrestrial vertebrates. Turtles are frequently transported artificially for various purposes, and intentional and accidental releases resulting from such activities often lead to

formation of feral populations. Moreover, turtles are known to easily hybridize between different species and sometimes even between different genera, chiefly on the basis of captive observations. Nevertheless, little is known of frequencies or consequences of such hybridization events in the wild. We studied one freshwater turtle assemblage in Honshu, Japan, which includes individuals characterized by unique combinations of morphological character states. In the preliminary analysis of a partial sequence of mitochondrial genome from three specimens of the assemblage with such unique character state combinations, two were shown to have a haplotype identical to that of *Chinemys reevesii* (a species native to Honshu), whereas another had a haplotype of *Mauremys mutica* (a species not naturally occurring there). We thus assessed hybridity of this turtle assemblage in detail. For the genetic analysis, we examined ten nuclear makers, i. e., four allozyme loci and six SINE loci, and a partial sequence of mitochondrial genome. Most individuals had diagnostic alleles only of *C. reevesii*, but a few individuals also had alleles characteristic of *M. mutica* heterozygously. The exact probability test revealed no statistically significant deviation of the observed genotypic frequency from the frequency expected on the basis of Hardy-Weinberg equilibrium at any of the polymorphic allozyme loci investigated. In the mitochondrial genome sequence, a few individuals that had alleles characteristic of *M. mutica*, also had a haplotype of *M. mutica*. The other individuals had a haplotype of *C. reevesii*. In the morphological analysis, nearly half of the individuals examined had various combinations of diagnostic character states of both *C. reevesii* and *M. mutica*, whereas the remainder exhibited character states invariably diagnostic of *C. reevesii*. These results indicate that the assemblage represents a random mating population, and consists primarily of *C. reevesii*, but with descendants of its hybridization with *M. mutica* and subsequent backcrosses. The results also suggest that indications of such past hybridization may remain more explicitly in morphological characters than in some genetic markers.

Theme:turtles, genetics, morphology

Type of Presentation: oral: contributed

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A Tail of Two Turtles - River Management and Imperiled Turtle Species in the Western USA

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Aquatic herpetofauna, because of their reliance on water for major portions of their life cycles, can be very susceptible to alterations in magnitude and timing of river flows. Sampling and radio-telemetry studies were conducted by the U.S. Bureau of Reclamation in an effort to assess management impacts on imperiled turtle species in two highly managed river systems of the western United States. The Spiny Softshell (*Apalone spinifera*) and Big Bend Slider (*Trachemys gaigeae*) exist in fragmented, little-known populations in the Upper Missouri River and Rio Grande, respectively. During 2006, turtle sampling via hoop nets was conducted to document relative abundance of species within the study areas. During 2007, individuals were fitted with radio transmitters and will be tracked through 2008 to determine seasonal and annual movements and habitat requirements. Radio-tagged *T. gaigeae* remained in a complex willow (*Salix* spp.) and cattail (*Typha* spp.) marsh adjacent to the Rio Grande for the duration of the study. Individuals moved very little on a seasonal and annual basis. These marsh habitats are very limited within the Rio Grande Basin, which could explain the fragmentation of populations of this species. Conversely, *A. spinifera* moved freely throughout the Missouri River during the study. Some individuals moved more than 30 km up or downstream. It is unclear whether these movements are directed migrations or simply haphazard wanderings. Meaningful data gathered during these studies include transmitter attachment improvements, species distribution and abundance, habitat requirements and movement data. These data will be used to make management recommendations to prevent further declines of these species.

Theme: reptiles, turtles, ecology

Type of Presentation: Poster (contributed)

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The Role of the Cytokine MIF (Macrophage Migration Inhibitory Factor) in the Reproductive Tissues of Amphibians characterized by Different Reproductive Strategies

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Most research on materno-fetal immunotolerance, that allows the survival of the semi-allogenic embryo in maternal tissues, has focused on mammals, particularly humans and mice. Studies on other vertebrates have been hindered by the lack of genetic information, recombinant proteins and specific antibodies for experimental use. Although the immunological mechanisms are still largely unknown, cytokines seem to play an important role in reproduction. We recently showed that the cytokine interleukin-1 and its functional membrane receptor, are also expressed at the materno-fetal interface of non-mammalian vertebrates including squamate reptiles, amphibians and elasmobranch fishes. In this study we focused our attention on MIF (Macrophage Migration Inhibitory Factor), an evolutionarily conserved pro-inflammatory cytokine, with homologues found in vertebrates, invertebrates and plants. MIF is involved in innate and adaptive immunity and it has been shown to be implicated in human and murine reproduction including ovulation, embryo receptivity and gestation. Specifically, expression of MIF was investigated in reproductive tissues of three amphibian species characterized by different reproductive modalities: the viviparous *Salamandra lanzai*, the oviparous *Triturus carnifex* and the ovuliparous *Xenopus laevis*. All animals were caught in their natural habitat during their reproductive season. Formalin-fixed, paraffin embedded tissues were examined by immunohistochemistry and frozen tissues were examined for western blot to verify the specificity of the anti-human MIF polyclonal antibodies used. Results showed a positive staining for MIF in all the species examined though with marked differences between those with internal (viviparous and oviparous species) and external (ovuliparous species) fertilization. A band of 12.5 kDa, corresponding to recombinant MIF, was found in all species. The expression of MIF in

non-mammalian viviparous and oviparous vertebrates suggests that this cytokine is a universal mediator of materno-fetal immunotolerance. Moreover, its presence in reproductive tissues of ovuliparous species suggests that this cytokine is involved in the mucosal immunity of the female reproductive tissues against pathogens.

Theme:amphibians, anurans, salamanders, reproduction, physiology

Type of Presentation: Poster, number of symposium: 1

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Comparative Parasitic Fauna of *Trachemys scripta elegans* and *Cuora amboinensis* from Peninsular Malaysia

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Local wild-caught Red-eared sliders (*Trachemys scripta elegans*) and sympatric Malayan Box turtles (*Cuora amboinensis*) from Peninsular Malaysia were examined for ectoparasites, helminths and haemoparasite. Following blood collection via venipuncture, the turtles were euthanized and all the organs were screened individually. Leeches were attached to 5% of *T. s. elegans* and 80% of *C. amboinensis*, on various sites of the external surface including the plastron. None of the turtles harboured any arthropod ectoparasites. A total of 11 endoparasite species (5 nematodes and 6 trematodes) were recovered from *C. amboinensis*, namely, *Serpinema octorugatus* (small intestine), *Falcaustra duyagi* (large intestine), *Falcaustra* sp. 1 (large intestine), *Oxyurid larvae* sp. 1 (liver), *Oxyurid larvae* sp. 2 (large intestine), *Atractidae* sp. (large intestine) *Parorientodiscus magnus* (large intestine), *Digenea* sp. 1 (liver), *Digenea* sp. 2 (large intestine), *Polystomoides malayi* (urinary bladder), and *Polystomoides asiaticus* (oral cavity). Further, juvenile forms of the latter two helminths were collected in the kidneys and lungs, respectively. All *T. s. elegans* examined were negative for nematodes and cestodes. Plasmodium-like haemoprotozoa was detected in 5% of the Giemsa stained blood films of *T. s. elegans*. *Haemogregarina* sp. and an unidentified plasmodium-like haemoprotozoa were detected in the blood of 80% and 20% of *C. amboinensis*, respectively. In addition, numerous unidentified intra-erythrocytic inclusion bodies were present in 50% of *C. amboinensis*. *T. s. elegans* is an exotic species, introduced to Peninsular Malaysia via the pet trade. This turtle did not appear to succumb to parasites which infected *C. amboinensis*, a local sympatric turtle. This may allow the former leverage when competing for habitats, food and ecological resources, leading to its rapid dispersal and colonisation of local habitats.

Theme:reptiles, turtles, ecology, parasitology

Type of Presentation: _Poster_contributed

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Distribution of Species Diversity in the Western Ghats, India

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Molecular studies have shown that species diversity is not equally distributed in the Western Ghats - Sri Lanka biodiversity hotspot, and that the continental island holds endemism that was caused by vicariance due to the geological discontinuity rather than by sea-level changes. These observations suggest that we can expect local endemism within the Western Ghats of India to be at least as high, because this mountain range is not only effectively separated from other ranges, but also divided by several important discontinuities. It has already been proposed that the apparent restricted distribution patterns of amphibians in the Western Ghats reflect the North-South isolation of distinct hill ranges providing a linear arena for allopatric isolation. As such, topological discontinuities may have played an important role in the origin of endemic species. We performed molecular phylogenetic analyses on multiple anuran families to study species richness and phylogeographic structure, and to understand the role of topological gaps in the distribution of frog diversity in southern India. Our analyses reveal a high number of undescribed species, most of which are known from a single hill range. These results strengthen the importance of Western Ghats as a hotspot of amphibian diversity.

Theme: Anura - India – Western Ghats - species diversity

Type of Presentation: Oral, Symposium 9: Biogeography of the South and South East Asian Herpetofauna.

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Defensive peptides in the skin secretions of the world's most primitive frogs: Are New Zealand frogs prepared against *Batrachochytrium dendrobatidis*?

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Over the past few decades, amphibian populations have undergone drastic declines on a global scale and countless studies have linked these events to the emergence of infectious diseases in many anuran populations. New Zealand native frogs of the genus *Leiopelma* form a distinct group that is considered the most archaic of all living frogs and have remained virtually unchanged in 70 million years. It is thought that some frog species in New Zealand have experienced population declines linked with the emergence of a skin-invasive amphibian chytrid fungus, *Batrachochytrium dendrobatidis*. Antimicrobial peptides produced by granular glands in the skin are thought to act as

important components of an innate immune system and may protect some species from disease. Differences in susceptibility to pathogens have been linked to variations in skin peptides among some species. We found that the defensive skin secretions produced by native New Zealand frogs contain antimicrobial peptides whose activity varies significantly between species. In vitro pathogen growth inhibition assays showed that the skin secretions from native New Zealand species are more effective against chytrid growth than those from introduced Australian species. The skin secretions of the critically endangered species *Leiopelma archeyi* are the best at inhibiting in vitro growth of the amphibian chytrid. We confirmed the presence of novel peptides in *Leiopelmatid* species by combining Maldi ToF/ToF and ESI Q-ToF mass spectrometry with “shotgun cloning” of the skin secretions. This approach is a recently developed technique that can rapidly provide robust structural data on skin peptides without harming the endangered donor frogs.

Theme: amphibians, anurans, endangered species, genetics,

Type of Presentation: Oral, symposium 6: Disease and amphibian declines - where do we go from here?

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Functional Mapping of Auditory Responses to Mate-Choice Cues in the Túngara Frog

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Across taxa, males have evolved elaborate signals that function in attracting females to mate. Typically, females demonstrate a strong preference for males of their own species and they demonstrate preferences for some males over others. Both types of preferences are typically mediated by a female's response to communication signals produced by males. Among anurans, communication occurs largely within the acoustic domain. Thus, understanding auditory responses to mate-choice cues is essential for a complete understanding of the sensory ecology of anuran communication. In our research, we investigate the neural mechanisms that mediate female preferences for elaborate male traits using the túngara frog (*Physalaemus pustulosus*), a common Leptodactylid that is indigenous to subtropical and tropical forests and grasslands of Central American and northeastern South America. Based on studies of the evolution of behavior in túngara frogs, we hypothesize that female preferences are mediated by an auditory bias. In other words, we hypothesize that mating preferences are largely determined by low-level auditory processing of mating calls and not, for example, by higher order neural systems responsible for integrating auditory information with other neural systems. In our studies, we measure neural responses by measuring neural activity-dependent gene expression. The túngara frog produces mating calls that consist of a descending frequency sweep, referred to as a whine. In addition to the single-note whine, túngara frog males produce a multi-note call referred to as a whine-chuck, and which typically has 1-4 chucks. Females have a strong preference for the whine-chuck call, but they do not seem to care whether a call has multiple chucks. Therefore, if our hypothesis is correct, multiple-chuck calls should produce similar responses in the auditory system as single-chuck calls, and both should produce greater auditory responses than simple whine calls. Patterns of activity-dependent gene expression in the auditory midbrain suggest that the auditory system does not have a bias toward whine-chuck calls. Rather, the response of the auditory midbrain is graded, as though it is responding to the overall duration or energy in the mating calls. Thus, our data suggest that behavioral responses to mating calls are mediated, not by a bias in the auditory system, but by higher-order integration centers in the brain. Ongoing analyses will determine whether higher auditory centers and/or other neural systems in the brain reflect mating preferences.

Theme: amphibian, anuran, reproduction, behaviour, physiology

Type of Presentation: oral, Symposium 3: Sensory Ecology of Anuran Communication

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Do Not Lay Your Eggs in the be influenced by Same Pool: Effects of Quality and Distance Between Waterbodies in *Epipedobates boulengeri*'s Tadpole Deposition Strategy

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Diversified use of resources is a risk-spreading strategy favored in environments where the availability of resources changes in an unpredictable manner. Risk spreading should in turn be influenced by sensory abilities to discriminate relevant microhabitat characteristics, as well as by the costs associated to the search of alternative resources. Males of the dart poison frog *Epipedobates boulengeri* must transport tadpoles on their back and select waterbodies to deposit their larvae. Previous observations have suggested that this species had developed a diversified bet-hedging strategy by choosing more than one pool to distribute larvae from the same cohort. In this study we confirmed that males developed this kind of strategy, and tested whether tadpole deposition patterns in this species were affected by the distance and by the quality difference between available puddles. Different corridors, each containing a set of pools varying in the experimental factors, were offered to *E. boulengeri* males that were carrying tadpoles. Males distributed their tadpoles in several waterbodies, depositing more larvae in better quality puddles. Males' selectiveness decreased when pools were more similar in quality and more distant in distribution. These results show that diversified strategies to select breeding resources are affected by distribution and availability of good resources, and that they indeed depend on discrimination capabilities in individuals.

Theme: Reproductive Strategy, Bet hedging, tadpole deposition, resources, quality, distribution, dendrobatids, *Epipedobates boulengeri*

Type of Presentation: Poster

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THE ROLE OF ADDITIONAL NOTES IN THE COMMUNICATION SYSTEM OF *ELEUTHERODACTYLUS JOHNSTONEI* (ANURA: STRABOMANTIDAE)

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The advertisement call of anurans serves two principal functions: attract conspecific females and mediate aggressive interactions among males. In the majority of species these two functions are accomplished using the same signal, often composed of a single type of note. However, in some species the advertisement call may be composed of two distinct types of notes that differ markedly in spectral or temporal characteristics. Such signals are called diphasic. It has been proposed that each of the two components of a diphasic signal may be differentially directed at one sex or the other, and thus serve different roles. In this study we investigated the structure and function of the diphasic call in *Eleutherodactylus johnstonei* in Bucaramanga, Colombia. We found that in contrast to the previously studied *E. coqui*, *E. johnstonei* males may add additional notes of either type following the typical call. Thus, the vocal repertoire of *E. johnstonei* is composed of four types of calls: the most

frequent call (Co-Qui), plus three variants that include one or more additional notes of either the Co, Qui or Co-Qui type. We used playback experiments to understand the function of additional notes in the communication system among males and between males and females. Males reduced the repetition rate of the Co-Qui call, especially when they were stimulated with calls that contained additional Co notes. However, when the stimuli were reproduced at intensities above the populational average (68 – 85 dB), the males stopped calling, oriented and approached the speaker. On the other hand, the females demonstrated a slight preference for calls that contained additional Qui notes, and rejected stimuli that contained additional Co notes. This slight female preference for calls that contained additional Qui notes could be due to the fact that the dominant frequency of the introductory Qui note displayed an inverse relationship with male body size (larger males produced Qui notes of lower frequency). We therefore suggest that the additional Qui notes could increase a given call's attractiveness to females. Additional Co notes appear to be related to agonistic interactions between males establishing territories, and females may be avoiding calls with Co notes potentially associated with conflicts among males.

Theme:Anurans, behaviour

Type of Presentation: Poster

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South Asian Regional Amphibian Conservation Action Plan

Sanjay Molur, Karthikeyan Vasudevan and Sally Walker

Sanjay Molur, Karthikeyan Vasudevan and Sally Walker

The regional needs for amphibian conservation activities in South Asia have been identified broadly in areas such as research, status, priorities, conservation action, training and education. One of the most critical components is the lack of knowledge of the presence and effects (if any) of the chytrid fungus on amphibian populations in the region. While population declines in several parts of the world have been attributed to this agent mainly, priorities in the region to tackle population declines still lie in preventing habitat loss, fragmentation, degradation of habitat quality; increasing awareness amongst the general public, local and national administrations; building a solid foundation with basic research to develop consensus in generating public support and political will for amphibian conservation; developing key biodiversity areas and priorities for this group; and understanding new and ongoing challenges to amphibian conservation such as harvest rates, chytrid effects, misconceptions of amphibians as agricultural pests, etc. The Amphibian Network of South Asia along with the Amphibian Specialist Group, South Asia regional network has initiated several actions which complement the recommendations of the Amphibian Conservation Action Plan in the region. Training in field techniques, education outreach and lobbying, Amphibian Ark activities, networking, workshops, newsletters, etc. are some of the actions in place. Also ongoing is updating of new species and conservation status information for the Global Amphibian Assessment programme. An interactive website is also being developed for the region. Some critical activities to be urgently initiated are regional chytrid study and key biodiversity areas assessment with ASG and ANSA network members from within the region to help understand and develop species-based action plans and eventually implement them.

Theme:amphibians, anurans, caecilians, conservation biology, captive breeding, endangered species, South Asia

Type of Presentation: Oral, Symposium 14: Amphibian conservation.

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An overview of the “Strategic plan for the conservation of Ecuadorian amphibians

Santiago R. Ron

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Ecuador has 465 amphibian species of which 30% are threatened with extinction and 29% are data deficient. Population declines have been particularly severe in the Andes where 45% of the species are threatened. As a response to this conservation crisis, the Museo de Zoología at Universidad Católica del Ecuador has developed a the “Strategic plan for the conservation of Ecuadorian amphibians in extinction risk” which includes the following components: (1) population monitoring and systematics, (2) training of human resources, (3) habitat conservation, (4) ex situ management, and (5) public education. In my talk, I will describe these components and I will give an overview of current progress of this program. I will also provide updated information on the conservation status of Ecuadorian amphibians.

Theme:Amphibian Conservation Action Plan, Andes, Ecuador, ex situ management, extinction, habitat protection, population declines

Type of Presentation: Oral, Symposium 14: Amphibian conservation.

