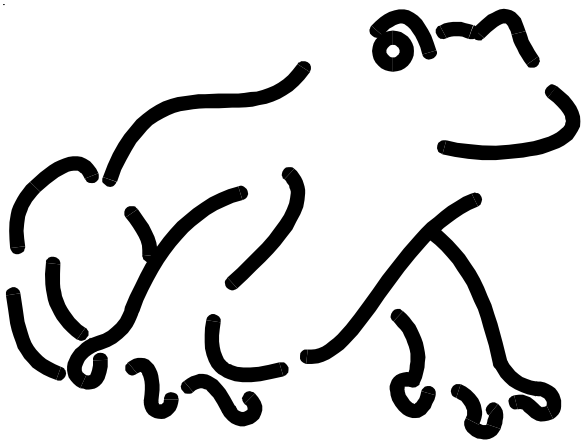

frog leg

Newsletter of the Declining Amphibian Populations Task Force - South Asia

No. 10, May 2002

Declining amphibians in Ladakh: evidences and hypotheses on causal factors

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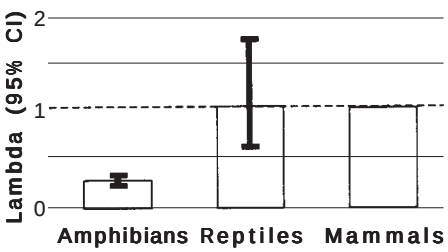
The survey of herpetofauna in Ladakh part of Jammu and Kashmir covered 42 locations in 75 field days of work between June and August of 2000 and 2001. The amphibians and reptiles were opportunistically searched in all locations. Information from local people was also used to find species and a species was marked present only when that species was observed. During the survey, seven species were recorded. The species presence/absence data for 37 sites was analysed using capture-recapture approach. When a species was seen for the first time in any location it was treated as 'capture' the resighting of the same species in any location was treated as a 'recapture'. The program SPECRICH2 (Hines *et al.,* 1999) provided estimates of number of species (species richness) along with the standard error and the species detection probability from the data. It was estimated that there were seven species of reptiles and amphibians (S.E. = 1.45) in the Ladakh region. *Bufo latastii, B. viridis* and *Scutiger occidentalis* are known to occur in the region, however, only *B. viridis* was recorded during this survey.

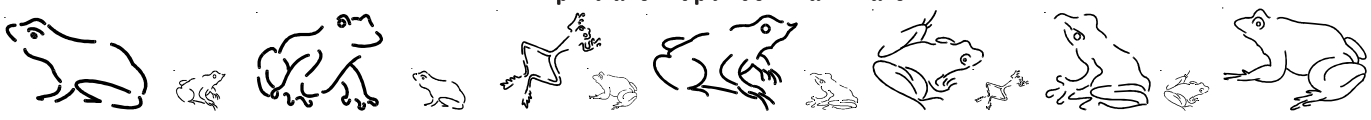
The data from this survey was compared with historical data on presence/absence of species in 3 different locations in Ladakh using the program COMDYN4 (Hines *et al.,* 1999) to quantify the change in different vertebrate communities (mammals, reptiles and amphibians). The data for reptiles and amphibians came from this study and published reports from 1976-78. The data on the occurrence of mammals came from a survey of this taxa, as part of a larger ongoing project at the Wildlife Institute of India (Anon, 2001). The data from two time periods came from the same locations and it was assumed that there was no change in the detection probabilities (test for the violation of the assumption was made). The measure of community change 'lambda' which is the ratio of the estimated number of species in the past by that from the present, was used. The amphibian community has undergone significant change since 1978, compared to, other vertebrate taxa. It is important to understand at this stage the limitations in the interpretation of the results from this analysis. The presence/absence data ignores the change in abundance of different species, which might have been the case for some species of reptiles and mammals.



Only one amphibian species *Bufo viridis*, was recorded from four locations in this survey while, in 1978 three species were recorded from three locations from the same area. The local extinction of two species endemic to northwest Himalayas (*B. latastii* and *S. occidentalis*) has contributed to the change. Currently, *B. latastii* is listed as Lower Risk-least concern, *S. occidentalis* and *B. viridis* as Data Deficient based on the assessment made in the Conservation Assessment and Management Plan workshop for amphibians in 1997 (Molur & Walker, 1998). The assessment on these species should be revised considering the urgent need for conservation efforts for these species in the Ladakh region.