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Surveys of *Batrachochytrium dendrobatidis* and its Amphibian Hosts at Regional and Local Scales in Ecuador

Santiago R. Ron and David Salazar-Valenzuela presenter: Santiago R. Ron

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Understanding the role of *Batrachochytrium dendrobatidis* in amphibian populations declines requires to integrate comprehensive global distribution data of the chytrid with local long-term population data of host species. Unfortunately, most surveys of *B. dendrobatidis* have been patchy and geographically biased towards regions where amphibian declines have occurred, especially at mid to high-altitude sites. We conducted a large-scale survey of *B. dendrobatidis* in Ecuador including, for the first time, lowland localities. In addition, we carried out mark-recapture surveys of *Atelopus* sp. (spumarius complex) between 2005 and 2008 at a population in Limón, Provincia Morona-Santiago where *B. dendrobatidis* is present. The regional surveys show that *B. dendrobatidis* occurs at a wide range of altitudes and habitat types in Ecuador. Positive records include abundant and widespread species like *Pristimantis achatinus* and *Engystomops petersi*. The population of *Atelopus* sp. from Limón shows a stable relative abundance after three years, despite the presence of *B. dendrobatidis*. Our results suggest that *Atelopus* sp. species can persist in the presence of *B. dendrobatidis*. This finding was unexpected because a majority of *Atelopus* species has suffered severe population declines generally attributed to *B. dendrobatidis*.

Theme:amphibians, anurans, ecology, conservation biology, endangered species

Type of Presentation: Oral, symposium 6: Disease and amphibian declines - where do we go from here?

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Uterine Angiogenesis in Squamate Reptiles: Implications for the Evolution of Viviparity

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Embryonic growth and development during pregnancy is dependent upon maternal oxygen supply. Because embryonic oxygen consumption increases throughout gestation, the vascular respiratory membranes of the uterus must be able to match embryonic oxygen demand as development proceeds. The ontogenetic changes in uterine vascular architecture during the squamate reproductive cycle, however, have not been characterised. The purpose of this study was to compare changes in uterine microvascular density and morphology between two species of Sphenomorphus group skinks that differ in their capacity to support embryonic development during gestation. We predicted that 1) overall uterine vessel density is higher in species with prolonged gestation, and 2) proliferation of the uterine vascular bed is associated with increasing embryonic growth and therefore oxygen demand. To test these predictions we used indirect immunofluorescence and laser-scanning confocal microscopy to visualise uterine microvascular density and morphology during the reproductive cycle of the oviparous skink *Ctenotus taeniolatus* and in *Saiphos equalis*, a species capable of supporting embryonic development during prolonged egg-retention. Optical sections were computationally reassembled to provide 3-dimensional reconstructions of uterine microvascular architecture. Vascular density and morphology were measured and quantified using ImageJ image analysis software. At Dufaure and Hubert (1961) embryo stages 28-30, just prior to the usual stage of oviposition, overall uterine vessel density (vessels mm⁻²) and vessel length density (mm mm⁻²) is similar in both *C. taeniolatus* and *S. equalis*. In *C. taeniolatus*, vascular density remains stable throughout gestation (i.e. until stage 30) with relatively little increase in vascular proliferation. In contrast, vessel density and vessel length density in *S. equalis* increases substantially during the latter half of gestation, becoming highest between embryo stages 38-40, just prior to birth. Vessel density and vessel length density for *S. equalis* doubles from 350 vessel mm⁻² and 36 mm mm⁻² respectively, during the first half of gestation to 605 vessels mm⁻² and 64 mm mm⁻², during late gestation. Increase in vascular proliferation late in gestation is a combined result of intussusceptive angiogenesis (vessel splitting via transluminal pillar formation) and vessel lengthening. The increase in uterine vascular proliferation at advanced embryo stages coincides with the period of rapid growth in embryo mass and concomitant increasing embryonic metabolic rate.

Theme: Blood vessels, confocal microscopy, lizards, uterus, embryonic development,

Type of Presentation: Oral, Symposium 1: Reproduction in reptiles: from genes to ecology

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Conservation genetics of Galápagos marine iguanas

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Marine iguanas (genus *Amblyrhynchus*) are endemic to the Galápagos archipelago and are threatened both by natural recurring perturbations as the recurring El Niño-Southern Oscillation (ENSO) and by anthropogenic correlated factors as introduction of non-native species and habitat pollution (e.g. the oil spill in 2001). A conservation strategy for this unique species is still pending. Our present research

is aimed to gain knowledge on the genetic structure of island populations based on neutrally evolving microsatellite loci and mitochondrial DNA markers in order to determine migration rates and gene flow between island populations. Although we found a rather low level of overall F_{ST} differentiation across the whole archipelago, Bayesian cluster analysis and analysis of migration patterns based on genotypes clearly rejects the former view of high gene flow and strong migration among island populations of *Amblyrhynchus*. Indeed the existence of at least nine highly different genetic clusters, most of them specific to a certain island, supports the view of strong genetic differentiation among island populations. Further we evaluated whether the 1997-1998 El Niño altered the genetic composition of Galápagos marine iguana populations from eleven islands, some of which experienced mortality rates of up to 90% as a result of El Niño warming. Based on microsatellite data, only one island (Marchena) showed signatures of a genetic bottleneck. Substantial decreases in mtDNA variation were also observed in populations from just two islands (Marchena and Genovesa). Our results suggests that, for the majority of islands, a single, intense El Niño event did not reduce marine iguana populations to the point where substantial neutral genetic diversity was lost. In the case of Marchena, simultaneous changes to both nuclear and mitochondrial DNA variation may also be the result of a volcanic eruption on the island in 1991. Therefore, studies that seek to evaluate the genetic impact of El Niño must also consider the confounding or potentially synergistic effect of other environmental and biological forces shaping populations. An effective conservation plan for Galápagos marine iguanas should consider the actual genetic population structure of this species. Future monitoring of this species should make use of the applied microsatellite loci based early detection of possible severe bottlenecks in this species.

Theme:Galápagos marine iguanas, El Niño-Southern Oscillation (ENSO), genetic population structure, gene-flow, migration, bottleneck, effective population size, conservation plan, monitoring

Type of Presentation: oral, Symposium 10: Conservation Genetics of Amphibians and Reptiles in the 21st Century

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Taxonomy of *Leposoma* spp. (Squamata, Gymnophthalmidae) in the Madeira River basin, Amazonas, Brazil, and the role of rivers in the morphological variation of *Leposoma osvaldoi* Avila Pires, 1995.

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Different vertebrate species in the Amazon, specially birds and primates, share an unique distributional pattern, where the presence of large rivers delimits the occurrence of sister species in their opposite banks. Recently, the role of major river tributaries, mainly the Madeira River, in the delimitation of geographic variants is being demonstrated. Few studies analyzed the role of rivers in the distribution of Amazonian lizards. This work examined if the rivers in the Brazilian portion of Madeira basin are delimiting the distribution of geographic variants in the lizard *Leposoma osvaldoi* (Squamata, Gymnophthalmidae). The geographic variation is determined by 20 measures of head scales obtained from digital photographs. The success of the methodology in identifying and quantifying the diagnostic characters between species was tested in two sympatric species that occur in the Madeira Basin, *Leposoma percarinatum* and *Leposoma osvaldoi*. One hundred and sixteen specimens, 81 of *L. osvaldoi* and 35 of *L. percarinatum*, distributed over 21 localities, were analyzed. The two species differ mostly in the dimensions of interparietal, length of second supraocular, width

of frontoparietal, anterior width of frontal and suture between prefrontals. In *L. osvaldoi*, there is a strong sexual dimorphism in head width, explaining the dimorphism shown in the width of some head scales. The analysis of geographic variation in *L. osvaldoi* provided strong evidence that Madeira River, as well as two of its tributaries, Aripuanã and Roosevelt rivers, delimit the occurrence of geographic variants in *L. osvaldoi*, in despite of clinal variation hypothesis. The geographic variants differ mainly by dimensions of the interparietal scale, frontal length and size of the suture between frontoparietals. Larger samples from critical localities still would be necessary to clarify the variation pattern in this region and start to evaluate their possible cause.

Theme: lizards, biogeography, taxonomy, morphology

Type of Presentation: Poster

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global aspects of lizard body sizes

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Body size is instrumental in influencing animal physiology, morphology, ecology and evolution, as well as extinction risk. At large scales body sizes usually show a unimodal, right skewed distribution. In order to better understand the evolution of body size and its ecological consequences I studied the body size distribution of 99% of the world's lizard species. I examine several hypotheses regarding the influence of body size on lizard evolution and extinction risk, assessing if body size influences species richness, herbivory, island dwelling, and extinction risk. The lizard body size frequency distribution is highly modal and right skewed and similar distributions characterize most lizard families and lizard assemblages across biogeographic realms. There is a strong negative correlation between mean body size within families and species richness. However, small size does not promote high diversification rates at the generic level but only at higher taxonomic levels corresponding to more disparate body plans. Herbivorous lizards are larger than omnivorous ones, which are in turn larger than carnivorous lizards. Insular lizards tend towards both extremes of the size spectrum, especially on islands devoid of mammalian carnivores. These phenomena may be linked, with the absence of mammalian predators allowing insular lizards to attain larger body sizes by means of release from predation and evolution into the top predator niche. Aquatic and nocturnal lizards probably evolve large size because of thermal constraints. While extinction risk increases with body size, this might be a result of bias in the size of species whose threat status has been studied.

Theme: lizards, morphology

Type of Presentation: Oral, Symposium 12: Ecophysiology of Reptiles

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The insular fragmentation in lizard communities of the Balbina Reservoir, central Amazon

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In a global context, there are few studies addressing effects on natural communities of habitat loss and isolation caused by hydroelectric dams. To better understand the impact of the flooding and island formation caused by the Balbina Reservoir on lizard communities, we assessed the effects of island shape, size and isolation on species richness and composition and the influence of litter depth, and densities of trees and palms on the abundance of the most common species. Through litter browsing and visual encounter surveys, lizards were sampled on 20 islands and 6 control points on the nearby mainland. A total 1375 individuals were found, belonging to 16 taxa, in 5 families (Polychrotidae, Gekkonidae, Gymnophthalmidae, Scincidae and Teiidae). Islands did not differ from the mainland in species richness. Considering only the island samples, the number of species was positively related to island area and negatively to isolation, but the relationship with isolation was leveraged by a single point. Path analysis indicated a direct effect of the landscape (area and isolation) on richness and weak direct effects of litter depth, of tree density and palm density. The species composition differed between islands and mainland when inferred from abundance data, but did not differ for presence/absence data. Using abundance data, three groups of species were found in a 2-dimensional PCoA ordination. Ordination of sites using all species were related to island area but not to isolation. However, when considering only species that occurred in >60% of plots, composition was related to isolation, but not to island area. This latter pattern was also found with presence/absence data using all species. A path analysis using quantitative and qualitative data indicated that the direct effect of island area on composition was greater than its total effect. The mediators of indirect effects - litter depth, tree density and palm density - all had negative effects. The same was not true for isolation; the total effect was greater than the direct effect because of the mediated positive contribution of litter depth. Environmental factors did not affect the abundance of *Ameiva ameiva*, *Kentropyx calcarata* and *Plica umbra*. Litter depth had a positive effect on *Mabuya nigropunctata*, and tree density on *Gonatodes humeralis*. The insularization caused by Balbina Reservoir has changed the structure of lizard communities. The area and isolation of each island influence composition.

Theme: lizards, community ecology, landscape ecology

Type of Presentation: Poster

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Crocodiles and 'Grey-Headed Nomads': A Deadly Combination?

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In Australia the estuarine or saltwater crocodile *Crocodylus porosus* is generally restricted to appropriate habitat north of the Tropic of Capricorn. One of the largest of the crocodiles, it is well known to attack humans. Despite the implications of its common names, these crocodiles may be found above the tidal influence of rivers, including associated swamps and billabongs where there is sufficient water for them to survive. When conditions become untenable in a particular water environment they are not adverse to moving across land to appropriate aquatic habitat. At European settlement 'alligators' were common across the northern rivers of Australia. By the 1960s, due in part to the popularity of their skins, *C. porosus* numbers had been depleted across most of their Australian range and the International Union for the Conservation of Nature spearheaded a recovery effort. Since that time crocodile numbers have steadily increased, and there are now increasing numbers of larger crocodiles in the wild. In parallel with the success of the crocodile conservation efforts, it has become increasingly popular upon retirement from the workforce for 'grey-headed nomads' to take a pilgrimage around the country, often camping out in remote areas. While crocodile attacks have been few over recent decades, with increasing numbers of crocodile-naïve tourists from the southern cities

seeking the solitude of the bush within this reptile's range, the opportunities for disaster are increasing. It is time for a re-think of the management of crocodiles for conservation and 'outback' tourism in Australia.

Theme:reptiles, crocodilians, endangered species, predator-prey, conservation biology

Type of Presentation: oral - contributed

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Developmental Plasticity In An Australian Anuran Wet Forest Ephemeral Specialist: The Sandpaper Frog, *Lechriodus fletcheri*.

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The capacity for an organism to respond with a flexible phenotype to varying environmental conditions to optimise survival and fitness is known as phenotypic plasticity. The biphasic life cycle of amphibians provides one of the clearest examples of this adaptive evolutionary strategy as reflected in variation in the timing of, and size at, metamorphosis in response to factors such as competition, predation and the persistence of the physical environment. One species that provides an ideal model to investigate phenotypic plasticity is *Lechriodus fletcheri*, a highly adapted ephemeral specialist that breeds in small ephemeral water bodies in the wet forests of south-eastern Australia and can reach metamorphosis in <15 days. While ephemeral breeders avoid predators and competition with other amphibians at the larval phase, tadpole density is generally high (due to the small size of most ephemeral pools) and death before metamorphosis from pond desiccation is the major hazard. We hypothesized that larvae of such amphibian ephemeral specialists would develop rapidly and metamorphose early in response to pond ephemerality (declining water levels), be relatively tolerant of high densities (density independent) and respond to food resource as a cue for the timing of metamorphosis. We tested these hypotheses using *L. fletcheri* as a model, raising tadpoles to metamorphosis under conditions of varying depth, density and food level. Metamorphosis occurred between 17 and 30 days, with most tadpoles metamorphosing between 18 and 24 days. At constant density and depth, food level had no effect on the timing of metamorphosis, but low food metamorphs were significantly smaller (low = 0.24 ± 0.04 g low versus high 0.38 ± 0.10 g; $p < .001$). When matched for density and food level, tadpoles in shallow water emerged earlier (median age = 19.0 days shallow, 21.0 days deep; $p < 0.003$) and were smaller (shallow = 0.33 ± 0.06 g, deep = 0.37 ± 0.09 g; $p < 0.003$), but density had little effect on timing of metamorphosis (all densities median age at metamorphosis = 20.5 to 21 days). Taken together, these data suggest that developmental plasticity in *L. fletcheri* is relatively food resource and density independent, but heavily reliant on water level. *L. fletcheri* has adapted to the niche of small, highly ephemeral pools by sacrificing size to emerge early when water level is low, or size to emerge at the same age when food levels are low while not responding to tadpole density.

Theme:amphibian, anuran, *Lechriodus fletcheri*, evolution, phenotypic plasticity, developmental biology

Type of Presentation: oral: contributed

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Ultrastructure of the ovarian follicles of the highly placentotrophic lizard *Mabuya* sp. (Squamata:Scincidae)

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The Mabuya genus lizards produce microlecithal eggs and develop a very complex allantoaplacenta which provides most of the nutrients needed for embryonic development. Samples of ovarian follicles of a population of Mabuya sp. were processed for electron microscopy to investigate if there is a correlation between the fine structure of the ovarian follicles and the development of a highly specialized allantoaplacenta. The single granulose layer of primordial follicles differentiates in previtellogenic advanced follicles into a polymorphic epithelium with small, intermediate and large cells. The three different cell types have numerous tubular mitochondria, smooth endoplasmic reticulum (SER), Golgi apparatus and primary and secondary lysosomes. Large cells are not pyriform and do not establish intercellular bridges with the ooplasm. There was no evidence of a defined Balbiani's vitelline body in any of the previtellogenic follicles observed. In advanced previtellogenesis, the zona radiata is constituted almost exclusively by oocyte microvilli that interdigitate with short and few microvilli from granulose cells. The peripheral ooplasm contains mitochondria, Golgi apparatus, SER and lysosomes. In vitellogenic follicles the granulose layer becomes monostratified, with cubic to squamous cells. Evidence of cytoplasmic lysis is observed at the apex of these cells; fewer organelles are evidenced, but more and larger lysosomes are found. The microvillar arrangement of the zona radiata loses their organization producing canaliculi that penetrate in the ooplasm. At these points are found small vesicles, dilated cisternae and large vesicles with an electron-lucid material that suggests the transfer of materials from granulose cells into the ooplasm. The ooplasm of periovulatory follicles contains abundant lipid droplets of different sizes but they do not constitute yolk platelets. The absence of an evident Balbiani's vitelline body, yolk platelets in the oocyte as well as the lack of intercellular bridges between granulose cells and the oocyte concurs with a differential oogenesis in this lineage, producing an oocyte with fewer nutrients at ovulation, which is related with the highest level of placentotrophy that characterizes this group.

Theme:reptiles, lizards, reproduction, developmental biology

Type of Presentation: poster

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Participative management of turtles in the Amazon: monitoring and preservation in a mosaic of two sustainable development protected areas.

Soledad Novelle, Fabiano Waldez, Henrique S. A. Carlos e Carlos Eduardo Marinelli.

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The establishment of reserves by itself does not guarantee the preservation of biodiversity and, without proposals for effective conservation, the populations of turtles in the Amazon remain under pressure even within legally protected areas. In Jurua River, the capture of adult individuals and predation of nests have impacted their populations. It creates a demand for monitoring systems that allows the understanding of the status of these populations in face of these pressures and the building of opportunities for ordered and sustainable exploitation. The Monitoring Program of Biodiversity and Natural Resources Use in Amazonas State Protected Areas (ProBUC) is implementing a

pioneering system in the Brazilian Amazon, where the design, data collection and decisions on the application of results in management are made together with the residents of the protected areas. Monitoring nesting beaches is one of the components of ProBUC, and since 2006 has been held in two protected areas of sustainable development: Uacari's Reserve (Stadual) and Middle Jurua's Reserve (Federal). In 2007, 576 nests were recorded for Amazon Turtle (*Podocnemis expansa*) and 384 for taricaya (*Podocnemis unifilis*). Only nine nests (1.58%) were depredated and 152 hatchling (0.34%) died due to handling. The nest success ranged less between taricaya (84-98%) than among Amazon Turtles (75-100%) totaling 9,093 and 34,058 hatchling respectively. For Amazon Turtles the average of nests was 67.66 (sd±73.05) and 4.865,42 (sd±6578.78) hatchlings per beach against 41.75 (sd±29.11) nests and 1.515,5 hatchling (sd±1226.80) of taricaya. These results and the liberation of a total of 43,151 hatchlings indicate the successful reproduction of these species and the success of the integrated monitoring proposed that is being implemented. With the establishment of a zero point of the regional species status, we will have some important information to plan the management of hatchling for future purposes, as example, supplying the market for turtle commercial breeders in Manaus, the largest city of the Brazilian Amazon and stimulating the breeding for subsistence consume. With income generation is expected a gradual reduction in environmental/social pressures on adults, particularly resulted from the current disordered exploitation. Integrated initiatives among protected areas of sustainable use shows promising results that should be encouraged to be replicated for other protected areas in Amazon, helping to maintain the populations of turtles and the protected areas mosaic management in Brazilian Amazon.

Theme: turtle, monitoring, sustainable development, Amazonian

Type of Presentation: Poster

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Participative Management of Turtles in the Amazon: Monitoring and Preservation in a Mosaic of Two Sustainable Development Protected Areas.

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The establishment of reserves by itself does not guarantee the preservation of biodiversity and, without proposals for effective conservation, the populations of turtles in the Amazon remain under pressure even within legally protected areas. In Jurua River, the capture of adult individuals and predation of nests have impacted their populations. It creates a demand for monitoring systems that allows the understanding of the status of these populations in face of these pressures and the building of opportunities for ordered and sustainable exploitation. The Monitoring Program of Biodiversity and Natural Resources Use in Amazonas State Protected Areas (ProBUC) is implementing a pioneering system in the Brazilian Amazon, where the design, data collection and decisions on the application of results in management are made together with the residents of the protected areas. Monitoring nesting beaches is one of the components of ProBUC, and since 2006 has been held in two protected areas of sustainable development: Uacari's Reserve (Stadual) and Middle Jurua's Reserve (Federal). In 2007, 576 nests were recorded for Amazon Turtle (*Podocnemis expansa*) and 384 for taricaya (*Podocnemis unifilis*). Only nine nests (1.58%) were depredated and 152 hatchling

(0.34%) died due to handling. The nest success ranged less between taricaya (84-98%) than among Amazon Turtles (75-100%) totaling 9,093 and 34,058 hatchling respectively. For Amazon Turtles the average of nests was 71 (sd±76.85) and 4.865,42 (sd±6578.78) hatchlings per beach against 45.37 (sd±25.80) nests and 1.515,5 hatchling (sd±1226.80) of taricaya. These results and the liberation of a total of 43,151 hatchlings indicate the successful reproduction of these species and the success of the integrated monitoring proposed that is being implemented. With the establishment of a zero point of the regional species status, we will have some important information to plan the management of hatchling for future purposes, as example, supplying the market for turtle commercial breeders in Manaus, the largest city of the Brazilian Amazon and stimulating the breeding for subsistence consume. With income generation is expected a gradual reduction in environmental/social pressures on adults, particularly resulted from the current disordered exploitation. Integrated initiatives among protected areas of sustainable use shows promising results that should be encouraged to be replicated for other protected areas in Amazon, helping to maintain the populations of turtles and the protected areas mosaic management in Brazilian Amazon.

Theme: TURTLES, CONSERVATION BIOLOGY, MANAGEMENT, MONITORING

Type of Presentation: ORAL

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Genetic variability and fitness in a rare British species, the Natterjack Toad (*Epidalea calamita*)

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The natterjack toad is a rare and protected species in Britain. Microsatellite diversity has previously been characterised for all the surviving British populations. Four of these populations had very low levels of microsatellite diversity. Fitness is predicted to correlate with genetic diversity, and it has been shown to do so in the natterjack toad, based on an inbreeding effect found in one low microsatellite-diversity population. I investigated whether this fitness cost is also seen in two of the other low diversity populations. For this study the larval fitness traits age at metamorphosis, survival and growth rate were measured in four British natterjack populations, two with high and two with low microsatellite diversities. No significant difference was found between populations for the traits growth rate and survival, however a significant difference was seen between populations for the trait age at metamorphosis. Genetic diversity was measured using both microsatellite and MHC markers. Microsatellites are tandem repeats that are in 'non-coding' regions of the genome. The major histocompatibility complex codes for proteins that are critical components of the cellular immune response. MHC class II loci are interesting because they encode cell surface proteins that bind antigens and play crucial roles in disease resistance. MHC loci were characterised in the natterjack toad, and single strand conformation polymorphism used to measure genetic diversity at one MHC locus. Genetic diversity results and correlations between genetic diversity and fitness in these four populations of Natterjack toad are presented and discussed.

Theme: amphibians, anurans, genetics, conservation biology, endangered species

Type of Presentation: oral, Symposium 10: Conservation Genetics of Amphibians and Reptiles in the 21st Century

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Ecology and reproductive cycle of the Lacertidae *Ophisops elegans ménétries*, 1832, in

Lebanese Mountains

Souad HRAOUI-BLOQUET

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SUMMARY- This lacertidae presents a large repartition in Lebanon, from the sea shore to 1700 m in altitude. He shows variation in coloration depending from the region where he was found. He lives in opening areas, preferring a sandstone habitat instead of a grassy one. The reproductive cycle of *Ophisops elegans* belongs to the mixed type. Mating occurs in spring after hibernation which lasts five months. A sexual repose is observed from August to April. In males, spermiogenesis is very active from April to July. Secondary sexual characters (epididymis, sexual segment of kidney, vas deferens) are also developed during this period. Gravid females and females with follicles in vitellogenesis are observed from April to the end of July. Each female has two clutches by year. Number of eggs by clutch, varies between 2 and 5. There is no correlation between length of females and the number of eggs by clutch. Period of mating starts at the beginning of May and lasts until mid July. The Incubation lasts 2 to 2 months and a half. The first newborns are observed at the end of July.

Theme:Key Words: Lacertidae (lizard), *Ophisops elegans*, ecology, reproductive cycle, mixed type, mountains, Lebanon.

Type of Presentation: oral

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An Amphibian Conservation Action Plan for East and Central Africa

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Amphibians belong to the animals which at the global scale are most threatened with extinction. Our answer to prevent amphibian diversity from loss is the IUCN Amphibian Conservation Action Plan (ACAP). Although a worldwide phenomenon, causes for amphibian decline and extinction rank differently at the regional scale, emphasizing the need of regional conservation focus. Eastern and central Africa harbour high biodiversity with certain 'hotspots'. Major problems here include high population growth, habitat change, and war. Perhaps contrary to what would be expected, amphibian extinction trends in this region have been little reported. However, this does not mean that they play a minor role, because first of all, we lack documentation. A related problem is that often taxonomy is poorly understood. We are just about to recognize that widely distributed species actually represent species complexes, and that loads of species new to science exist. As a consequence, our current idea of the conservation status of many species can only be considered 'provisional'. A network of standardized monitoring of amphibian diversity change is needed, spatially equally distributed and covering different habitats. Monitoring should generally involve local scientists and therefore begin subsequent to local workshops where methods are taught. In addition, efforts towards a better understanding of taxonomy and species' distributions should be a focus of conservation initiatives. Therefore, capacity building in taxonomy-related skills are another demand. Further, field studies should address the presence/absence of pathogens, especially of amphibian chytrid. Analyses so far suggest that this fungus is widely distributed in eastern Africa but that it might be harmless to the majority of species--in contrast to other parts of the world. If so, this fungus should become a particular target organism of future studies. This may allow for a better understanding of its interaction with amphibians in general. Also capacities for conservation breeding, largely lacking in

Africa, should be established so that ex situ conservation measures, including emergency response, can be addressed. For the establishment of an East and Central African ACAP, an alliance of stakeholders should be united including regional partners (scientists, authorities, NGOs) supported by international financial power and knowledge transfer.

Theme: amphibians, anurans, caecilians, conservation biology, captive breeding, endangered species, east Africa, central Africa

Type of Presentation: Oral, Symposium 14: Amphibian conservation.

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Amazonian poison frogs under climate change: potential distributions based on climate niche models

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Climate is subject to ongoing change. We know that during the last glacial maximum, ca 21,000 years ago, it was colder and drier within the Amazon basin, while under current anthropogenic climate change temperatures are expected to drastically increase within a few decades. The temperature span over historical time in Amazonia is about 10°C, and humidity change is mirrored by alternation of savanna and rain forest vegetation. The question is how do species, bound to their specific climatic niches, will respond? We address this complex question in dendrobatid frogs by computing potential distributions with GIS-based climate niche models under past, current and future climate scenarios. We discuss potential refuges, postglacial dispersal and possible change in geographic ranges in the future. Species' past potential distributions only partly correspond to suggested refuges, implying that climatic niches may have shifted. Under future global warming scenarios, species responded differently. We observed stable, decreasing and increasing potential distributions. The latter, however, often would result in enormous allocation, which is questionable in most species.

Theme: amphibians; ecology; conservation biology

Type of Presentation: Oral, Symposium 11: Dendrobatoid Frog Biology.

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Sex in dragons: Comparative genomics and the molecular basis of genetic and environmental sex determination.

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Reptiles may exhibit genotypic sex determination (GSD) with either male or female heterogamety, or one of three different patterns of temperature-dependent sex determination (TSD). There has been a tendency to view these sex determining mechanisms as a dichotomy but an increasing body of evidence suggests that sex determination in reptiles is more like a continuum of states represented by species whose sex is determined primarily by genotype, species where genetic and environmental mechanisms coexist and interact in lesser or greater measure to bring about sex phenotypes, and species where sex is determined primarily by the temperature of incubation. We have used a

combination of laboratory incubation experiments, Comparative Genome Hybridisation and AFLP fragment analysis to demonstrate that high incubation temperatures can reverse genotypic males (ZZ) to phenotypic females in the dragon lizard (*Pogona vitticeps*), which has GSD with female heterogamety. Temperature thus overrides gene(s) involved in male differentiation in that species. The future application of genomic approaches to this problem, in particular comparative approaches using chromosomal techniques, genomic analyses of a Bacterial Artificial Chromosome library of *Pogona vitticeps* and massive parallel sequencing, should shed light on the underlying genetic architecture of sex determination in dragons and lay the foundations for experimental tests of our models of evolution in Australian agamid lizards.

Theme: reptiles, lizards, genetics, developmental biology

Type of Presentation: Oral, Symposium 1: Reproduction in reptiles: from genes to ecology

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The Hog Island Boa – On the Road to Recovery?

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Islands frequently support very distinctive faunas that are of considerable conservation interest. One characteristic that is commonly observed in a wide range of island species is the evolution of giant and dwarf forms. Snakes are no exception to this island phenomenon with both giant (e.g. tiger snakes on Australian islands) and dwarf (e.g. boa constrictors on Caribbean islands) forms evolving in different environments. Indeed, the dwarf boas of some Caribbean islands are of particular interest as they are currently classified within the same subspecies as the gigantic mainland form (*Boa constrictor imperator*). In addition to the interest which these dwarf boas instil in naturalists and evolutionary biologists, these distinctive island forms are also in demand for the pet trade. The Cayos Cochinos boa constrictor (*Boa constrictor imperator*), known in the pet trade as the 'Hog Island Boa', exists solely on two small islands 17 km off the northern coast of Honduras. Popular in the pet trade for its small size, light 'pink' colouration and relatively docile disposition, this dwarf boa has become highly desirable with reptile enthusiasts. However, intensive and uncontrolled collection for the pet trade during the 1980s and early 1990s led to fears that the population had been extirpated from the wild. In 2004 a long term mark recapture study was initiated on Cayo Menor to determine the population size and the impact collection has had on the population. A total of 414 individuals were captured during visual encounter surveys and PIT-tagged between 2004 and 2007. Preliminary analysis of four years of data, using program MARK, estimated an adult population size of <1000 individuals on Cayo Menor. Male and female survival was found to be constant ($\phi = 0.54$), but detectability was variable with females being more detectable ($p = 0.45$) than males ($p = 0.23$). Initial analysis indicates that increased levels of protection in the Cayos Cochinos have allowed the wild Hog Island Boa population to begin to recover. Genetic analyses are underway to determine whether collection for the trade has resulted in a population bottleneck, and to examine the phylogenetic relationships of the Hog Island Boa. In the meantime, continued threats from illegal collection leave the population vulnerable to future exploitation.

Theme: reptiles, snakes, natural history, conservation biology, endangered species

Type of Presentation: Poster

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Invasive Species Education in Australia: a three tiered approach towards better management

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Invasive species are recognised as a highly significant problem for agriculture and biodiversity conservation in Australia yet management of such species is often localized, adhoc and conducted without reference to a broader regional context. Correspondingly, there is little coordination of the educational effort around invasive species and their control. What educational effort there is, tends to be directed towards the techniques and mechanics of population control rather than longer term strategic approaches. To assist in overcoming these short comings, the Education Program of the Invasive Animals CRC has embarked on an ambitious nationwide program of education and awareness raising at three levels through its “Balanced Scientist” Program (PhD education), stakeholder training (Diploma in Conservation and Land Management), and schools education (“FeralFocus”). Our approach emphasises online delivery of course and other educational materials combined with short-term residential components. The latter are particularly important for building links among researchers and practitioners that promote information flow across regional and state boundaries. Although our program emphasises mammals and fish as key invasive animals for Australia, we support research relating to cane toads and invasive reptiles and our educational program is designed to cross taxonomic boundaries and to adapt to emerging invasive threats.

Theme:invasive species, reptiles, amphibians

Type of Presentation: Oral

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Endocrine Influences On Gestation in Viviparous Lizards

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An evolutionary shift from oviparity to viviparity requires some profound changes in female physiology. An endocrine system geared for vitellogenesis and the development of oviductal shell glands must shift emphasis to the hormonal support of gestation; increased reliance upon placentotrophy versus lecithotrophy requires the elaboration of increasingly complex placentae, which raises the possibility of maternal-embryonic signaling; while the endocrine mechanisms responsible for oviposition and a suite of nesting behaviours must be replaced by systems ensuring the timely initiation of parturition. In temperate lizards, reproductive cycles are geared so that young are born at the most advantageous time of year: spring or early summer. Working from the premise that reproductive patterns have evolved to optimise offspring fitness at birth, this paper reviews evidence from data gathered from a range of model species to test the hypothesis that interactions between the maternal endocrine system and environmental stimuli mediate the timing of parturition in viviparous lizards. Methods include blood sampling to measure annual variations in plasma hormone concentrations, in vitro incubations of tissues to analyse their steroidogenic capacity at key stages of gestation, and injection of hormones to assess their capacity to induce parturition. The biennially reproducing *Niveoscincus microlepidotus* has fully developed embryos in autumn that are

not born until well into the following spring. The significant temporal separation between the completion of embryonic development and birth of the offspring offers special opportunities to examine the endocrine control of gestation and of parturition. Plasma progesterone profiles and in vitro incubations of corpora lutea show that luteolysis does not signal the end of gestation, neither in this species nor in the annually reproducing *N. ocellatus*. In particular, I present evidence that the embryos may play a role in the timing of parturition in viviparous lizards. In both *Niveoscincus microlepidotus* and *N. ocellatus*, in vitro incubations demonstrate that embryonic adrenals produce detectable amounts of corticosterone. In *N. microlepidotus*, corticosterone production increases with embryonic stage, is greater at higher temperatures, and is stimulated by ACTH. Warmer spring temperatures may therefore interact with the embryonic adrenal to trigger the maternal hormonal cascade leading to parturition.

Theme: lizards, reproduction, physiology, developmental biology

Type of Presentation: Oral, Symposium 1: Reproduction in reptiles: from genes to ecology

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Artificial Incubation Boosts Conservation of Tuatara

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A common methodology used in conservation programmes for oviparous reptiles is artificial incubation of eggs, head-starting the resulting offspring and subsequently releasing these juveniles into the wild. However low success rates for some species raise questions about the viability of these techniques. Tuatara (*Sphenodon* spp.) are medium-sized, long-lived reptiles that are the sole living representatives of the order Sphenodontia. They survived only in New Zealand, where their natural range was restricted to offshore islands due to predation by introduced mammals. Female tuatara have small clutch sizes (1-19 eggs) and reproduce every 2 to 7 years, making recovery of small populations slow. Recent conservation programmes for tuatara have focused on artificial incubation of eggs and head-starting of juveniles to augment declining island populations, and establish new populations on islands undergoing ecological restoration. Artificial incubation and head-starting increase survival of eggs and juveniles compared to incubation in natural conditions, producing large numbers of animals for release into the wild. Over 760 eggs from 6 island populations have been artificially incubated and hatched since 1989. Four new populations have been established using founders from this programme, and four island populations that were declining in the presence of Pacific rats (*Rattus exulans*) have been augmented. One of these islands, Little Barrier Island, is a 3000 hectare Nature Reserve on which a remnant population of tuatara was found during surveys in 1991 and 1992. Eight adult tuatara (4 females, 4 males) of unknown age were taken into captivity on the island to protect them from Pacific rats. Eggs laid by these tuatara were artificially incubated to maximise hatching success, and the resulting 152 juveniles were head-started in captivity on the island. In 2004 Pacific rats were eradicated. In 2006 the island was confirmed to be rat-free, and subsequently 106 of the larger head-started juveniles were released at two sites on the island. Reintroductions using tuatara from artificial incubation and head-start programmes have been monitored closely, and no failures have been recorded. High success rates may be attributed to refinement of husbandry techniques, and knowledge and elimination of the cause of decline, i.e. introduced predators. In the long term, it is not known whether artificially incubated and head-started individuals will exhibit reduced fitness. Due to low fecundity in tuatara, long term success of these programmes will take decades to confirm.

Theme:tuatara, artificial incubation, head-starting, conservation, reintroduction
Type of Presentation: Oral, Symposium 8: Herpetological Conservation & Biology
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Cryptic diversity in reed frogs (*Hyperolius cinnamomeiventris*) from tropical Africa

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The Cinnamon-bellied reed frog, *Hyperolius cinnamomeiventris*, is suggested to display a large geographical distribution involving major parts of the Congo basin and adjacent East Africa. We studied material from localities in Angola (type locality), the Central African Republic, the Democratic Republic of Congo, Gabon, Kenya and Uganda. Specimens are morphologically similar but a phylogenetic approach using different mitochondrial genes, suggested that at least two, probably four to five species are involved. For most of which species names are available. We further assessed species distributions running ecological niche models. We conclude that for conservation purposes, deeper insight into potential species complex from the Congo basin should be generally addressed.

Theme:amphibians, anurans, genetics, taxonomy, conservation biology
Type of Presentation: oral
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Influence Of Gut Proteins In Cane Toad Metamorphosis: A Novel Approach To Disrupt Its Life cycle

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Cane toads (*Bufo* [*Chaunus*] *marinus*) were introduced to Australia in the 1930s to control sugar cane beetles (Frenchi beetle and greyback beetle). This proved unsuccessful and cane toads have now spread to large areas of Northern Australia and are about to invade Western Australia. The animals are considered pests as they breed in prodigious numbers and are toxic to many native animals. A recent approach by CSIRO to control the toads involves the development of a cane toad specific biocontrol agent. Our approach first entails the identification of genes expressed by adults but not tadpoles using DNA microarrays. Two gut-associated targets, gastrokinin and trefoil factor were selected and synthetic peptides relevant to these genes were designed and synthesised. These peptides were used to generate specific antibodies in chicken or rabbit hosts. Subsequently, these antibodies were injected into tadpoles to test any neutralising effect of corresponding target proteins during the early life stages of cane toads. Protein and mRNA levels of relevant genes along with tadpole morphological parameters were measured and analysed. This presentation will focus on the results and strategies currently underway.

Theme: amphibians, anurans, morphology, developmental biology, physiology

Type of Presentation: Oral, Symposium 2: Invasive Reptiles and Amphibians: Global Perspectives and local solutions

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Can We Control *Bufo* [*Chaunus*] *marinus* (Cane Toads) By Interrupting With Developmental Genes During Metamorphosis?