Habitat destruction in this region has been restricted to the valley fans where there are human habitations. There are large intact areas where amphibian populations could survive, however their absence remains unaccounted. Stochastic events such as flash floods and droughts are not uncommon in the region. However, these events have to be correlated with the dis-appearance of the species in different localities to attribute stochastic events as a causal factor for change in the amphibian community. A comparison of temperature profiles revealed no clear-cut change from the past.

There are evidences suggesting considerable depletion of ozone above Ladakh since 1978. It is estimated that ozone depletion has occurred at



the rate of 5% per decade in the intervening period (Dr. S.L. Jain, National Physical Laboratory, pers. comm.). Further, the current UV radiation levels in Ladhakh are eight times more than in Delhi and the magnitude comparable to that of Antartica (Dr. S.L. Jain, National Physical Laboratory, pers. comm.). Among the various possible causal factors that explain the observed phenomenon, the hypothesis of climate change since the late 1970s, mortality due to disease alone or disease linked to climate change needs to be tested. This will enable identification causes for the local extinction of *Bufo latastii* and *Scutiger occidentalis* and formulate recovery plans for the species.

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On the occurrence of *Bufo scaber* Schneider, 1799 from Kalakkad-Mudanthurai Tiger Reserve, Tamil Nadu

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Bufo fergusonii (Bufonidae) was described by Boulenger (1892) based on an individual collected from Cavalry Parade ground, Thiruvananthapuram, in Kerala. Subsequently, the species has been reported in India from Chennai (Nungambakkam) in Tamil Nadu (Rao, 1915), Mysore (Daniel, 1963a) and Lakkavalli State Forest in Karnataka (Krishnamurthy, 1999), Banjara Hills (Hyderabad) in Andhra Pradesh (Donahue & Daniel, 1966), and Sambalpur District in Orissa (Dutta, 1988 -- based on specimens collected during 1955-1957). Outside India, the species has been reported from Sri Lanka (Dutta & Manamendra-Arachchi, 1996). Recent reports on the amphibians of Kalakkad Wildlife Sanctuary (Cherian *et al*., 1999; Ravichandran, 1996) indicate the absence of the species from the Kalakkad-Mundanthurai Tiger Reserve. I encountered this toad, in the Kadayam Range of Kalakkad-Mundanthurai Tiger Reserve, where individuals were found calling along the edge of Gattana Dam (9 and 10 June 1999, ca. 140m, 77°18'-77°19'E & 8°47'-8°48'N). The dam lies in the northern part along the reserve boundary. The call resembled that of a call of the Marbled Toad *Bufo stomaticus*, but more shriller and insect like (a continuous "tria, tria, tria ..." repeated at irregular intervals). The individual was identified based on the presence of weak parietal ridge and rounded parotid glands (Boulenger, 1892; Daniels,1963a, b; Dutta & Manamendra-Arachchi,1996). In their recent taxonomic review of the genus *Bufo,* Dubois and Ohler (1999) have proposed *Bufo fergusonii* to be the junior subjective synonym of *Bufo scaber* Schneider, 1799.

***Bufo scaber* at Kalakkad-Mundanthurai Tiger Reserve**

Habitat

I found a few individuals calling from a grass-covered open area along the reservoir edge. One individual (Male, SVL - 33.7mm) was calling atop a half-submerged herb along the reservoir edge. There was slight drizzling during both the days. The surrounding habitat was of dry deciduous thickets. The species had been reported from coastal scrub forest (Daniels, 1997), grass-covered reservoir margin (Dutta & Manamendra-Arachchi, 1996). Individuals of this species were observed breeding in rainwater pools in scrub forest (Indraneil Das, pers. comm.). The available data on the species probably shows its habitat specificity, being restricted to the dry forests and adjoining areas at lower altitudes. The species is nocturnal in habit and in captive conditions it is known to feed exclusively on termites (Rao, 1915).

Acknowledgements

I would like to express my thanks to B.C. Choudhury and Sugato Dutt for an opportunity to work in the FREEP-KMTR project. The Tamil Nadu Forest Department for the permission and logistic support. Karthikeyan Vasudevan for his comments on the earlier manuscript. Ashok Raghavendran for his support in the field.

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The Global Amphibian Assessment

Neil Cox

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The world is entering an extinction crisis that is potentially more serious than anything that has taken place over the last billion years. This extinction crisis is particularly serious for species that occur in tropical rainforests and freshwater habitats. Amphibian are one group for which extinctions seem to outstrip even the worst predictions.