T. Shanmuganathan, D.C.T. Halliday, J. Pallister, D. Venables, R. Voysey, D. Boyle, T. Robinson, C. Hardy, A. Hyatt

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In 1935, cane toads (*Bufo* [*Chaunus*] *marinus*) were introduced from Central and North America to Australia to control sugar cane beetles. This was unsuccessful and cane toads now have invaded much of Northern Australia and are about to invade Western Australia. They are considered pests as they breed in extraordinary numbers and are toxic to a range of native animals. Currently, we are developing a biocontrol agent which aims to stimulate an immune response and thus interfere with metamorphosis. This approach was developed on the hypothesis that cane toad proteins normally expressed at metamorphosis or in adulthood can be delivered to tadpoles and stimulate an autoimmune response. To date we have established a captive colony, identified several candidate adult-specific genes and a viral delivery vector and conducted animal trials with different recombinant viruses. This presentation will focus on results from the above activities and describe future strategies for the biological control of *Bufo* [*Chaunus*] *marinus*.

Theme: amphibians, anurans, morphology, developmental biology, captive breeding, physiology

Type of Presentation: Oral, Symposium 2: Invasive Reptiles and Amphibians: Global Perspectives and local solutions

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**Preliminary Observations On Osteological Variation In *Adenomera hylaedactyla* (Cope, 1868)
(Anura: Leptodactylidae)**

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The genus *Adenomera* currently includes eight species that occur in South America east of the Andes. This genus is taxonomically difficult due to extensive morphological variation both within and between species. It is also possible to find two or more cryptic species living in sympatry and even in syntopy. To resolve these identification problems, other kinds of data such as molecular, advertisement call and osteological data, have been used. Subtle variation on external morphology associated with different call types have proven efficient in discriminating species. Recently, a new scheme of relationships, based mainly on molecular data, was proposed nesting the genus *Adenomera* within the genus *Leptodactylus*. However, in order to confirm this hypothesis, a greater taxon sampling and more characters are needed. An osteological characterization made with four putative species of indicated that osteological characters could be of use in analyzing relationships involving *Adenomera* and related genera, as well as among the species of the genus. According to preliminary acoustic observations, the advertisement call data of specimens in the campus of the Federal University of Amazonas (Manaus, Brazil), seems to indicate one species only. However, they show extensive morphological variation. No detailed osteological studies have yet been done with *Adenomera hylaedactyla*. So being, the present study aims to examine the osteological variation within specimens of *Adenomera hylaedactyla* from the locality cited above and, if possible, to relate this osteological variation with dorsal design and color pattern. So far three adult specimens, of a total of 15 that will be analyzed, have been cleared and stained for osteological studies, according to the protocol of Taylor & Van Dyke, and photographed. The osteological variation observed so far was: epicoracoid (left overlapping the right or vice-versa), urostyle (fused or partially fused), dentigerous process of vomer (straight or arched series), lateral borders of the cultriform process of parasphenoid (straight and parallel or broadened medially, curved, convergent anteriorly) and zygomatic ramus of each squamosal (parallel or oriented slightly to the outside). Color pattern variation observed until now was: light grayish-brown background with extensive dark marks and pinkish glands, distributed all the way to the sacral region; grayish-green background with many dark spots, few larger dark marks and distinct interorbital mark; plain dark brown background without conspicuous dorsal markings or interorbital mark.

Theme: Osteology, variation, *Adenomera hylaedactyla*, morphology, anurans

Type of Presentation: poster

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Independent Evolution of Intriguing Morphologies: Examples from Caecilian and Amphisbaenian Using Molecular Approaches

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Extant caecilians and amphisbaenians are limbless (with few exceptions in amphisbaenians) and the similarity of their snake-like bodies is the hallmark feature of these groups. The body morphology of these two groups is very conservative, nevertheless, the tail shape in amphisbaenians and the ending portion of the body of certain caecilian species have had some morphological variations. Herein, molecular approaches are taken to investigate the evolution of a vertical keel on the body terminus of caeciliid species and also the sharp reduction of the tail with a cone on its tip in amphisbaenian species. In caecilians, a vertical keel on the body terminus has arisen independently in South America and Africa. In amphisbaenians, the sharp and short tail has arisen independently in two distantly related families. Whether the appearances of these variations have some adaptive function is unknown and further studies with different approaches may clarify the evolution of these intriguing characters.

Theme: caecilians, amphisbaenians, molecular data, convergence, morphology

Type of Presentation: oral, Symposium 4: Evolutionary Transitions of Body Shape in Extant Amphibians and Reptiles: Call for Integrative Approaches.

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21 YEARS MONITORING A POPULATION OF *Bufo granulosus* IN THE AMAZON

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We have been monitoring the population dynamics of the toad *Bufo granulosus* since 1986 (21 years) in a Peninsula of Tapajós River, Village of Alter do Chão, Pará, Brazil (2°36'04''S, 54°51'45''W). In this study we verify whether there is any seasonal patterns in the toad's population fluctuation and in case so whether it is correlated with changes in climatic conditions produced by the Southern Oscillations (El Niño) – used here as an index, the Surface pressure anomalies (hPa). The study was done in September and November during each of the 21 years (1986-2007). Annual changes in abundance of adult reproductive males were tracked down by subdividing a 400 m long linear transect established at the river shore in 1 m parcels. Transect was located 1 m distance from the water edge on a sandy beach. The population census consisted in walking slowly (less than 1 km/h speed) and recording all frogs seen within the 400 m transect during three consecutive nights. The surveys started at 7 PM and ended by 11 PM. The mean number of males ranged from 36 individuals in 1999 to 468 in 1997. In 2003, we concluded that there was a strong relationship between El Niño oscillations and the rate of increase of the frogs, but only disregarding an outlier. However, we did not take into account a possible effect of density-dependent population control. With five years of more data, we found a negative effect of population density in the previous year and in the rate of increase of the frogs, but no effect of rainfall in the previous year or the Southern Oscillation Index, indicating that internal population controls may be more important than climate in determining population fluctuations.

Theme: amphibians, anura, Amazon, population ecology

Type of Presentation: Poster

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Taxon Sampling and Dendrobatoid Systematics

Taran Grant

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A number of studies have examined the phylogenetic relationships of dendrobatoid frogs. Although the results of these studies are largely congruent—an encouraging sign that knowledge of the evolutionary history of these frogs is improving—they are not identical, and some of the differences have important consequences for understanding dendrobatoid evolution. Interpretation of these differences is not straight-forward. In part different results may be due to different analytical assumptions (e.g., different optimality criteria, model assumptions, alignment methods). However, even when analytical assumptions are constant across studies, taxon sampling may vary greatly. It is widely recognized that greater taxon sampling provides a stronger test, with ingroup sampling invariably more thorough than outgroup sampling. Nevertheless, these categories are defined subjectively (the ingroup is defined as the group of interest for a given study and taxa are sampled from the outgroup to test ingroup relationships and homologies), which means that the hierarchic level at which one study defines its ingroup may correspond to or surpass the limit of another study's outgroup sampling. It is known that the resulting differences in the extent and density of sampling of different studies may affect results, but the extent of the effects is poorly understood. In this talk I will report the results of taxon inclusion and exclusion experiments to assess the effects of differing taxon sampling on the inferred relationships of Dendrobatoidea using published and new empirical data and a single assumption set.

Theme:Phylogeny, systematics, Dendrobatoidea

Type of Presentation: Oral, Symposium 11: Dendrobatoid Frog Biology.

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The phylogenetic analysis of amphibian alkaloids

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Alkaloid-based chemical defense is estimated to occur in more than 300 species of amphibians and has originated no fewer than 11 times. More than 800 alkaloids have been found in amphibians. Differences in alkaloid profiles have been used in amphibian taxonomy for decades, and explicit phylogenetic analysis of alkaloid profiles may provide important insights into the evolution of chemical defense and a predictive framework for experimental and comparative studies. However, important questions are raised by the fact that the source of these alkaloids appears to be extra-genetic in many, if not all, species. In this talk I will address the theoretical, analytical, and empirical challenges to the phylogenetic analysis of amphibian alkaloids, with particular emphasis on dart-poison frogs and their relatives (Dendrobatidae).

Theme:amphibians, anurans, salamanders, natural history, ecology, behaviour, taxonomy

Type of Presentation: oral, symposium 13 (Sequestered Defensive Compounds in Tetrapod Vertebrates)

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Anurophauna Spatial And Weather Distribution From Parque Ecológico Altamiro De Moura Pacheco – GO

Tarcilla Valtuille de Castro Guimarães (Guimarães, T.V.C.)

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Amphibians are vertebrates extremely dependents of environmental humidity. They have a permeable skin and most species have an aquatic larval phase (tadpoles), which limits great part of species to humid or aquatic environment. The Amphibian class is divided in three orders, Urodela, Gymnophiona and Anurian, which is more represented in numbers of species, occurs on all continents except Antarctica. The objective of the present study is collect information about the diversity and spatial distribution of the amphibians, anurans. The Parque Ecológico Altamiro de Moura Pacheco (PEAMP), has Atlantic Forest fragments from Goiás State, with an area of 4123 ha, located on South Center position of Goiás. The collects started in January of 2007, being bimonthly. Two methodologies were used in antropogenic areas (poulties, orchard, pastures and ponds), mesophilic woods, and gallery woods: Pit fall, with 10 lines which consists in 4 plastic buckets bed on ground and disposed in “Y” form, interconnected whit a black plastic sailcloth with 50 cm high, being checked up by 9 a.m., 3 p.m. and 5 p.m. and nocturne effective collect, were marked 10 points reaching all study area, starting from 6 p.m. to 11 p.m.. Were registered 37 species of amphibians’ anurans belonging to seven families: Bufonidae (2 species), Brachycephalidae (1 specie), Cycloramphyidae (2 species), Hylidae (15 species), Leiuperidae (6 species), Leptodactylidae (9 species), Microhylidae (2 species). Between those, 32 were observed in reproductive activity, been the most abundant: *Dendropsophus cruzi*, *Dendropsophus minutus*, *Hypsoboas albopunctatus* e *Physalemus cuvieri*, found on rain period, dry and in all fitophisionomies. The antropic areas shows more wealth and abundance for its temporaries and artificial lakes, where on the Ribeirão João Leite shore there is less number of species. In spite of the good represent of species, it’s clear beyond the results, the PEAMP ecosystem is very important for the anurophauna refuge.

Theme: anurans, conservation biology, ecology.

Type of Presentation: _Poster_ contributed

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Structure and variation of *Rana saharica* mating calls in Libya

Tarek Bashir Jdeidi

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The mating calls of *Rana saharica* in north eastern Libya (Wadi Alkuf) are made up of pulse groups which are separated by distinct intervals. The number of pulse groups can vary between 6 and 13 with 9-11 Pulse groups being most common. Most parameters of the call are influenced by ambient temperature, as the water temperature rises, the number of pulse groups per call and per unit of time increases, while the call duration, intervals between pulse group, and duration of the pulse groups decrease. The further comparison with the mating call of *Rana saharica* in north western Libya revealed pronounced differences. At water temperature of 20°C north eastern Libya population show lower number of pulse groups per call, where as the duration of pulse groups, the pulse group period, intervals between pulse groups, and call duration are distinctly longer than in the calls of the north eastern population, these differences in mating calls indicate that, the *Rana saharica* is not uniform throughout its ranges in Libya. It is proposed that *Rana saharica* in Libya be made as a separate subspecies.

Theme:Amphibians *Rana Saharica* Bioacoustics Taxonomy Libya

Type of Presentation: Oral

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The Lizard Fauna of a Restinga at Northeastern Brazil

Thiago Marques Pinto and Gabriel Omar Skuk Sugliano

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Species composition and aspects of spatial distribution and activity patterns were studied for the lizard fauna of a restinga area at the coast of the Brazilian state of Alagoas. The area is situated between the municipalities of Marechal Deodoro and Barra de São Miguel. (approximated coordinates: 9°46'10"S & 35° 52'25"W). Restingas are common habitats at coastal Brazil, characterized by sandy soils with herbaceous, arbustive or arboreous vegetation with a differentiated faunistic composition. The study area has 144 hectares situated in public land and is not a conservation unit, although some actions are being made in this direction. The southern part of the area has more sparse vegetation with exposed sandy soil, whereas the northern sector is mainly covered with a low forest. Research was developed between August, 2005 and February, 2006. To study the lizards there were utilized transects for visual search and a system of pitfall traps with fences. There were found seven species of lizards of which the teiid *Cnemidophorus ocellifer* was the more common followed by the tropidurid *Tropidurus hispidus*. At the southern part of the area, *C. ocellifer* was the more abundant species and the only captured in pit fall traps. Sparse observations of *T. hispidus* and *Ameiva ameiva* were made there. At the northern sector, seven species were recorded, included the three just mentioned. *Cnemidophorus ocellifer* was the more frequent lizard observed at the transects, but at the pit fall traps the most captured species was *T. hispidus*, followed by *A. ameiva* (mostly young individuals). It is suggested that this was due to the fact that transects at this area followed trails which accompany the forest border, whereas the pit falls were installed in more shadowed areas (to prevent lizards of dying from overheating). Then *T. hispidus* has a preference for more shadowed habitats than *C. ocellifer*. It was found a bimodal pattern of activity for the former species which was more frequent between 8-12 a.m. and between 14-17 p.m. The scincid *Mabuya macrorhyncha* was captured at the border and interior of the restinga forest and the gymnophthalmid *Micrablepharus maximiliani* at the pit fall traps at the border and in shadowed forest nearer to coastal dunes. The gekkonid *Coleodactylus meridionalis* and the gymnophthalmid *Dryadosauria nordestina* were captured exclusively in shadowed forest floor.

Theme:Lizards, Fauna, Restinga, Species Composition, Spatial Distribution and Activity Patterns.
Type of Presentation: Poster
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Clutch size can be used as an accurate estimate of the size of nesting *Podocnemis expansa* in Rio Trombetas, PA/Brasil.

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We captured 26 postnesting *Podocnemis expansa* in November 2007, in Reserva Biológica do Rio Trombetas, on Farias and Jacaré beaches. Our objective was to compare the carapace length and weight of the female to the number, length, width, and weight of the eggs to test whether these clutch characteristics would be useful in estimating the size of the nesting females from all of the nests on the beach. After a female had finished nesting she was taken to the reserve base and measured (carapace length, width and height, plastron length), weighed, marked and released. Each nest was marked immediately after the female was captured and opened the following day at 0700 h to count, measure, and weigh the eggs. After a regression analysis we found a significant relationship between the clutch mass and female length ($r^2 = 0,422$), mean egg mass and carapace length ($r^2 = 0,344$), and clutch mass and female mass ($r^2 = 0,259$). It was possible to correlate the nests with the higher number of eggs to the larger females. 92% of the females weighing more than 23 kg laid more than 80 eggs. Only two female weighing more than 23 kg did not lay more than 70 eggs. The smallest female weighed 20 kg, suggesting that this is the minimum size for reproduction in this population. 96 % of the females larger than 65cm carapace length laid more than 80 eggs. In summary it is possible to say that nests that have more than 80 eggs are most likely to have been laid by females larger than 23 kg and 65cm carapace length. It is necessary to capture a larger number of post nesting females from these and other nesting beaches to be able to test the feasibility of using such estimations of size of female in relation to clutch size before this measure can be used with confidence to monitor the demographic changes in size structure of nesting females in this population and monitor recruitment of newly mature females.

Theme:turtles, clutch size, *Podocnemis expansa*, postnesting size
Type of Presentation: poster
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Phylogenetics based on mtDNA and Nuclear DNA of the Dipsadinae: A Clade of Neotropical Colubrid Snakes

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Beckstead Jack Sites

Snakes of the Neotropical subfamily Dipsadinae are poorly known from both ecological and phylogenetic perspectives, despite unique feeding adaptations and bizarre diets. Some of these snakes have specialized diets on snails and slugs, and they have a unique dentition and jaw structure that permits them to extract gastropods from their shells (they are referred to as “goo eaters”). Other

snakes have enlarged rear fangs, are mildly venomous, and prey on frogs, frog eggs, and lizards. Previous studies found these rear fanged snakes (cat-eyed snakes, blunt-headed vine snakes, and nightsnakes) formed a monophyletic group referred to as the Leptodeirini. However, a more recent phylogenetic study based on mtDNA, found the Leptodeirini did not form a monophyletic group. Instead, a hypothesis was presented where the goo eaters are recovered as a derived group of dipsadines. A recent hypothesis suggests that the evolution of the goo eaters was linked to the exploitation of a new niche (eating invertebrates), which may have led to an adaptive radiation because of the large amount of food available and lack of competition. This hypothesis was based on the mtDNA locus, and in this study we selected six loci from the Squamate Tree of Life project to test the mtDNA relationships on the dipsadines, and to see how these “slow evolving” loci perform at the generic level. Preliminary parsimony analyses found three most parsimonious trees with slight differences. In the first tree the cateyed and blunt-headed snakes formed a clade sister to the nightsnakes. In the second two trees the cateyed and blunt-headed snakes clade was sister to the goo eaters. The consensus tree shows this as an unresolved polytomy. A preliminary maximum likelihood phylogeny placed the cateyed and blunt-headed snakes sister to the goo eaters, with low support. The nuclear data provide a low level of signal that is overwhelmed by the mtDNA when combined. The only conflict is among the placement of the nightsnakes or cat-eyed and blunt-headed snakes being sister to the goo eaters. The nuclear data do not support the monophyly of the traditional Leptodeirini. Therefore, these new data only re-arrange the relationships among the basal, rear-fanged members of the Dipsadinae, which still support the adaptive radiation hypothesis for the goo eaters.

Theme:systematics, snakes, Dipsadines, neotropical, molecular data

Type of Presentation: poster

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Intraspecific phylogeography of the subtropical lancehead *Bothrops alternatus*

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Several cycles of climatic changes in the end of Pliocene and throughout the Pleistocene affected the biota's distribution in the whole world. In this period the open formations of South America passed through several expansion and retraction processes, when the genealogical lineages of associated species were certainly shaped by these fluctuations. Using different phylogeographical approaches, we can increase the information about the evolutionary processes concerning species and biota formation. One of the poison snakes clearly associated with grasslands formations (Cerrado, Pampas and highland grasslands of Brazil) is *Bothrops alternatus*, a widely distributed lancehead from southern South America (Southern Brazil, Paraguay, Uruguay and Northeast of Argentina). We used mitochondrial DNA sequences from two different regions (partial cytochrome b and partial ND4 plus tRNA-His-Ser and partial Leu) comprising 1200 bp, aiming to investigate genetic diversity, geographic structure and past demographic fluctuations in this species. At the moment 88 samples for the partial cytochrome b gene covering almost the complete distribution of *B. alternatus*, were sequenced and analyzed. The observed genetic diversity was low (nucleotide diversity = 0,0053) and neutrality tests (Tajima's $D = -2.380$, $P < 0.01$; Fu's $F_s = -5.71362$, $P < 0.02$) were not significant. No significant genetic structure was observed through the haplotype networks (Median-Joining Network) or the phylogenetic analyses (Neighbor-joining and Maximum Likelihood trees). On the other hand, signals of population expansion was found in the star-like tree and in the demographic analyses using bayesian skyline plot, that showed a continuous population expansion for the species, occurring mainly during the last 200,000 years (middle to late Pleistocene). A similar population expansion at

almost the same period was identified for *Bothrops jararaca*, an atlantic forest dweller species. One likely scenario for *B. alternatus* evolutionary process is a population bottleneck before 460,000 years ago (the TMRCA for the species) followed by a population expansion (demographic and geographic) in the drier periods of the Pleistocene with a low diversification of genetic lineages. More data (more loci and samples) and simulation approaches will be used to test this and other scenarios.

Theme:Snakes, genetics, phylogeography, genetic diversity, demographic fluctuations

Type of Presentation: oral_contributed

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A molecular footprint of limb loss: Sequence variation of an autopodial identity gene

Tiana Kohlsdorf

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The homeobox gene *Hoxa-13* is involved in multiple functions, including body axis development and hand/foot formation in tetrapods. In this study we investigate whether the loss of one function (disappearance of limbs in snakes) left a molecular footprint in exon 1 of *Hoxa-13* that could be associated with the release of functional constraints caused by limb loss. Fragments of the *Hoxa-13* exon 1 were sequenced from 13 species and analyzed, with additional published sequences of the same region, using relative rates and likelihood-ratio tests. Five amino acid sites in exon 1 of *Hoxa-13* were detected as evolving under positive selection in the stem lineage of snakes. To further investigate whether there is an association between limb loss and sequence variation in *Hoxa-13*, we used the 'Random Forests' method, which approaches the problem as one of classification where w

Theme:limb loss, squamata, tetrapods, *hoxa-13*, developmental genes

Type of Presentation: oral, Symposium 4: Evolutionary Transitions of Body Shape in Extant Amphibians and Reptiles: Call for Integrative Approaches.

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Evolutionary Relationships Between Foot Morphology and Substrate Usage in Tropidurinae Lizards

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Evidence for evolutionary changes in lizard external morphology coupled with the colonization of novel microhabitats is abundant for body size and limb proportions, but is comparatively scarcer for foot morphology. Locomotion is clearly associated with foot morphology among lizards, as different surfaces likely impose distinct energetic and functional demands for performance, and morphological variation might be relevant during evolutionary processes of colonization of novel habitats. For example, running on sand involves low friction and force restitution coefficients, and larger feet might enhance performance in these habitats, whereas high clinging ability, given by longer nails,

may improve arboreal locomotion. Here we investigate morphological evolutionary changes and their relationships with habitat usage among 23 species of Tropicurinae. Foot morphometric traits (toe length, width and height, nail length, foot sole width and length) measured on adult males from the collection of the Museum of Zoology of the University of São Paulo (MZUSP) were added to data on limb and tail lengths from a previous study. Ecological indexes for the degree of substrate usage were calculated for each species based on published information. Significant phylogenetic signal was detected for some traits, so we performed both conventional and phylogenetic statistics. The scores obtained from a principal component analysis performed with the morphological data were correlated with the ecological indexes, and the same was done with independent contrasts (Nee and Constant branch lengths). The results (conventional versus phylogenetic) were considered under a likelihood approach. The conventional analysis indicated that hindlimb, foot sole length and tail were positively correlated with the use of trunks. Also, the use of sand was negatively correlated with forelimb length and positively correlated SVL, toe and nail lengths, which may increase foot area in contact with the substrate. The phylogenetic analyses confirmed the results for trunks, as components including linear measurements that exhibited phylogenetic signal (tibia, femur, humerus, radius, toe, nail and tail lengths) were positively correlated with ancestral reconstructions with trunks estimated as the node ancestral substrate. Although none of the components retained using independent contrasts correlated with ancestral reconstructions of sand, in the conventional analyses all the variables that correlated with sand presented higher likelihoods for models using a star phylogeny and did not exhibit phylogenetic signal. Therefore, adaptive changes in morphology, hypothesized to affect locomotor performance, might have played a role in evolutionary habitat shifts by Tropicurinae lizards, specifically associated with the use of sand and trunks.

Theme:reptiles, lizards, ecology, natural history, morphology

Type of Presentation: Poster contributed

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Aquatic predator influence on occurrence of aquatic and larval amphibians in East Texas ponds

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We sampled 51 ponds in the Davy Crockett and Angelina National Forests in East Texas. All ponds were sampled at least once in each of the following months: February, April, June, and October. Throughout the study we have captured 11 anuran and 5 salamander species. Dominant predators include large mouth bass, green sunfish, bluegill, crayfish, and several types of large insects. We have identified 3 main pond types: bass dominated, green sunfish dominated and invertebrate dominated. Amphibian richness differed among the pond types. Green sunfish dominated ponds had the least species and the fewest number of individuals, followed by bass dominated ponds, and invertebrate dominated ponds had the highest species richness. We also observed that some species were more commonly associated with fish ponds and another group of species were more commonly associated with invertebrate ponds. We found that patterns of amphibian co-occurrence were heavily influenced by the dominant predator.

Theme:amphibians, anurans, salamanders, community ecology, predator-prey

Type of Presentation: oral

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Defensive Behavior of Lizards: What It's Taught Us And Has Yet To Reveal.

Tracy Langkilde

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Lizards are exposed to selective pressure by a range of organisms that employ a variety of antagonistic strategies. As a result, this group displays a wonderful diversity of defensive behavior including elaborate displays of size and skill, death feigning, blood squirting, caudal sacrifice, and vocalizations. These strategies are designed to permit an individual to avoid antagonistic encounters, or to reduce the costs of these encounters when they occur. While not as well studied as some other aspects of saurian biology, defensive behavior of lizards has provided important insights into the evolution and significance of species interactions. These include: 1) what determines the nature of an individual's behavioral response, 2) how native species respond to novel antagonistic threats, 3) how behavioral flexibility effects evolutionary change, and 4) the costs and benefits of behavioral defensive strategies. Saurian systems promise to continue to enlighten the fields of behavioral and community evolutionary ecology. They are amenable to long-term robust field studies, making them ideal for addressing the evolution and community-level consequences of antagonistic species interactions. In this symposium talk, I will synthesize our current knowledge of defensive behavior of lizards, identify some important gaps in this field, and suggest some exciting directions for future research.

Theme:reptiles, lizards, ecology, community ecology, natural history, behavior, predator-prey

Type of Presentation: oral, Symposium 13: Sequestered Defensive Compounds and Other Defensive Tactics in Tetrapod Vertebrates

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A novel technique for monitoring highly cryptic lizard species in forests

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There are no effective or efficient methods for monitoring arboreal forest lizards, especially in areas of low lizard densities. This is problematic for their conservation and research. A novel technique has been developed using closed-cell foam covers on trees as artificial retreats. This was tested at three sites in New Zealand by comparing lizard occupancy rates with conventional methods (lizard houses, g-minnow traps, pifall traps, Onduline Artificial Retreats and spotlighting). At one site where Duvaucel's geckos (*Hoplodactylus duvaucelii*) were abundant, most methods detected their presence, but geckos were more abundant under covers and occupied a greater proportion of them (39 geckos per 100 checks) compared with conventional methods. Also, younger animals were better represented under covers and adult sex ratios were more even. This suggests improved population sampling. On a per unit effort basis, night spotlighting resulted in 0.6-1.6 geckos per hour, whilst covers returned 3.1 geckos per hour. At the other two sites where either Pacific geckos (*H. pacificus*) or Forest geckos (*H. granulatus*) were at very low densities, only covers were able to detect their presence. Lizard houses typically catch between 0-1 geckos per 100 checks, whereas at these sites, covers returned 4 geckos per 100 checks despite them being quite scarce. This is a significant improvement in detectability. Covers offer improved population sampling of arboreal forest lizards, and improved efficiency and lower costs compared to other conventional sampling techniques. Covers may also reduce some potential biases experienced using conventional sampling techniques, however further research is required as to whether covers are subject to other biases. This

demonstration of the potential of closed-cell foam covers is a first step towards establishing them as a more useful method for monitoring arboreal forest lizards.

Theme:arboreal; forest; lizard; gecko; sampling techniques; surveying; monitoring; covers; Duvaucel's gecko; *Hoplodactylus duvaucelii*; Pacific gecko; *Hoplodactylus pacificus*; forest gecko; *Hoplodactylus granulatus*; New Zealand

Type of Presentation: Oral

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The NZ Lizards Database: empowering people and organisations with knowledge for informed decision-making and management

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New Zealand has more than 94 species of lizard, of which only 48 are formally described; and more than half are threatened. Yet, lizards remain an under-appreciated and obscure fauna, with much of conservation efforts focused on New Zealand land birds, despite lizards being the only other major vertebrate group. Lizards are critical for ecosystem processes and function and occupy almost all ecosystems in New Zealand and they are unique in terms of endemism and evolutionary significance, but such attributes also put lizards at enhanced risk from introduced mammalian predators. The New Zealand Department of Conservation has funded the development over three years an national database of New Zealand lizards from 2007 to be hosted by Landcare Research's infosystem servers. There are two major components of this database: an interactive and searchable bibliography which allows the downloading of complete publications; and a series of extensive species files, maps and photographs describing each species and stating key conservation, management, research, ecological and taxonomical information. This database is intended for a wide range of stakeholders from private individuals such as landowners, conservation activists, tertiary students and academia; to organisations such as the Department of Conservation, Regional Authorities, Research Institutions, Iwi and conservation groups, such as biodiversity sanctuaries. Empowering people by improving access to knowledge for informed decision-making and management of at-risk populations of New Zealand lizards is the intended outcome. This database is expected to result in improved productivity, further research projects and allocation more funding from various sources and is expected to significantly improve the long-term conservation status of a forgotten fauna

Theme:reptiles, lizards, web, internet, database, information system

Type of Presentation: oral

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A review of herpetofaunal reintroductions, translocations and supplementation (RTS) projects in New Zealand

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New Zealand has up to 94 endemic species of lizard, in which over 50% are threatened and less than ten species appear secure. All four species of frog are threatened and the two species of tuatara now have a relictual distribution on offshore islands. As a result, there have been a number of

herpetofaunal reintroductions, translocations and supplementation (RTS) projects in New Zealand to secure populations and alleviate the threat status of these species. However these RTS events are poorly recorded or followed up and their results rarely published. We therefore present the only comprehensive data available on RTS projects and provide a review of these projects. A total of two tuatara, twenty lizard and three frog species have been involved in more than 50 RTS events overall. The vast majority of RTS events have occurred on offshore islands, however some current management plans are now considering mainland initiatives, such as "mainland island" ecological projects. Several other planned RTS projects are currently restricted to early proposal development stages. There is a lack of strategy or direction in RTS projects in New Zealand, a clear lack of follow-up monitoring of populations established in RTS events and therefore a lack of publication of RTS outcomes. Success cannot therefore be adjudged on an independent basis, nor lessons learnt. We develop some criteria for evaluating success in RTS projects in New Zealand, and make strong recommendations to (1) follow up RTS events with post-RTS monitoring, (2) publish results in some format, and (3) to develop both a national RTS strategy and (4) multi-species recovery plans with consideration for community-led ecological restoration projects, inclusive of all herpetofaunal species

Theme:herpetofauna, lizards, frogs, tuatara, re-introduction, translocation, supplementation, New Zealand

Type of Presentation: poster

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Are invasive amphibians spreading *Batrachochytrium dendrobatidis*?

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Batrachochytrium dendrobatidis (Bd) is recognized as a global contributor to amphibian declines and extinctions. Two competing, but not mutually exclusive hypotheses for the emergence of this disease are the Novel Pathogen Hypothesis (NPH) and the Endemic Pathogen Hypothesis (EPH). The NPH assumes that Bd was broadly introduced across a relatively limited timescale. Here we present arguments that the global trade in amphibians and concurrent release of nonnative and translocation of native species contributed to the global pattern of pathogen distribution. We present one case study that shows clearly that the introduction of amphibians to an island system was the source of Bd and subsequent disease emergence.

Theme:*Batrachochytrium dendrobatidis*, invasive amphibians, amphibian trade

Type of Presentation: Oral, Symposium 2: Invasive Reptiles and Amphibians: Global Perspectives and local solutions

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Is amphibian life history explicitly linked to the response to Bd exposure?

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Batrachochytrium dendrobatidis (Bd) is emerged at multiple locations in Europe and is now implicated in mass mortalities of more than 10% of Europe's amphibian species. At the index site of emergence, Peñalara Natural Park, 3 species suffer mass mortality associated with metamorphosis. Using field data and experiments, we examined the nature of the host pathogen dynamic for one of these species, the common toad *Bufo bufo* to determine how exposure to Bd at different life history stages affected the probability of infection and mortality. We found that the strength of the Bd dose, life history stage and condition all affect infection and mortality dynamics.

Theme: *Batrachochytrium dendrobatidis*, life history, exposure, infection

Type of Presentation: Oral, symposium 6: Disease and amphibian declines - where do we go from here?

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Chelonians and Crocodilians of Tocantins State, Brazil: Biodiversity and Conservancy

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The Tocantins State, located in Central Brazil, characterized by an ecotone region that contains within its limits ecosystems of biomes of the Amazon, Caatinga and Cerrado, building up a remarkable biodiversity. However, studies about the magnitude of biodiversity in Tocantins are scarce, and chelonians and crocodilians are example this. Thus, this unprecedented study, presents the diversity of species of chelonians and crocodilians of Tocantins and the implications for conservation of both. It was considered only primary records provided by the literature and scientific collections (MZUSP, MPEG, CHUNB and Herpetnet). The species of chelonians and crocodilians following list of reptile species the Brazilian Society of Herpetology (BSH). Among the 15 species of chelonians found in Amazon, eight were documented for Tocantins: *Kinosternon scorpioides*, *Chelonoidis carbonaria*, *Chelonoidis denticulata*, *Podocnemis expansa*, *Podocnemis unifilis*, *Chelus fimbriatus*, *Mesoclemmys gibba*, *Phrynops geoffroanus*. Meanwhile, specimens of *Rhinoclemmys punctularia* (MZUSP 3030, MPEG 54 and 67) and *Platemys platycephala* (MZUSP 2689, 2692) collected in Marabá, State of Pará, and the record of *Phrynopsis* (cf) *vanderhaegeri* to Palmas, capital of Tocantins, indicate the occurrence of at least 11 species of chelonians in Tocantins. For crocodilians, among the six Brazilian species, five of them were confirmed to Tocantins State: *Caiman crocodilus*, *Caiman latirostris*, *Melanosuchus niger*, *Paleosuchus palpebrosus* and *Paleosuchus trigonatus*. Although the record of *P. trigonatus* was visual (literature) in Tocantins River, northern of Tocantins State, specimens collected in Marabá-PA (MPEG 21 e22) and Gurupi river (MZUSP 2188), boundary between Pará and Maranhão States, support the occurrence of this specie in the confluence of Araguaia and Tocantins rivers. It is noteworthy that *C. latirostris* record

is represented by only one specime of Bananal Island (MZUSP 2136), confirming the southwest Tocantins as the northern limit of distribution of this species. Despite the expressive chelonians and crocodilians diversity provided this compilation study, the registers was provided for only 25 and 35 municipalities respectively, of 139 emancipated in Tocantins. Therefore, there is a large gap of knowledge about biodiversity, and consequently an emergency need for studies of inventory and collection of both groups in Tocantins, where investment in agrobusiness and construction of hydroelectric power plants are political priorities of state and federal governments and large threats of irreversible dimensions, for conservation and biogeographical knowledge of both groups in Tocantins and Brazil. Financial Support: UFT, DAAD, NGC.

Theme:turtles, crocodilians, conservation biology

Type of Presentation: Poster

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New dinosaurs from Niger, West Africa

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In 2007 and 2008, excavations in northern Niger revealed a new dinosaur site of lower Cretaceous age. We found 2 specimens of a sauropod which represents a new genus. Moreover in the same area, well preserved dinosaur tracks were found. These tracks are interpreted to stem from a deinonychid theropod ("raptor") and from a sauropod which might be identical with the new species mentioned before. Although no bones or teeth of deinonychids were found, the tracks represent the first record of raptors from Africa South of the Sahara.

Theme:Paleontology, Dinosaurs, Cretaceous, Niger

Type of Presentation: oral: contributed

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Historical Biogeography Of South And Southeast Asia: Insights From Squamate Model Systems

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Shaped by some of the most dramatic tectonic events of the Cenozoic, the parts of southern and eastern Asia that have become known as the Oriental faunal region comprise vast areas of great geological and ecological complexity. South and Southeast Asia are home to a massively diverse herpetofauna with heterogeneous biogeographical affinities. For large parts of the region, relatively little or vague geological or tectonic information is available. However, Pleistocene climatic and sea level oscillations especially in insular Southeast Asia are well documented. These have long been regarded as the predominant processes in shaping the contemporary biodiversity of the region, by influencing island and highland habitat connectivity. To address spatially and temporally congruent patterns of divergence, and particular deviations from these patterns, I use inferences of phylogenetic relationships and divergence times for squamate lineages that are broadly co-distributed across South

and Southeast Asia but have contrasting geographical origins and dispersal abilities. The available data reveal both deep genetic divergences, and complex shallow phylogeographic structure due to alternating dispersal and vicariance events. Correspondence across lineages for temporally and geographically coincident divergences in the Miocene and Pliocene suggests that several major climatic and geological events, in addition to the late Pliocene–Pleistocene glacial cycles, had broad impacts on lineage diversification and species divergence in South and Southeast Asia.

Theme: Reptiles, snakes, lizards, biogeography, phylogeny, Asia

Type of Presentation: Oral, Symposium 9: Biogeography of the South and South East Asian Herpetofauna.

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San Lucan Chorus Frog: Ecology and threats in oases of Baja California, México.

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All of the information on ecology, natural history and interactions with exotic species in this species is available under an earlier name (*Hyla regilla*) and little is known for populations of Mexico. San Lucan Chorus Frog (*Pseudacris hypochondriaca*) in the Baja California Peninsula may be particularly prone to extinction caused by human activities and exotic species due to their habitat specificity, small size and fragmented distribution of their populations. We investigated the ecological dynamics and some specific threats that face five isolated populations of San Lucan Chorus Frog in oases of the Baja California Peninsula, México. We evaluated temporal and spatial patterns of abundance, microhabitat use, demographic parameters, and how these patterns are affected by human activities (water management, cut of vegetation, cattle), and presence of exotic species (Bullfrog, Guppy, Tilapia, Crayfish and Cats). We conducted monthly sampling (3 consecutive nights per month/oasis) from August 2006 to date using a mark-recapture method. Preliminary results show that San Lucan Chorus Frogs are active and breeds in winter, from November to April. Breeding activities were recorded in all oases, however we record juveniles in only one oasis. In oases with exotic species the abundance of San Lucan Chorus Frogs was considerably lower than in oases without exotic species. Further, in oases with exotic species, San Lucan Chorus Frogs were excluded from the principal water body (>2m shoreline). We conclude that introduction of exotic species and specific human activities are synergic and play specific roles on the ecological dynamics of the San Lucan Chorus Frogs. We detect that almost all human activities are deleterious for native populations of San Lucan Chorus Frogs, however certain activities can benefit it and can be used as conservation strategies for this specie in the Baja California Peninsula oases.