Until now, fewer than 1,000 of the 5,000 known amphibian species have ever been assessed for their conservation status and needs. It is feared however that over the past 15 years, some 40-50 amphibian species have become extinct, including well-documented extinctions occurring in Central America, Puerto Rico and Australia.

Following the first meeting of the Global Amphibian Specialist Group (Washington DC, January 2001), Conservation International (CI) immediately started to implement a Global Amphibian Assessment (GAA), over a 24-month period, in collaboration with the IUCN Species Survival Commission. In essence, the GAA is a comprehensive, strategic review of the overall conservation status of every species of amphibian, with an analysis of their conservation needs. It will become the blueprint for amphibian conservation worldwide over the next decade. This blueprint is needed in order to ensure that future investments in amphibian conservation are spent wisely and directed towards activities that will stem the tide of amphibian extinctions.

Currently the following activities are being undertaken in close collaboration with leading amphibian experts around the world: assessment of the risk of extinction for each described amphibian species according to the accepted global standard (the IUCN Red List Categories and Criteria), with an examination of the type of threats the species is experiencing, such as habitat loss, disease or over-harvesting. Distribution maps are being drawn for every amphibian species, with the habitat preferences of the species being described and recorded. The types of conservation actions (both those that are currently in place as well as those that need to be implemented), and population trends for each species will also be documented.

The GAA is being conducted on a regional approach. Regional Coordinators are responsible for the initial data collection, and entry of these data in the GAA database. For those regions in which expert meetings of herpetologists are already scheduled, the Assessment intends to take advantage of the opportunity to ask those present to carry out reviews of the results. In some larger and species-rich regions, specific GAA expert review workshop will be organised.

The information produced through the GAA will be drawn together and analysed to prepare a comprehensive assessment of the status and conservation needs amphibians, including information on geographic patterns of diversity, levels and types of threat, overall trends, habitat requirements, and conservation priorities. The results will be fully integrated into the official IUCN Red List of Threatened Species, and will be directly linked to CI's 'hotspot' conservation work.

Special thanks to the following organisations for the technical and monetary support provided to run the Declining Amphibian Populations Task Force-South Asia network and in the publication of this Newsletter.

DAPTF SSC IUCN CBSG India CBSG South Asia FRAWG

Conservation Assessment and Management Plan (CAMP) and Global Amphibian Assessment (GAA) Workshop for Amphibians of South Asia

Circular — First information

To Field biologists, taxonomists and conservationists studying South Asian Amphibians

From The Organizing Committee for the proposed South Asian Amphibian CAMP-GAA Workshop

Date 25 March 2002

Ref Conservation Assessment and Management Plan (CAMP) and Global Amphibian Assessment (GAA) Workshop for Amphibians of South Asia.

Dear Colleague:

We are pleased to announce that the Amphibian Network of South Asia (ANSA), Conservation Breeding Specialist Group – South Asia (CBSG-SA), Declining Amphibian Populations Task Force – South Asia (DAPTF-SA), Zoo Outreach Organisation (ZOO), Wildlife Information Liaison Development Society (WILD), Global Amphibian Specialist Group (GASG, SSC, IUCN), Declining Amphibian Populations Task Force (DAPTF, SSC, IUCN) and the Center for Applied Biodiversity Science at Conservation International (CI/CABS) have joined hands in organizing a Conservation Assessment and Management Plan (CAMP) and Global Amphibian Assessment (GAA) Workshop for Amphibians of South Asia. The tentative dates for the workshop is the week of 1-5 July 2002 at a place in or close to Coimbatore, Tamil Nadu, India.

This is a "first information" circular to ascertain the interest and availability of potential participants and also to ascertain their willingness and ability to contribute information. We are most in need of field biologists who can give hard data on amphibian distribution and status or information relevant to taxonomy. The objective of this 5-day workshop is to gather information on the distribution, trends, threats, population and derive a status according to the 2001 IUCN Red List Criteria for all species, subspecies and populations of amphibians occurring in South Asia. The workshop is a combined activity of the CAMP workshop process as well as the Global Amphibian Assessment, which is a global initiative to determine the status of all described amphibian taxa around the world.

CAMP workshop

For those of you who are unfamiliar with the term "CAMP workshop" as we mean it, it is not the same as a "camp" as frequently used for medical, military and nature education events. It is an acronym for Conservation Assessment and Management Plan, which is a Workshop "process". This is called a process because it is not a one-time event but an ongoing programme on which long-term conservation action can be built with continuous inputs of information from active field biologists. The CAMP workshop process was developed by the IUCN/SSC Conservation Breeding Specialist Group more than a decade ago to prioritise species for captive breeding and has evolved into a dynamic tool for catalyzing *in situ* conservation action.

CBSG, SSC, IUCN has conducted more than 70 CAMPs throughout the world, the results of which have been used for conservation planning at various levels and biodiversity strategic action. The Zoo Outreach Organisation (Z.O.O.) office hosts the regional network of CBSG, South Asia and has conducted 17 CAMP workshops within this region. There will be many associates, sponsors, and collaborators for this workshop, however.

A CAMP Workshop is carefully planned and implemented, as well as followed up in a systematic manner. The objective of such planning is to insure that current information of the highest quality is collected from a range of specialists from a specific geographic area. CAMP workshops use trained facilitators to run the exercise in such a way that all participants get an opportunity to input their information and opinions and a consensual output is taken for a final Report. CBSG is an objective organizer with no vested interest in anything except a correct, timely and useful output. Facilitators motivate participants to keep to a schedule so that all species and issues can be covered. CAMP workshops are serious exercises; we discourage your bringing family members or friends, leaving the workshop for any reason or not keeping to the schedule we decide consensually in the first day.

Global Amphibian Assessment (GAA)

The GAA is a collaboration between the IUCN Species Survival Commission and the Center for Applied Biodiversity Science at Conservation International, implemented in partnership with numerous organizations and experts around the world. The aim of the project is to assess the status of all the world's amphibian species according to the IUCN Red List Categories and Criteria, to map the distributions of each species, and to code each species for habitats, threats, conservation actions, and population trends. The results will be presented in a book, as well as being publicly available on the internet, and will be used for setting biodiversity conservation priorities, as well as for research purposes. The results of the GAA will not be static, but will be available for constant updating as new information becomes available.

The GAA is planned on a regional basis, and for this purpose the world has been divided into 31 GAA regions, one of which is South Asia. In each region one person has been appointed to take a first cut by assessing all the species in a particular region. The results of this first cut are then being reviewed by a broader group of scientists (in some cases through regional workshops, such as the one proposed in this letter) before being "fed into" the GAA. Dr Sushil Dutta is doing the first cut of the GAA amphibian data for South Asia.

We are proposing to combine the GAA and CAMP processes in South Asia as much as possible, hence the proposal for a joint workshop. We shall send a printout of the first cut of GAA data, collected by Dr Dutta, to all those who express an interest in attending the workshop. This data printout will assist you in preparing for the workshop, and provide an initial draft of a lot of the data needed for the CAMP process.

We believe that the GAA is an essential project in getting amphibians to where they really belong in the world's conservation efforts, as well as contributing further to amphibian research.

This first information circular includes a two-page form, which will enable us to proceed with your registration and participation in the workshop. ***Please note: filling in both sides of the form are mandatory in order for you to get further mailings and be considered for the CAMP***. We have also included a map which indicates where the field biologists on our list are located in South Asia. We need people who have surveyed amphibians in all parts of South Asia and as you can see, there are big gaps if their actual location is indicative of scope of studies as is the case much of the time.

Hopefully, when we get your list of field studies, we can fill some of these gaps. Please suggest people who might have hard information about amphibian distribution that should be invited to the workshop. We are especially interested in making sure that no advanced students or new members of government service get overlooked.

In the event that you are NOT able to consider attending the workshop but would still like to be included in the CAMP-GAA process, you may state this on the form and still participate by filling out Taxon Data Sheets for species in the particular geographic areas that you have studied. These will be incorporated into the working group assessment of each species and you will be given credit for your contribution.

Accommodation, food, printed materials, etc. will be provided to all participants by the organisers. If you would prefer an accommodation of your own choice we will suggest hotels in your stated price range to be paid by you. We will not provide local transport to the workshop venue but will reimburse you for a three-wheeler or taxi from airport, rail or bus station if necessary. Details of this will be given later along with a map to the venue.

As we are trying to get as many specialists from far-flung areas and countries of South Asia as possible, please use all your efforts to obtain travel support from your institution.