Theme: amphibians, anurans, ecology, conservation biology

Type of Presentation: Poster

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Distribution and modern status of *Hierophis caspius* in southeast of European Russia

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Our 1998–2007 field surveys in the southeast of European Russia (the Astrakhan, Volgograd, and Saratov regions, Republics Kalmykia) have allowed much data to be collected for objective analysis of the modern distribution of *Hierophis caspius* (Gmelin, 1779) within the territory under survey. The northern boundary of the *Hierophis caspius* habitat was found to go much souther than it had been thought earlier. The existing indications of *Hierophis caspius* penetration north up to southern districts of the Saratov region are not confirmed today by collection of specimens and observations. There the northern boundary of the *Hierophis caspius* habitat should be drawn along the Don river north to the B. Golubaya river mouth (48°58' N), then southeast to the Volga river (somewhat norther of Volgograd City), and northeast through the south of the Volgograd Trans-Volga region to the Khara river mouth (49°14' N, somewhat norther Elton Lake). Its habitation is due to various types of biotops, mainly with a complex microrelief (gullies, ravines, hill slopes, riversides, neglected sand-pits etc.) and to bush thickets. Usually they are met at small distances from water (a river, lake, channel etc.). Most preferred habitats of *Hierophis caspius* are abrupt riversides and abrupt ravine slopes with numerous bird (*Riparia riparia*, *Merops apiaster*, *Coracias garrulus*) holes. *Hierophis caspius* is often met within settlements. In the region, *Hierophis caspius*, as a rule, is met sporadically, as single individuals. The maximum abundance indices (2–3 ind/route km) are characteristic of ravine and gully slopes among bush thickets in the northern Yergenine Highland. Similar abundance indices (up to 2 ind/1 route km) are characteristic of fixed sand edges in the northeast Astrakhan region. A lower abundance of sledge runner (up to 2 ind/3 route km) was noted at the Khara river mouth in the Volgograd Trans-Volga region. Thus, the above data speaks for *Hierophis caspius* being represented now by stable populations within a vast territory of the southeast European Russia, but its habitat is of mosaic character there. In view of separation of the peripheral settlements of *Hierophis caspius* in the region, we would recommend its inclusion into the regional Red books as a rare taxon with a stable abundance. Especially protected natural territories should be established in the places of its concentration.

Theme: reptiles, snakes, ecology, conservation biology

Type of Presentation: Poster, symposium 8: Herpetological Conservation & Biology

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Slow Worm (*Anguis fragilis*) as a Species Complex

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Anguis fragilis is a lizard species widely distributed throughout Europe and Western Asia. Traditionally, two Slow Worm forms (western “*fragilis*” and eastern “*colchica*”) regarded by some authors as different subspecies have been recognized within this area. A long contact zone between these forms has been suggested to occur in north-southern direction from the Baltic Sea coast through Central Europe (along the border between the Czech and Slovak Republics) to the north-western Balkans. Nevertheless, a question of the true taxonomic status of both forms aroused discussion to the present. With the aim to elucidate the taxonomic position of the *A. fragilis* population within the Czech and Slovak Republics we focused on the situation in the sense of the species phylogeography. We sampled several populations in both countries and compared them using mitochondrial DNA with distant populations from the Balkans, Great Britain and Western Asia. The obtained phylogeny

exhibits a basal dichotomy, which separates a “western” clade comprising most of the Czech samples, south-western Slovakian samples and the British sample from an “eastern” clade consisting of western Asiatic populations (Georgia, Iran, Turkey) and the Balkan populations forming a distinctive evolutionary sub-lineage. Surprisingly, the Carpathian populations (including the Slow Worms from north-eastern part of the Czech Republic) are phylogenetically closer to the Western Asiatic populations than to the populations from the Bohemian Massive and fall into the “eastern” clade. See the figure showing maximum likelihood tree based on mtDNA data (numbers suggest bootstrap support values based on NJ/MP/ML analyses with 1000 replicates). The genetic distance between the “western” and “eastern” clade of *A. fragilis* s.l. suggests a clear interspecific differentiation (7.7% between W and E; 12.9% between *Anguis* and *Pseudopus*). Therefore, it is evident that the taxonomy of the Slow Worm needs to be changed. Although, more populations have to be included into the study to resolve the complex taxonomy and nomenclature, we can preliminarily conclude that *A. fragilis* s.l. represents a species complex consisting of at least two different species: (1) *A. fragilis* s.s. occurring in the Western and Central Europe, and (2) *A. colchica* (priority of other available names needs examination) distributed across the Carpathian area as far as Western Asia. Taxonomic status of the Balkan populations remains, however, unclear. (Supported by DE06P04OMG008, MK00002327201, LC06073, IRP IAPG AV0Z 50450515, VEGA 1/4332/07.)

Theme:Reptiles, *Anguis fragilis*, genetics, taxonomy

Type of Presentation: poster contributed

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The Reproductive Cycle of the American Alligator: Physiology and Endocrinology

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Most crocodilians live in the tropics, but the American alligator is found as far north as latitude 35°, and in winter is sometimes subjected to temperatures below zero. Thus, the reproductive cycle of the American alligator is strongly affected by seasonal changes in temperature. During winter (October to March) when the temperature falls below 15 °C alligators stop eating (and growing) until ambient and water temperatures rise in spring. In late March and early April alligators commence breeding behavior. Both males and females bellow and a long complex breeding activity continues until the female ovulates in late May. Males reach sexual maturity at a total length of 1.8 m, but males of 3 and 4 m appear to dominate the breeding group. Testes of the male increase in size and mass with the onset of spermatogenesis. The right testis is situated more anterior to the left and is about 20 - 25% heavier. Plasma testosterone also increases from less than 1 ng/ml to as high as 100 ng/ml. Larger males have larger testes and higher testosterone levels than smaller males, though both produce spermatozoa. Following the breeding phase, the testes decrease in mass; plasma testosterone falls to pre-breeding levels and remains low until the following spring. The female cycle mirrors that of the male. Vitellogenesis and ovarian follicular growth commence in late March, plasma estradiol increases from less than 5 pg/ml to over 600 pg/ml. Plasma testosterone also shows an increase in females with developing follicles but rarely reaches more than 2 ng/ml. All of the indices of vitellogenesis, plasma calcium, zinc, iron, protein, lipids and vitamin E are elevated during this phase. Following ovulation there is a period of about 2 - 3 weeks during which the albumin and shell are deposited. Structural bone is mobilized for egg-shell formation. During this period the female moves to isolated shallow water areas and constructs a mound nest of vegetation. A clutch of about 40 eggs is deposited in a single night usually during the first two weeks in June. Incubation lasts from 65-80 days, during which time the female remains close to the nest. At hatch the female responds to the vocalization of the neonates and opens the nest. The young remain with the mother for one year, sometimes two.

Theme: crocodilian, alligator, reproduction, hormones

Type of Presentation: Oral, Symposium 7: The biology and management of crocodilians.

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Body temperature of coastal *Cnemidophorus* in Brazil: is there inter-habitat variation in thermal ecology among species or populations?

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We analyzed the body temperature of 16 coastal populations, belonging to five species of the genus *Cnemidophorus* from 15 different restinga habitats along the eastern coast of Brazil in order to evaluate how some environmental factors affect the lizards' body temperatures. Lizards were collected when active using a rubber band. Cloacal body temperature (T_b) were taken immediately after capture with a quick-reading thermometer. Substrate (T_s) and air temperature (T_a) (approximately 1cm above the substrate) were taken as close as possible to the point at which each lizard was first sighted. Lizards were euthanized with ether and immediately fixed in 10% formalin. Mean body temperatures among groups were compared using one-way Anova. The influence of environmental temperatures (T_s and T_a) on T_b was tested by multiple regression analysis. Mean body temperature in activity of different coastal species and populations of *Cnemidophorus* varied from $34.8 \pm 2.6^\circ\text{C}$ (*Cnemidophorus ocellifer* - Praia do Porto, SE) to $39.3 \pm 2.0^\circ\text{C}$ (*Cnemidophorus natio* - Guaratiba, BA). The lowest environmental temperatures were recorded in Praia do Porto, SE ($T_a = 29.7 \pm 1.6$, $T_s = 32.1 \pm 2.7^\circ\text{C}$) and the highest in Comboios, ES ($T_a = 34.8 \pm 2.9^\circ\text{C}$; $T_s = 42.6 \pm 6.5^\circ\text{C}$). There was a significant relationship between mean T_b of each population and the corresponding mean T_a and T_s (T_a : $F_{1,14}=10,755$; $P<0,05$; $r^2=0,434$; T_s : $F_{1,14}=6,795$; $P<0,05$; $r^2=0,327$);

multiple regression analyses demonstrated that neither Ta nor Ts explained an additional part of lizard Tb ($F_{2,13} = 5,006$; $P < 0,05$; $r^2 = 0,435$; $P_a = 0,138$; $P_s = 0,908$). In general, the five species of *Cnemidophorus* did not differ significantly in their mean body temperatures, except for *C. lacertoides* and *C. ocellifer* which had a significantly lower Tb than *C. littoralis* and *C. natio* (Ancova, $F_{4,582} = 13,180$; $P < 0,001$; $r^2 = 0,412$; $P_a < 0,001$; $P_s = 0,05$). On the other hand, environmental temperatures (air and substrate) differed significantly among studied areas (Anova, Ta: $F_{14,551} = 13,415$; $P < 0,001$; $r^2 = 0,254$; Ts: $F_{14,518} = 13,363$; $P < 0,001$; $r^2 = 0,265$). We concluded that the different species/populations of coastal *Cnemidophorus* in Brazil tend to have similar mean Tbs in activity, and that the apparent differences among them may result from the influence of environmental temperatures at each area. The Tb of other cnemidophorine species of South and North America are similar to those of the five *Cnemidophorus* species studied in restinga's areas. Thus, independent of geographic variation and/or of whether species are bisexual or unisexual, the high Tb in activity seems to be a conservative evolutionary trait for the genus.

Theme: Lizards, Ecology, Thermoregulation, *Cnemidophorus*

Type of Presentation: Poster

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Phylogenetic Relationships Among the Atlantic Forest Frogs Genera *Cycloramphus* and *Zachaenus* (Cycloramphidae).

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The genera *Cycloramphus* and *Zachaenus* represent a monophyletic assemblage of frogs restricted to the Atlantic Rainforest, with highest diversity associated to the mountain complex of the South and Southeastern Brazil (Figure 1). These species can be split in two groups according to their reproductive and habitat traits, although their monophyly have not been consistently tested: the first includes terrestrial species, with nidicolous tadpoles that develop in terrestrial environment; the other, fast flowing stream associated species, with exotrophic tadpoles that develop in semi-terrestrial conditions. In this study, we performed a phylogenetic analysis using 118 characters based on external morphology, miology, and osteology, and 23 terminals. Four equally lengthy trees were recovered and in all *Zachaenus* is deeply nested among *Cycloramphus*. These results strongly suggest that *Cycloramphus* and *Zachaenus* are synonyms. According to our results, terrestrial reproduction arose once in the group from a stream dweller ancestor. The pattern of geographic distribution of the species are indicative of a possible route in wetter periods in the past interconnecting disjunct populations of Southeast and Northeast Brazil throughout the rainforests once covering the Espinhaço mountain range.

Theme: Amphibians, anurans, reproduction, taxonomy, morphology

Type of Presentation: Poster

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Why Would Females of a Neotropical Rattlesnake Show Long Term Sperm Storage (LTSS) ?

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Many authors have investigated sperm storage in snakes from temperate regions, but few studies concerning neotropical snakes have been made. Snakes from temperate regions, usually present sperm storage on the oviducts during the winter. This strategy is named Long Term Sperm Storage (LTSS) and it's an obligatory component of asynchronous reproductive cycles in many species of temperate pitvipers. Some authors suggest that LTSS should not be a component of neotropical snakes reproductive cycles because these cycles are expected to be continuous all over the year, as a result of the climatic conditions (hot areas), the high availability and the abundance of preys. Despite this, seasonal reproductive cycles, including obligatory LTSS were described for some Brazilian pitvipers from genus *Crotalus* and *Bothrops*. *Crotalus durissus* is a widely distributed specie, occurring from North to South America. LTSS has already been described for *Crotalus durissus terrificus*, subspecies that occurs in Southern of Brazil. The aim of this study was to investigate the females' *C.d. cascavella* reproductive cycle to find out if there are any differences between this subspecies and *Crotalus d. terrificus* reproductive cycle due to the influence of the climate in the caatinga. *Crotalus durissus cascavella* is a neotropical rattlesnake subspecies that occurs in Northeast of Brazil. Climate conditions in caatinga and open areas, where this snake lives, are dry and hot almost all over the year. A sample of 53 *Crotalus d. cascavella* female adults from the Northeast of Brazil, deposited at "Coleção Herpetológica Alphonse Hoge" at Instituto Butantan were dissected and their genital tracts were examined. Nine females showed vitellogenic follicles in the ovary. Five showed Uterine Muscular Twisting (UMT). The snakes that presented vitellogenic follicles and UMT at the same time were collected during winter (July and September n=3) and spring (October n=2). A subsample of 3 snakes had their uteri removed for histological analysis. Spermatozoa were found in the UMT of two snakes, collected in July and September. Our data showed that despite the fact that this subspecies lives in hot and dry areas, *Crotalus durissus cascavella* carries out winter LTSS by means of a UMT. The presence of LTSS in *Crotalus* from both temperate and tropical regions seems to corroborate the hypothesis that phylogeny has an important role on the pattern of the reproductive cycle of females from the genus *Crotalus*.

Theme:snakes, reproductive biology

Type of Presentation: poster

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Are Secondary Forests a Paradise for Reptiles in Tropical Mexico?

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A controversial hypothesis has been recently formulated that secondary forests can act as reservoirs of primary forest biodiversity in the tropics. We test this hypothesis by using reptiles as case studies in Quintana Roo, south of Mexico. To quantify reptile species richness and abundance, we sampled induced grasslands and re-growth and mature rainforests by means of 36 transects in each vegetation type from January to September 2004 (4 transects monthly). A total of 756 individuals belonging to 35 species (15 lizards, 18 snakes and 2 tortoises) were recorded. Reptile abundance and snake species richness was highest in mature forests. Assemblage structure of all reptiles and all lizards could be differentiated among the three vegetation types but snake assemblages did not differ between secondary forests and induced grasslands. Microhabitat availability had a very important role on species composition through the vegetation gradient. This study shows that reptiles depend to a large extent on the habitat quality of primary rainforests, and that secondary forests lack the habitat

complexity many specialist taxa may rely upon. Therefore, herpetofauna assemblages can be used as indicators of regional diversity trends in the tropics.

Theme: reptiles, snakes, lizards, ecology, community ecology, conservation biology

Type of Presentation: Poster

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Modelling potential distribution of the axolotl within the Xochimilco freshwater system, Mexico

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The axolotl (*Ambystoma mexicanum*) is one of the most threatened amphibians in Latin America. From 1998 to 2006 the population in the Xochimilco freshwater system (one of the last two remaining habitats for the species) declined from six to one axolotls per sq km. This notable decline has led the species to be classified as 'Critically Endangered' in the Global Amphibian Assessment. The Xochimilco freshwater system is a complex system consisting of more than 60 interconnected man-made channels, lagoons and wetlands. This system has suffered considerable hydraulic and water quality changes since pre-hispanic times. The expansive urbanization of Mexico City and the increased demand for water resources, have reduced the habitat quality of the system. Originally fed by natural springs and rainwater, sewage outflows currently make a substantial contribution to maintaining water levels. Potential distribution models such as the Genetic Algorithm for Rule Set Predictions (GARP) and Maxent can help to understand in which places the axolotl is able to survive within its deteriorating habitat. This modelling approach was used to determine: (1) the distribution of axolotls within the system, and (2) environmental correlates of this distribution pattern. We sampled eleven physicochemical variables and axolotls in 29 canals and eight lagoons. We used interpolation techniques based on the Inverse Distance Weighted method to create environmental layers to be used in the distribution models. Because of the low population density of axolotls, only five presence points were found. GARP results show a patchy predicted distribution consisting of small areas separated by at least 3 km from each other. These predictions were corroborated in the field, and only one specimen was found within one of the seven predicted sites. Maxent models were used to make predictions across larger continuous areas, and explanatory variables gave higher response rates to concentrations of nitrates and ammonia. Both models identified a particular group of channels where axolotls are likely to be absent. Results from these models can be used to establish protection measures and set the basis to promote restoration actions for the axolotl and its habitat.

Theme: Salamanders, ecology, conservation biology, endangered species.

Type of Presentation: oral

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Ultrasonic Signaling by a Bornean Frog

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Among anuran amphibians, only two species, *Odorrana tormota* and *Huia cavitympanum*, are known to possess recessed tympanic membranes. *Odorrana tormota* is the first non-mammalian vertebrate demonstrated to communicate with ultrasonic frequencies (i.e., >20 kHz), and the frogs' sunken tympana are hypothesized to play a key role in their high-frequency hearing sensitivity. Here we present the first data on the vocalizations and communication behavior of *H. cavitympanum*. We found that this species emits extraordinarily high-frequency calls, a portion of which are comprised entirely of ultrasound. This represents the first documentation of non-mammalian vertebrate producing purely ultrasonic signals. In addition, the vocal repertoire of *H. cavitympanum* is highly variable in frequency modulation pattern and spectral composition. The frogs' use of vocal signals with a wide range of dominant frequencies may be a strategy to maximize acoustic energy transmission to both nearby and distant receivers. The convergence of the call characteristics of *O. tormota* and *H. cavitympanum* should stimulate additional, phylogenetically-based studies of other lower vertebrates to provide new insight into the mechanistic and evolutionary foundations of high-frequency hearing in all vertebrate forms.

Theme: amphibians, anurans, behaviour

Type of Presentation: oral, Symposium 3: Sensory Ecology of Anuran Communication

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Temperature-Dependent Sex Determination And Global Change: Are Some Species At Greater Risk ?

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The response of embryos sexual differentiation to temperature in species with Temperature-dependent Sex Determination (TSD) is traditionally characterized by two parameters: the pivotal temperature (P), defined as the theoretical constant temperature of sex ratio parity (1:1), and the transitional range temperature (TRT), defined as the range of constant temperatures that yield both sexes. Inter-specific and even inter-population variations of these parameters with latitude have been proposed. Moreover, the sex ratio of individuals has been shown to have heritable components. Most authors consider P alone as the best predictor of offspring sex and of the response of natural populations to temperature variations. We here show that the proportion of nests producing both sexes (mixed nests) is positively correlated to the TRT in several TSD turtle species. These results were obtained using two complementary methods: (i) a statistical model based on published studies of natural populations and (ii) simulations with a new thermal model of TSD considering a mechanistic approach. We then conclude that the value of TRT is of primary importance in predicting the consequences of global warming on TSD species. We predict that species with larger TRT could be more likely to withstand global warming.