In the next three months we will be sending you a list of amphibians, the first cut of the GAA South Asia data, Taxon Data Sheets, and other information about the CAMP-GAA process, and the new Red List Criteria and guidelines of IUCN SSC.

This workshop will set a precedent for other such regional red listing exercises so we hope to make it a tremendous success. The information collected from this workshop will be compiled along with the global overview for amphibian assessments, which is to be included in the 2003 IUCN Red List of Threatened Species.

Therefore, it is an important event. We hope all of you can attend and will prepare for the workshop by reviewing your field notes, by conducting new rapid assessment surveys, and by speaking with colleagues. This workshop, with its objective of assessing all South Asian Amphibians for inclusion in the Red List of Threatened Species is a very good opportunity to pull out all your published and unpublished information, museum collections and systematics.

Finally, of course, the state of the world today demands that we include a caveat that this workshop will be held if funding and other circumstances are favourable. We hope this will be the case.

We look forward to working with you in this workshop.

With best wishes,

Sanjay Molur
Co-chair, DAPTF-SA, For the Organising Committee

Organising Committee
Sushil Dutta, Reader, PG Department of Zoology, Utkal University, Bhubaneswar, Orissa, India
Indraneil Das, Associate Professor, Universiti of Sarawak, Malaysia
Simon Stuart, Senior Director, CI/CABS - IUCN/SSC Biodiversity Assessment Initiative, Conservation International
Sanjay Molur, Founder/Secretary, WILD; Red List Advisor, CBSG, South Asia
Sally Walker, Founder/Secretary, ZOO, Convenor, CBSG, South Asia

ABSTRACTS FROM VARIOUS JOURNALS

Alytes, 2000, 18 (1-2): 15-50.

Systematics of *Fejervarya limnocharis* (Gravenhorst, 1829) (Amphibia, Anura, Ranidae) and related species. 1. Nomenclatural status and type-specimens of the nominal species *Rana limnocharis* Gravenhorst, 1829

Alain Dubois & Annemarie Ohler

A detailed analysis shows that the nominal species *Rana limnocharis* was first made nomenclaturally available by Gravenhorst (1829), and then a second time and independently by Wiegmann (1834). The consequences of these facts regarding the name-bearing types of these two nominal taxa are discussed and neotypes are designated for both of them. The status of the following related nominal species are also discussed, and their type-specimens are described: *Rana cancrivora* Gravenhorst, 1829; *Rana vittigera* Wiegmann, 1834; *Rana gracilis* Wiegmann, 1834; *Rana multistriata* Hallowell, 1861; *Rana wasi* Annandale, 1917. Finally, on the basis of several recent pieces of information, it is suggested that the group of frogs usually known "*Rana limnocharis* group" or "subgenus *Fejervarya*" should be recognized as a distinct genus, *Fejervarya* Bolkay, 1915.

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Alytes, 1999, 17(1-2): 81-100.

Miscellanea nomenclatorica batrachologica. 19. Notes on the nomenclature of Ranidae and related groups

Alain Dubois

The need of "working taxonomies", as tools providing a framework for alpha-taxonomic revisionary works and hypotheses for phylogenetic analyses, is pointed out, especially in groups with wide distribution and high number of species. Even during the transitional period, non-ambiguous communication between zoologists requires that use of names for taxa strictly follows the international rules of zoological nomenclature. Several cases fo recent nomenclatural problems are pointed out in the "family Ranidae". Rediscovery of the generic name *Chirixalus* Werner, 1899 provides an opportunity for discussing several careless treatments of the generic and infrageneric taxonomy of frogs of the "genus *Rana*" by recent authors. The name Indiraninae Blommers-Schlosser, 1993 is shown to be an invalid junior synonym of Ranixalinae Dubois, 1987, and, on this occasion, the fact that family-group names are regulated by the rule of priority is reminded once again. In order to help knowing the valid name among several names published simultaneously, in the case they are considered subjective synonyms, two tables of first-reviser actions in the Ranidae and related groups are presented. Finally, discussion of the nomenclatural status of the name "*Rana duboisi*" recently published by Emerson & Ward (1998) allows to point to the problems posed by the publication of data taken from unpublished manuscripts by colleagues, either submitted to review by an editor, or privately communicated by the author or another person. This case is also the basis for the discussion of two more general questions, which are likely to appear again on several occasions in the years to come: is a species name rendered nomenclaturally available by publication, either (1) of a Genebank catalogue number, or (2) of a cladogram including this species? The answer to both questions is clearly "no", at least under the current Code. Allocation of names to taxa is not based on definitions, diagnoses or descriptions, but on the taxonomic allocation of name-bearing type-speciemens: the recent proposal of attaching the names to "phylogenetic definitions of taxon names" is therefore based on a major misunderstanding and entertains an unneccessary confusion between taxonomy and nomenclature, as the current nomenclatural system is liable to accomodate any kind of taxonomy, including "phylogenetic ones.

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Asiatic Herpetological Research, 2001, Vol.9, pp. 77-100

A review of the distribution of diploid, triploid and Ttetraploid Green Toads (*Bufo viridis* complex) in Asia including new data from Iran and Pakistan

Matthias Stock, Daniel Frynta, Wolf-Rudiger Grosse, Claus Steinlein & Michael Schmid

A summary of the distribution of green toads containing most of the data published after the discovery of polyploid forms (1976) including a map, an index and a bibliography are presented and discussed. 21 Asian type localities of hitherto described nominal green toad taxa are shown. The tetraploids are distributed in high mountains and extremely continental regions with strong climatic shifts. Records of triploid specimens are situated in supposed contact zones between the parapatric diploid and tetraploid toads at foothills of Middle Asian high mountains, and triploid bisexual populations occur in the Karakoram and West-Himalayas. Habitats of diploids appear to be restricted to lowlands and valley grounds. Polyploids seem to be more resistant. The methods hitherto used for the determination of the ploidy level and their applicability are evaluated. We show new data on this species complex from Iran including cytometric, karyological, bioacoustic and morphological data and we draw taxonomic conclusions for tetraploid Bufo oblongus, diploid *Bufo viridis kermanensis*, and probably diploid *Bufo kavirensis*. New information on the distribution of triploids in northwestern Pakistan based on flow cytometric measurements is presented. The ploidy level of *Bufo latastii* is revealed to be diploid.

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Journal of South Asian Natural History, 2001, 5(2): 109-115

Permanent marking of a fossorial caecilian, *Gegeneophis ramaswamii* (Amphibia: Gymnophiona: Caeciliidae)

G. John Measey, David J. Gower, Oommen V. Oommen & Mark Wilkinson

Despite the importance of permanent marking of animals for quantitative ecological studies, no such technique has been applied to any of the poorly known caecilian amphibians. We evaluated four techniques (Panjet, freeze-branding, Elastomer Visible Implant tags and Soft Visible Implant Alphanumeric tags) of permanently marking a fossorial caecilian, *Gegeneophis ramaswamii* Taylor, in the southern Western Ghats, India. All the tested techniques are viable options for marking caecilians in the field but differ in their portability ease and speed of application, and their suitability for batch and / or individual marking of animals. Panjet tattoos were deemed to be particularly effective and practical for batch marking, while Soft Visible Implant Alphanumeric tags offer good potential for individual marking.

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Journal of South Asian Natural History, 2001, 5(2): 173-186
Systematics of the genus *Philautus* Gistel, 1848 (Amphibia, Anura, Ranidae, Rhacophorinae): some historical and metataxonomic comments
Alain Dubois & Annemarie Ohler

We present some historical and metataxonomic comments on the data presented by Bossuyt & Dubois (2001) in their review of the genus *Philautus.* This stresses the existence of some historical and geographical patterns in the descriptions of species one referred to this genus, and in their changes of generic allocation. These data suggest that changes in taxonomies are not only linked to theoretical evolution of the dominant ideas in the field of taxonomy, but are also largely influenced by the ideas and skills of individual taxonomists. Some comments are also offered regarding the replacement in the scientific literature of the name *Ixalus* by the name *Philautus,* and the fate of the name-bearing types of species referred to this genus. We suggest that the methodology here proposed for historical and metataxonomic analysis of systematic data could be used profitably for studying the taxonomies of other zoological groups.