Theme: reptiles, turtles, ecology, reproduction, genetics, conservation biology

Type of Presentation: Oral, Symposium 1: Reproduction in reptiles: from genes to ecology
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Are there still Frogs out There? Effects of Land Use Change and the Example from Malawi (Africa)

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Land use change with loss of natural habitats is one of the main causes of biodiversity erosion together with global warming and emergent diseases. Very little is known about the decline of amphibians in Africa, mainly due to the fact that quantitative data are largely missing, and taxonomy is still in a pioneering phase. For the Malawian herpetofauna taxonomic works and recent distribution data are scanty and outdated as referred mainly to works done in the Sixties and Seventies of the 20th century. In the last decades the drastic alteration of landscape (Fig. 1) through human encroachment has radically changed the patterns of amphibian communities. Is our knowledge reflecting the actual situation of anuran's communities? The aim of this study was to evaluate the diversity of amphibians in selected areas and to analyse the effects of land use change. Field works were carried out in the years 2006-2008. Species richness and species compositions were investigated by means of systematic sampling surveys. Cluster sampling with samples of 30x30 m were conducted in purposefully selected areas. The structure of seven amphibian communities was quantitatively investigated. Comparative methods (e.g., diversity and similarity indices) and graphic representations were used to test differences in the observed diversity between samples. Of about 80 amphibian species listed for Malawi more than 40 species were recorded. For those species new data about distribution, ecology and natural history were generated. The comparative analysis of the seven communities showed a range of alpha diversities apparently not necessarily correlated with land use change and human disturbance (Fig.2). Preliminary considerations on the possible influences of different surroundings on amphibian communities are provided. In particular, the importance of vegetation cover and the availability of temporary water bodies will be discussed in the frame of a sustainable management of cultivated areas. In Malawi, like in many other African countries, urbanisation, population growth and the consequent need for arable land rapidly increase, producing quick modifying scenarios. Understanding the possible effects of these modifications on the local fauna is of great importance for conservation and land management purposes. Future longterm and more comprehensive studies of African amphibian communities are needed to obtain a better understanding of their ecological needs and to avoid the extinction of some of these natural jewels.

Theme: amphibians, anurans, ecology, community ecology, natural history, conservation biology

Type of Presentation: Oral, Symposium 8: Herpetological Conservation & Biology

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Herpetofauna of a terra firme forest fragment in urban area, Manaus, Amazonas, Brazil.

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Brazil is in the top positions in terms of richness of species of reptiles and amphibians, and yet, the world leader in diversity of amphibians. However, the richness of species now known is underestimated, because new species are often described, and there are still many areas not sampled, which certainly host species yet unknown to science. The herpetofauna of Brazilian Amazon is represented by some 160 species of amphibians, 104 species of lizards and anfisbenians, 180 species of snakes, 16 turtles and four alligators. However, the Amazonian species are little known in about species distribution, and possibly this is due to the small number of researchers specialized in these groups, the magnitude of the biome areas and the difficulties of access to many areas that potentially harbor great wealth of species. For some groups, such as snakes and anfisbenians, for example, the difficulty of sampling should be an aggravating factor, that the production by the scientific institutions. This study aimed to estimate the richness of species of amphibians and reptiles of a terra firme forest fragment about 400 ha, located in an urban area in Manaus, Amazonas, Brazil. We conducted the field collections between the 9th and 23 October 2007, using pitfall traps (two sets with four buckets of 60 l each prepared as a "Y" and a line with 10 buckets of 60 l, visual and acoustic surveys. We recorded 183 individuals, belonging to 50 species, being 20 of lizards (17 genera, seven families), 18 amphibians (10 genera, six families), nine snakes (nine genera, four families), one turtle and two alligators (two genres, one family). These results demonstrate the importance of fragments in urban areas as refuges for wildlife, and call for attention by the importance of environmental diagnoses in deforestation situations due to the advancement of urban border on natural ecosystems.

Theme:herpetofauna, Amazonia, fragments

Type of Presentation: poster

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The first record of *Hypsiboas nympha* (Anura: Hylidae) for Brazil.

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On December 13, 2006 we found a specimen of *Hypsiboas nympha* (INPA-H 18303, SVL 34.7 mm; body mass in life 1.9 g) at the municipality of Coari (04° 23' 02" N; 64° 44' 13" W. 73 m elevation), Amazonas, Brazil. The frog was collected in Terra Firme Forest by R. de Fraga and V. T. de Carvalho and verified by J. Faivovich. *H. nympha* is distributed in the western Amazon Basin, species is know from the northern and southern regions of eastern lowland Ecuador and from northeastern Peru at elevations below 600 m, and from lowlands of Colombia around Leticia. The northernmost locality of *H. nympha* is “Singue,” province of Sucumbíos, Ecuador, whereas the southernmost record is Leticia, Colombia (Faivovich et al. 2006. *Herpetologica* 62: 96-108). This record represents the easternmost limit known for this species (figure 1). This specimen represents the first Brazilian record extending the known distribution 1420 km E from the type locality in Ecuador: Provincia de Sucumbíos: Reserva de Producción Faunística Cuyabeno, (00° 05' 02" S; 76° 12' 54" W, 290 m), ca. 3.3 km E of the Lago Agrio-Tarapoa-Puerto El Carmen Road (Faivovich et al. op. cit.). Our new locality in Brazil is 630 km East of the nearest record in Leticia, Colombia (Faivovich et al. op. cit.).

Theme:amphibians - distribution - *Hypsiboas nympha*

Type of Presentation: poster

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Preliminary growth study of *Phrynops rufipes* in the isolated Reserva Florestal Adolpho Ducke, in Manaus, Amazonas, Brazil.

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Phrynops rufipes is a medium sized freshwater turtle that is restricted to closed-canopy rainforest streams. Published information about the growth of this specie is limited. Their home range is rather small, ranging only from 1–2 km along a stream (0.4–0.8 ha). It appears to be a trophic specialist, feeding mostly on palm fruits throughout its range. Our objective is to obtain a growth curve model for this specie utilizing the Fabens method. The individuals were collected in four small streams, and their small tributaries in the Reserva Florestal Adolpho Ducke, Amazonas, Brazil (02°58'S, 59°56'W). Our recaptures were performing during 2007 and 2008 respectively using baited fyke nets and funnel traps. From 1984 to 2008, 83 capture-recapture events were recorded including 53 females: (CL=135-242 mm), 30 males (CL 123-225 mm) and one juvenile. The marked turtles (recaptures) were measured and visually sexed. For size measurements we recorded the maximum straight-line length of the carapace (CL). We used the Fabens method in FiSAT II program for obtain the Von Bertalanffy growth model for males and females separately. We establish a maximum carapace length in order to construct the growth curve (225mm for males and 242mm for females). One immature, measuring 84 mm CL, was captured in may of 2008. We assumed this animal hatched on 1 July 2007 (mean period estimated for hatching of *P. rufipes* in Reserva Florestal Adolpho Ducke Reserve) and measured 54.7 mm CL (mean size of *P. rufipes* hatchlings). Growth constant estimated from the Von Bertalanffy model was 1.7% higher for females ($k=0.170$) than males ($k=0.167$), whereas the parameter b was 0.77 for females and 0.75 for males.

Theme:reptiles, turtles, growth, recaptures

Type of Presentation: Poster

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Systematic Resolution of the *Leptodactylus bolivianus* complex (Amphibia: Anura: Leptodactylidae) Results in a Distributional Enigma.

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The *Leptodactylus bolivianus* complex is distributed from the Caribbean islands of Providencia and San Andrés off the coast of Nicaragua and mainland Costa Rica to Bolivia on the east side of the Andes in South America. Previous authors argued that this complex contains one or two species. Until this study, there has been no systematic evaluation of the *L. bolivianus* complex throughout its geographic range. Analysis of external morphological features, advertisement calls, and molecular

data result in characterization of three clades with distinct distributions – Clade A occurs on Providencia and San Andrés, and on mainland Costa Rica to Venezuela in the Caribbean drainage portions of Colombia and Venezuela; Clade B occurs in Amazonian drainages of Venezuela, Roraima (Brasil), and Guyana, Suriname, and French Guiana; Clade C occurs in Amazonian Brasil, Colombia, Peru, and Bolivia. Larval morphology and advertisement calls support species level differentiation for Clades A and C. There are no larval and advertisement call data available for Clade B. The morphological data cannot resolve whether Clades B and C represent distinct species. Preliminary analyses of molecular data are most consistent with species level differentiation between clades B and C, resulting in recognition of three species in this complex. The results of this study identify a zoogeographic enigma: Why is it that neither Clade B nor Clade C occurs in the Brazilian State of Pará?

Theme:Frogs, *Leptodactylus bolivianus* complex, systematics, zoogeography

Type of Presentation: Oral, contributed

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***Allobates femoralis* (Dendrobatidae): A handy**

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Fixed site attachment and a long calling period within an environment of little temperature change render the males of the diurnal Pan-Amazonian frog *Allobates femoralis* a rewarding species for field studies on both calling and hearing in anurans. The terrestrial calling positions are spaced at several meters, thus allowing one to move within the territories without disturbing the resident males. Vocally active males react with stereotypic phonotactic responses to the playback of conspecific and a large variety of synthetic calls. Thus, the highly repeatable positive phonotaxis make *A. femoralis* "handy" in obtaining reliable and repeatable data from an animal behaving in its natural habitat. To test for interference effects of co-occurring species on the male-male communication system of *A. femoralis*, we compared the calls and the phonotactic reaction of territorial males at eight Amazonian sites: four where *A. femoralis* occurs together with *Epipedobates trivittatus* and four where *E. trivittatus* is absent. The occurrence of *E. trivittatus* gave rise to significantly narrower and more asymmetric frequency-response curves in *A. femoralis*, without concomitant differences in the call or in body size. To investigate the relative contributions of different evolutionary mechanisms to geographic differentiation of these populations, we compared calls, colouration, body shape, and the cyt-b gene. As expected, the studied traits did not evolve as a unit. Contrary to our expectations and in contrast to current models of speciation in the Amazon basin, most geographic variation in calls and cyt-b was attributable to geographic distance between populations. In addition, a short history of the development of the international *A. femoralis* study group is given.

Theme:amphibians, anurans,behaviour,reproduction

Type of Presentation: Oral, Symposium 11: Dendrobatoid Frog Biology.

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Effects of incubation temperature on embryonic development rate, sex ratio and post-hatching

growth in the Chinese three-keeled pond turtle, *Chinemys reevesii*

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Understanding the effect of incubation temperature on embryos and hatchlings may have important implications for husbandry and conservation in turtles. Unfortunately, such knowledge is deficient for most Asian turtles. We incubated eggs of the Chinese three-keeled pond turtle (*Chinemys reevesii*) at 6 constant temperatures (24, 26, 28, 30, 32 and 34 °C) to test for the effects of embryonic thermal environment on incubation duration, hatching success, hatchling size and mass, sex ratio and post-hatching growth. Incubation duration (ID) decreased nonlinearly as the temperature (T) increased, and could be estimated by the equation: $ID = 42.74 \cdot \exp(4.30/(T-17.28))$. Eggs incubated at 32 °C and 34 °C had lower hatching success than those at 24, 26 and 28 °C. The turtle showed a Male-Female pattern of temperature-dependent sex determination (MF or TSD I a), with male bias at low temperatures (24 °C and 26 °C), and female bias at high temperatures (30, 32, and 34 °C). The relationship between sex ratio (SR) and temperature (T) could be estimated by a nonlinear equation, $SR = 0.025 + 0.923 / (1 + \exp(-(T-30.03)/0.009))^{0.006}$. Hatchlings from eggs incubated at 24, 26 and 28 °C were larger and heavier than their counterparts at 30, 32 and 34 °C. However, the temperature influence on hatchling size disappeared when the turtles were 3 months old, while most hatchlings from eggs incubated at 34 °C did not survive. After 3 months, female turtles from 30 °C and 32 °C grew faster than did male turtles from 24 °C and 26 °C; females from 28 °C grew significantly faster than males from the same temperature. In contrast, there was no difference in growth rate either within females or within males from different temperatures. The dichotomy of growth rate between turtles from high vs low temperatures are thus largely attributed to between-sex difference rather than temperature effects. Taken together, our results indicate that the temperatures ranging from 28 to 30 °C are most suitable for egg incubation in *C. reevesii*, because of the high hatchability and post-hatching survival, and the fastest growth of hatchlings in these thermal regimes.

Theme:reptile, turtles, ecology, reproduction

Type of Presentation: Oral, Symposium 1: Reproduction in reptiles: from genes to ecology

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“Twenty Years Of Multi-Agency Conservation For The Yellow-blotched Sawback (*Gratemys flavimaculata*): What Do We Know And Where Do We Go From Here?

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The yellow-blotched sawback (*Gratemys flavimaculata*) is an imperiled, riverine turtle that is endemic to the Pascagoula River and its tributaries of south Mississippi (U.S.A.). Very little was known about the life history and ecology of this species prior to its Federal listing as threatened in 1991. However, since then, there have been significant resources devoted to three areas for species conservation: habitat protection, public education, and research. Overall, 238084 hectares have been preserved in the Pascagoula River system, which remains one of most pristine major river systems in the lower 48 United States. Most of these land acquisition efforts have been completed by The Nature Conservancy (TNC), U.S. Forest Service, and U.S. Army Corps of Engineers. Additionally, outreach education to school-age children and adults within the river system was initiated by the Mississippi Museum of Natural Science (MMNS) to educate the public, with emphasis on endangered species like *G. flavimaculata*. During the fiscal year 2006-2007, MMNS outreach instructed 11,886

children from counties within the Pascagoula River basin and welcomed nearly 13,000 visitors to the Natural Science Museum from counties within the Pascagoula River basin. Lastly, many agencies (including US Fish and Wildlife Service; Mississippi Wildlife, Fisheries, and Parks; U.S. Army Corps of Engineers; Linnaeus Fund of Chelonian Research Foundation; Mississippi-Alabama Sea Grant) have provided research funds to study aspects of the life history and ecology of *G. flavimaculata*, including: species distribution, population status, home range and movements, reproductive ecology, reproductive hormone levels, impacts of non-native vegetation on nesting, impacts of recreational boating on nesting, impacts of boating recreation on basking, conservation genetics, basking ecology, and impacts of Hurricane Katrina on coastal populations. However, even though all three aspects of species conservation have been addressed, there continues to be issues (both natural and anthropogenic) that could disrupt conservation efforts for this species including: impact of invasive species, impact of Hurricane Katrina on coastal populations, continued human population increase in south Mississippi, excessive boat traffic impacting basking behavior, and a strategic petroleum reserve project that could significantly impact the Pascagoula River and its freshwater communities.

Theme: turtle; conservation biology; endangered species; *Graptemys flavimaculata*; Pascagoula River; yellow-blotched sawback

Type of Presentation: Oral, Symposium 15: Development and Implementation of Recovery Programs for Endangered Chelonians.

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Diversity and Distribution of Caiman sp from Amazon to Pantanal

William Rangel Vasconcelos

William Magnusson, Zilca Campos, Izeni Farias e Tomas Hrbek.

The Alligatoridae includes three genera in the South America, *Melanosuchus*, *Paleosuchus* and *Caiman*. The *Caiman* is frequently submitted to different types of systematic classification. Twenty years have passed since the first spectacled caiman morphotype description was done in the Amazon and Pantanal of South America. These morphotypes were recognized by the presence or absence of mandible jaw pigmentation, and by the transverse ventral scales, nuchal scales and longitudinal ventral scales at the sub specific, population or specific level, depending on the author. These morphotypes are recognized today as *Caiman crocodilus* and *Caiman yacare* (two categories). The geographical distribution of these lineages overlaps and there are two different potential evolutionary explanations: secondary contact with hybridization, and differentiation along a cline. Morphologically intermediate individuals exist along the Madeira, Guaporé and Abunã Rivers, and we concentrated in those areas. The aim of this study was to register patterns of diversification natural populations of *Caiman* sp ranging from Amazonian rain forest through the Pantanal region, of the Paraguay River basin. The fieldwork was conducted in 2007 and 2008, and 157 caimans were caught in 17 localities. Twenty characters and metrics were collected for each sampled individual. The effect of body size was removed by regressing all morphometric variables against SVL length. The results of PCA analysis showed the relationships of individual's scores and the best subset of variables to conduct posterior classification. Intermediate forms were found from Autazes, Amazonas State in the north to Cáceres, Mato Grosso State in the south. Previous studies indicated Costa Marques in Rondônia State as the limit of southern intermediates, but this study indicates that clinal variation occurs over a much greater area, extending the zone of probable interbreeding ~90 km to the north and 665 km to the south.

Theme: caiman sp, Amazon and Pantanal, South America

Type of Presentation: Oral, Symposium 7: The biology and management of crocodilians.

Studies of Various Incubation Conditions on Hatching Rate of Green Sea Turtle Eggs

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The experiments were finished in the National Gangkou Sea Turtle Reserve (NGSTR, N 22 ° 33 ', E 114 ° 54 ', <http://www.seaturtle.cn/>). In 2006 and 2007, we conducted five experiments about the effects of various factors on hatch rate of green turtle (*Chelonia mydas*) eggs. Results of these experiments indicated that removing contaminants on the egg surface including mucus, yolk and albumen from broken eggs, by gently washing in 1 ‰ iodine solution, greatly reduced the rates of fungal infections and damage by worms in sands, and significantly improved hatch rate. Generally, depth of replanted nests should be about 70 cm beneath the beach surface; however, the site of vegetation zone in National Gangkou Sea Turtle Reserve (NGSTR) of China is not appropriate for transplanting sea turtle eggs, and clutch size which above 50 eggs had significant effect of quantities reducing hatch rate. At last, some other methods to improve hatch rate were also discussed. Our findings can be used as references for other turtle-related conservation who engages in the same work.

Theme:Key words: Green turtle; Egg; Transplant; Hatch rate; Mucus; Contamination

Type of Presentation: Poster

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Juvenile Green Turtles Sex Identification Technology

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Under different constant incubation temperature, we got 161 hatchlings total from 200 green sea turtle (*Chelonia mydas*) eggs. The sex of hatchlings was determined using standard histological technique. The testis shows a thin cortex and conspicuous medullary cords surrounded by stromal tissue, while the ovary shows a thick cortex and remnants of medullary cords. Allantoic fluid and blood sample to determine the sex of immature turtles were used steroid hormone assays. When $E2:T < 1.5$, the hatchling is male (♂), but when $E2:T > 1.5$, for female juvenile turtles (♀). Pivotal Temperatures (PT) of Green sea turtles is near 29.4 °C in China Sea Turtle Bay (CSTB), at a sex ratio of about 1:1. This study was utilized Chemiluminescent Immunoassay System (CIS) to determine the sex hormone profiles (estrogen and testosterone) in the allantoic fluid and plasma of green sea turtle hatchlings. By determining the estrogen profiles for hatchlings, the method of blood sample may provide an accurate technique, and the ways of measuring thermosensitive period (TSP) or by the length of incubation period to estimate the proportion of male and female are also some non-invasive techniques to determine hatchling sex, which can be performed relatively easily and inexpensively.

Theme:Sex determine; E2; T; PT; CSTB

Type of Presentation: oral

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Manipulating clutch size of a snake reveals a nonlinear continuum of egg size-number trade-offs: is egg-size variation fitness-related?

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The relationship between offspring size and offspring number is crucial to life-history evolution. To examine how these two life-history variables are coupled and whether an altered balance between them will result in changes in maternal fitness, we manipulated clutch size of the Chinese cobra (*Naja atra*) by using the techniques of hormonal manipulation and follicle ablation. Females receiving exogenous follicle stimulating hormone produced more but smaller eggs, and females undergoing follicle ablation produced fewer but larger eggs. Neither body mass at hatching nor egg size (mass) at oviposition had a role in determining hatchling survival and growth. Female hatchlings were more likely to die in early post-hatching days and grew more slowly than male hatchlings. Our data show that: (1) there is a nonlinear continuum of egg size-number trade-offs in *N. atra* within which there is a single inflexion where the rate at which egg size decreases with increasing clutch size, or clutch size increases with decreasing egg size, is maximized; (2) there is a fixed upper limit to egg size for a given sized female, and the limit is not determined by her body volume; (3) egg size has no role in determining hatchling survival and growth; and (4) the extent to which females may enjoy reproductive benefits in a given reproductive episode depends on how well egg size and egg number are balanced.

Theme:*Naja atra*; Chinese cobra; Manipulating clutch size; Egg size-number trade-off ; Offspring survival ; Growth

Type of Presentation: Poster

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Geographical patterns of variation in life-history traits and genetic structure of the northern grass lizard *Takydromus septentrionalis*

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We collected northern grass lizards (*Takydromus septentrionalis*), a lacertid endemic to China, from different populations covering its whole distributional range to study geographic variation in life-history traits and intra-specific genetic variation. Females laid eggs in laboratory enclosures without any constraints resulting from food availability on reproduction. Oviposition occurred between April and August, with females from high latitudinal populations laying eggs earlier than did those from low latitudinal populations. Most eggs were incubated under one constant (28 °C, CT) and two temperature-shift (cold first and hot first in which eggs were first incubated at 24 or 32 °C and then at the other, each for 10 days, and finally at 28 °C until hatching) thermal regimes. Adults are monomorphic in body size but sexually dimorphic in head size and abdomen length, with males being larger in head size and females being larger in abdomen length in all sampled populations. Body size and head size differed among populations, but no clear-cut geographic patterns of variation in these traits were detected. Geographic variation in egg size, clutch size and clutch mass was very evident,

with females from low latitudinal populations generally laying more but smaller eggs in single reproductive episodes than did those from high latitudinal populations. Copulations occurred much more frequently between males and females from the same population than from different populations. A total of 329 lizards from 24 mainland and island (Zhoushan Islands) populations were used to study genetic structure. From the 1143 bps of the mitochondrial cyt b gene full length sequenced, 194 variable loci and 74 haplotypes were identified. The phylogenetic analyses of BI and ML reveal three lineages in the species. Haplotypes in Clade 1 belong to the central and western mainland populations, and haplotypes in Clade 2 belong to the eastern mainland populations and some populations in Zhoushan. All haplotypes in Clade 3 are mainly from the southern populations in Zhoushan. Haplotype network also reveals a similar population structure. The phylogeographic structure is more evident in the central and western mainland populations than in the others. Lineage sorting in the eastern part of the lizard's distributional range has not been completed yet primarily because of the young age (~10000 years) of Zhoushan Islands. The phylogenetic relationship and the formation history of Zhoushan Islands provide an inference that *T. septentrionalis* in Zhoushan Islands originated from at least two genetically distinct source populations.

Theme: *Takydromus septentrionalis*; lizard; life history trait; geographic variation; genetic structure

Type of Presentation: Oral:

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Many-lined sun skinks (*Mabuya multifasciata*) do not compensate for the costs of tail loss by increasing feeding rate or digestive efficiency

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We used the many-lined sun skink (*Mabuya multifasciata*) as a model system to evaluate the energetic and locomotor costs of tail loss, and to examine whether tailless skinks compensate for the costs of tail loss by increasing feeding rate or digestive efficiency. We successively removed three tail segments from each of the 20 experimental skinks initially having intact tails. Energy content in each removed tail segment was measured, and swimming performance was measured for each experimental skink before and after each tail-removing treatment. Another independent sample of 19 skinks with intact tails were measured for swimming performance to serve as controls for successive measurements taken for the experimental skinks. Tailless experimental skinks and control skinks were then measured for food intake and digestive efficiency. Tail loss affected swimming speed, but the adverse influence was not significant until more than 55% of the tail (in length) was lost. Our data show that partial tail loss may not severely affect energy stores or locomotor performance in *M. multifasciata*. However, as tail breaks occurred more frequently in the proximal portion of the tail in skinks collected from the field, we conclude that caudal autotomy occurring in nature often incurs substantial energetic and locomotor costs. As tailless and tailed skinks did not differ in food intake, apparent digestive coefficient and assimilation efficiency, we conclude that tailless individuals do not compensate for the costs of tail loss by increasing feeding rate or digestive efficiency in *M. multifasciata*.

Theme: Skinks; *Mabuya multifasciata*; Tail loss; Tail regeneration; Food assimilation; Locomotor performance

Type of Presentation: Poster

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Evaluation of herpetology in Brazil

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This evaluation of the studies of reptiles and amphibians in Brazil was based on the data base of the National Center for the Conservation and Management of Reptiles and Amphibians. These data refer to the research processes with reptiles and amphibians for didactic or scientific purposes (N=620). It is important to highlight, that out of the 143 education and research institutions involved in the projects, the federal agencies invest more in research on herpetofauna than the private ones, respectively n=45 and n=33 (Figure 1). Out of the processes registered in the data base it was possible to observe that a project can involve more than one taxon, more than one biome, and it can be multi-instructing. Thus in the analysis of the taxonomic groups, it was observed that the Class Reptilia (Orders Squamata, Chelonia and Crocodylia) is present in the majority of the projects (n=348; 43,28%; N=804), on the other hand, the Order Anura (Class Lissanphibia) is of greatest interest (n=285; 35,45%; N=804) (Table 1 and Figure 2). The Mata Atlântica Biome is the most studied (n=252; 31,34%; N=804), and the least studied (n=23) is the Pantanal (n=23; 2,86%; N=804) (Table 1). The most studies areas of knowledge apart from the taxa related to evolution, ecology, biology and embryology. Still in relation to Table 1, in seven main Brazilian biomes, the studies are distributed as follows: in Amazônia Biome the majority of the studies is on chelonia (n= 51; N=158); in the Biomes Mata Atlântica, Cerrado and Pampas the majority is on anura (n=121, N=252; n=58, N=211; n=17, N=48), respectively. In Caatinga Biome the majority of the studies is on squamata (n=16; N=41), in the Pantanal Biome the majority is on crocodylia (n=11; N=23). Finally, in Costeiro Marinho Biome, there are equal number of studies on anura and squamata (n=9; N=25). It is noted that out of the 46 recorded projetos that include all biomes, the most studied taxon is the Order Anura (n=24) (Tabela 1). These analyses are important to guide the subsidies of governmental and non-governmental agencies, to define the management approach and execution of conservation policies and oversight of herpetofauna. They can also guide funding agencies in defining allocations. They can identify the areas of knowledge to be explored on Brazilian herpetofauna by researchers.

Theme:herpetology, Brazil, reptiles, amphibians

Type of Presentation: poster

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Individual foraging specialization of Himehabu, *Ovophis okinavensis*: Variations in seasonal activity and response to prey odor

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Many animals are known to specialize on particular prey items. In evolutionary biology, ecological specialization has been considered to link to a speciation process and mechanisms of coexistence. In recent years, much attention has been paid to individual specialization. It is considered that individual specialization greatly affects ecological interactions in community both- inter- and intra-specifically. Here, I studied individual foraging specialization of *Ovophis okinavensis* (Japanese pit-viper) in a northern area of Okinawa-jima Island. The snake is a typical ambushing forager occurring in forest areas on the subtropical islands of the Okinawa and Amami Groups, Ryukyu Archipelago, Japan. Its diet consists of frogs, lizards, snakes, birds, and small mammals. First, I examined individual differences in a temporal appearance pattern in the field. Second, I carried out an experiment to examine differences in preference for prey odors among individuals in the laboratory. The field

survey demonstrated that the snake appearance patterns temporally synchronized with those of several frog species, and the stomach contents of the snake predominantly consisted of frogs. The individual appearance patterns of the snake were categorized into three types, each of which corresponds to appearance patterns of each of or combination of two frog species (*Rhacophorus viridis viridis* and *Microhyla okinavensis*). In addition, snakes of each categorized group showed chemical preference for frogs to which the snakes synchronized their appearance patterns. These results indicate that snakes in the present population showed individual specialization in the temporal appearance pattern and food habit, although *O. okinavensis* has a broad food habit as a species level. Furthermore, there are also individual variation in ambushing site selection in relation to water body where frogs breed (distance to nearby water and height from water surface). These results suggest that each individual has foraging specialization on specific frog species.

Theme:Snakes, Ecology, Predator-prey

Type of Presentation: Poster

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Parameters of fecundity in two broadly distributed sea kraits of the genus *Laticauda* (Elapidae: Squamata) in the Ryukyu Archipelago, Japan.

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Sea kraits of the genus *Laticauda* are oviparous marine elapids occurring in the tropical shallow waters. *Laticauda laticaudata* and *L. colubrina* are particularly broadly distributed in the tropical Indian and Pacific Oceans with the Ryukyu Archipelago of Japan representing the northernmost extremity of their breeding ranges. Nevertheless, little (*L. laticaudata*) or nothing (*L. colubrina*) has been known of the breeding habits of the two species in the Ryukyu region. We report several fecundity parameters in their the Ryukyu populations for the first time. Two gravid female *L. laticaudata* were captured in the Southern Ryukyus on 22 July. Each of them laid three eggs in captivity on 28 or 31 August. Eggs were elongate in shape, measuring 72.7 ± 5.77 mm (mean \pm SD, range : 65.7–78.1 mm) long and 19.5 ± 0.648 (18.5–20.1) mm wide, weighing 18.1 ± 0.948 (16.5–18.8) g. Relative clutch masses (RCMs) for the two females were 0.278 and 0.294. Six gravid female *L. colubrina* were captured also from the Southern Ryukyus on 15, 19 and 24 July. They laid eggs between 29 July and 6 September, and the clutch size was 6.67 ± 3.83 (3–13). Eggs measured 66.8 ± 9.2 (54.1–88.9) mm long and 28.2 ± 2.79 (21.7–32.2) mm wide, and weighed 32.1 ± 4.79 (22.0–42.9) g. RCM was 0.28 ± 0.06 (0.22–0.35). The largest and smallest females exhibited the largest and smallest clutch sizes, respectively, but the correlations between these parameters remain uncertain, due to the small sample size ($n = 6$). Eggs of the largest female were elliptical in shape, 64.2 ± 4.61 (55.6–73) mm long and 30.4 ± 1.18 (28.5–32.2) mm wide, whereas those of from the smallest female were much more elongated, 80.4 ± 6.89 (77.2–88.2) mm long and 22.5 ± 0.67 (21.7–22.9) mm wide. Four eggs of *L. colubrina* hatched after 162–193 days of oviposition. SVL and weight of hatchlings were 325 ± 8.30 (315–332) mm and 16.3 ± 2.48 (13.4–19.4) g, respectively. The clutch size of *L. laticaudata* observed falls within the range observed for other populations. In *L. colubrina*, the mean RCM obtained in this study is greater than those for other populations. The clutch size and egg measurements obtained in this study are within the ranges of corresponding values reported in the previous studies.

Theme:snakes, reproduction
Type of Presentation: Poster ,contributed
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Comparison Between the Primary and Secondary Sex Ratios in Two Sympatric Gekko Species from the Northern Part of Okinawajima Island, Japan (Reptilia, Squamata)

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A gekkonid species *Gekko hokouensis* and its undescribed cryptic species *Gekko* sp. occur sympatrically on Okinawajima and a few adjacent islets of the Ryukyu Archipelago, Japan. The former has heteromorphic sex chromosomes (ZW) and shows genotypic sex determination (GSD), whereas the latter lacks heteromorphic chromosome pairs and shows temperature-dependent sex determination (TSD). We examined the primary sex ratio (sex ratio in the hatchling cohort) and the secondary sex ratio (sex ratio in the matured individuals) in these species. For the primary sex ratios, field observations were conducted from May 2007 to May 2008 and captive observations were also conducted from April to August 2007. We collected in each month of gravid females of each species from a limited area of the northern part of Okinawajima. These females were brought back to laboratory in the central part of the island and housed individually in a plastic cage. All eggs laid in the cages were collected within a day after deposition and were left under natural temperature. Hatchlings were kept until reaching maturity and sexed by examining the secondary sexual characters. We then estimated the primary sex ratio in the natural population for each species on the basis of the ratio in number of gravid females in each month to total gravid female number in a whole breeding season and the sex ratio in juveniles obtained from each monthly gravid female sample. The secondary sex ratio was estimated for each species on the basis of the frequency of females in the whole adult geckos counted in another region of northern Okinawajima from May 2007 to May 2008. The primary sex ratio in *Gekko hokouensis* was not significantly biased (59:41), whereas in *Gekko* sp. it was significantly female-biased (30:70). The secondary sex ratio was not significantly biased in either species (120:119 in *Gekko hokouensis*; 97:106 in *Gekko* sp.). The primary and secondary sex ratios did not significantly differ in *Gekko hokouensis*, but did in *Gekko* sp. These results suggest that unbiased sex ratio (1:1) is maintained throughout the growth in the GSD gecko, whereas in the TSD gecko the sex ratio, biased in favored of females in the hatchling cohort, is secondarily adjusted to be 1:1 by maturity. Further studies on the male and female survivorships and the age structures in assemblages of reproductively active individuals in each of the two species are strongly desired.

Theme:reptiles, lizards, ecology, reproduction, captive breeding
Type of Presentation: oral
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Diversity and Distribution of Brown Frogs in China

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Brown frogs are holoarctic anurans distributing in palearctic and indomalayan realms and according to Frost the genus *Rana* is limited to the brown frogs and include 44 species. China has a high rich in brown frog diversity and endemism. From 1997, we have taken several surveys in most provinces of China mainland and collected 18 species of the brown frogs and got available information. 22 species of brown frogs have been known from China including 3 new ones in 2007 and 2008. they are *Rana amurensis*, *R. arvalis*, *R. asiatica*, *R. chaochiaoensis*, *R. chensinensis*, *R. chevronta*, *R. culaiensis*, *R. dybowskii*, *Rana hanluica*, *R. huanrenensis*, *Rana johnei*, *R. kunyuensis*, *R. kukunoris*, *R. longicrus*, *R. maoershanensis*, *R. omeimontis*, *R. multidenticulatus*, *R. sangzhiensis*, *R. sauteri*, *R. zhenhaiensis* and *R. zhengi*. Among them, half are endemic to China mainland and 3 (13.6%) to Chinese island (Taiwan). And others also occur in the adjacent countries of China. In China, most brown frogs distributed in the East (only *R. arvalis*, *R. asiatica* and *R. kukunoris* in westnorthern China and *R. chaochiaoensis*, *R. chevronta*, *R. omeimontis* and *R. shuchinae* in southwestern China) and 9 species distribute in palearctic realm, of which *R. culaiensis* and *R. kunyuensis* are endemic and narrowed to Mt. Culai and Kunyu, and 12 species in indomalayan realm, of which 10 are endemic, and *R. chevronta* narrowed to a small range in Mt. Emei and *R. zhengi* to Hongya near Mt. Emei. Only the Chinese brown frog (*R. chensinensis*) bestride palearctic and indomalayan realms. *Rana johnei* scattered in several mountains in south China and Hainan island, Lao and Thailand are its south distributing border. As a holoarctic genus in amphibia, China is mainly the south border in its distribution and centers for their speciation which mainly located in Taiwan island, area around Baihai sea, Mt. Emei and Nanling Mountains. The population status and major threats is under less concern to most of these frogs and the data of several newly founded species is deficient. While *R. chevronta* is critically endangered, *R. sauteri* is endangered, and *R. longicrus* is vulnerable. On the other hand, although as the top 1 utilization of frogs in China as food and Chinese traditional medicine source, the main threat of *R. dybowskii* is over-exploitation. Now there are many protected areas within its range. It can be successfully reproduced in captivity; farming of this frog takes place in northeastern China.

Theme: anurans, taxonomy, conservation biology

Type of Presentation: Poster

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Maximum size of the dwarf caiman, *Paleosuchus palpebrosus* (Cuvier, 1807), in Central Amazonian and in the surrounding the Pantanal.

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Species of *Paleosuchus* and *Osteolaemus* are considered to be the smallest crocodilians, with adult sizes between 1.2 and 1.5 m. However, there are controversies in relation to the maximum size dwarf caiman, *Paleosuchus palpebrosus*, in the literature. In the studies population dwarf caiman in small streams surrounding Pantanal, already found one individual dead had measured 92 cm SVL, cm (snout-vent length). This study, we evaluated size structure of populations and maximum size of the dwarf caimans in two locals, in forest flooded in central Amazonian and small rivers and surrounding of Pantanal. We searched for individuals dwarf caimans in nocturnal census in forests flooded, igapós, Cururu lake, near the Solimões River, central Amazonian and in the small streams and rivers surrounding Pantanal. We captured 150 individual's hatchlings (75), males (40) and females (35) during study. The snout-vent length of dwarf caiman varied 11.0 to 99.0 cm. The hatchlings have 19 a 20 crests in the hatched and majority of the dwarf caiman had mutilated tail when were more old. For determined the maximum size of caiman we used relationship snout-vent length (SVL) and length total (TL) of 27 caimans that had intact crests (≥ 19). The correction formula $TL = 1.17 + 1.84 \cdot SVL$ ($N=27$, $r^2=0.99$, $P=0.00$) was used for calibrated the length total when caimans no had crests intact.

The size structure of the caimans reached above 180 cm in the surrounding Pantanal and in the central Amazonian. However, we believe that destruction of habitats and hunting pressure already can to be affecting in size structure in both areas.

Theme:crocodilians, ecology

Type of Presentation: Poster

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Natural Resistance to Snake Venom

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The primary biological function of snake venom is to immobilize prey and predators of a wide spectrum of animal taxa. Paradoxically, snakes are resistant to conspecific venoms. The main lethal component of elapid snake (Elapidae) venoms are alpha-neurotoxins (neurotoxins) that inhibit the function of the nicotinic acetylcholine receptors (AChR) at the neuromuscular junction. Earlier, we identified that *Naja* and *Laticauda* are resistant to neurotoxins because of a unique glycosylation of the AChR that interferes with the toxin-receptor binding. Here, by using genetic markers specific for neurotoxin resistance, we mapped the phylogenetic pattern of resistance among snakes. The data indicates that neurotoxin resistance is not restricted to Elapidae, but also present in several basal lineages among Alethinophidia. We conclude that the neurotoxin resistant phenotype evolved first, which then permitted the evolutionary modifications leading to the production and delivery of highly potent neurotoxins. In addition to snakes, snake venom neurotoxin resistance also occurs among mongooses (Herpestinae, Carnivora) whose diet includes elapid snakes. In Herpestinae, the molecular mechanism of resistance appears to be the same as in snakes, reflecting a convergent evolution at the molecular level. However, while all the Herpestinae lineages sampled from mainland Africa (where Elapidae snakes are present) carry the resistant genotype, their sister group from Madagascar (an island devoid of snakes capable of injecting potent neurotoxins) all lack the resistant genotype. A possible role of neurotoxin resistance in the evolution and diversification of snakes and Herpestinae is discussed.

Theme:snakes, venomous snakes, snake venom, evolutionary physiology, predator-prey

Type of Presentation: oral presentation

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