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Zeylanica, 2001, 6(1): 1-112
A review of the frog genus *Philautus* Gistel, 1848 (Amphibia, Anura, Ranidae, Rhacophorinae)
Franky Bossuyt & Alian Dubois

This paper is devoted to a review of the specific taxonomy of the frog genus *Philautus* Gistel, 1848. From 1822 to 1999, 177 nominal species were either described as members of this genus, or of other genera but subsequently referred to this genus. We tried to review the available information on the taxonomic status of these 177 names and the status of their name-bearing types. As a result of this review, 143 types are known to be extant, including 19 lectotypes and 8 neotypes designed and / or described in the present paper. In conclusion of this preliminary analysis, we provisionally distribute these 177 names, and 56 nominal species now referred to other genera. These results are highly provisional, both at specific and supraspecific levels. Additional works, using various characters and methods, will be necessary to confirm or reject the validity of a number of these species, and many additional species clearly remain to be discovered and described in the whole range of this genus. At supraspecific level, the taxonomy we use (a single genus *Philautus* with three subgenera) is also highly provisional, as the generic taxonomy of the whole subfamily Rhacophorinae is in strong need of revision. The present work will provide clear nomenclatural bases for future works on the phylogeny and taxonomy of this difficult group.

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Occasional papers of the Amphibia & Reptile Research Organization of Sri Lanka, 2001, (2): 1-8
Menikdena: a local herpetofaunal hotspot
Ruchira Somaweera, Kanishka Ukuwela & Senani Karunaratne

A systematic study on the herpetofauna of Menikdena archaeological reserve and arboretum at Dambulla (Intermediate zone) Sri Lanka, has been carried out from 14th March 1998 to 12th October 2001. The study was carried out during field visits of the Natural History Society of Trinity College and the Menikdena Archaeological Reserve & Arboretum Development Project of Trinity College, which is the only restoration project conducted by a secondary school in Sri Lanka. The survey revealed a rich and varied herpetofaunal diversity in the area, and effects of environmental discontinuities (ecotones) on the specie composition and abundance of herpetofaunal assemblage. This study also enabled to document the variation of herpetofaunal diversity associated with anthropogenic ecosystems and natural ecosystems, creating an awareness of the various threats faced by the herpetofauna of the area, and to propose further recommendations for their conservation. A total of 63 species were recorded in the survey with 20 (31.7%) endemic forms. 16 of the recorded species are listed as 'Nationally Threatened' in the 1999 IUCN list of Threatened Fauna and Flora of Sri Lanka. Some records are the first of the relevant species from the intermediate zone of the country.

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Molecular Phylogenetics and Evolution, 2001, 21(3): 398–407
Out of Asia: mitochondrial DNA evidence for an Oriental origin of Tiger Frogs, genus *Hoplobatrachus*
Joachim Kosuch, Miguel Vences, Alain Dubois, Annemarie Ohler & Wolfgang Bohme

Most examples of intercontinental dispersal events after the Miocene contact between Africa and Asia involve mammal lineages. Among amphibians, a number of probably related groups are known from both continents, but their phylogenies are so far largely unresolved. To test the hypothesis of Miocene dispersal against a Mesozoic vicariance scenario in the context of Gondwana fragmentation, we analyzed fragments of the mitochondrial 16S rRNA gene (572 bp) in 40 specimens of 34 species of the anuran family Ranidae. Results corroborated the monophyly of tiger frogs (genus *Hoplobatrachus*), a genus with representatives in Africa and Asia. The African *H. occipitalis* was the sister group of the Asian *H. crassus, H. chinensis,* and *H. tigerinus. Hoplobatrachus* was placed in a clade also containing the Asian genera *Euphlyctis* and *Nannophrys.* Combined analysis of sequences of 16S and 12S rRNA genes (total 903 bp) in a reduced set of taxa corroborated the monophyly of the lineage containing these three genera and identified the Asian genus *Fejervarya* as its possible sister group. The fact that the African *H. occipitalis* is nested within an otherwise exclusively Asian clade indicates its probable Oriental origin. Rough molecular clock estimates did not contradict the assumption that the dispersal event took place in the Miocene. Our data further identified a similar molecular divergence between closely related Asian and African species of *Rana* (belonging to the section *Hylarana*), indicating that Neogene intercontinental dispersal also may have taken place in this group and possibly in rhacophorid treefrogs.

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Occasional publication of the Indian Society for Conservation Biology
A synopsis to the frog fauna of the Western Ghats, India
S.D. Biju

Literature survey indicates that more than 200 species of anurans are known from India. However, no serious attempts have been made to comprehensively study the amphibian fauna of this region. The Western Ghats of India, a global hotspot, constitutes one of the amphibian rich areas in tropical Asia.

Of the 206 species of anurans reported from India, 104 are known to occur in the Western Ghats. A seven-year field survey

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NEW DESCRIPTIONS - ABSTRACTS

Alytes, 2001, 19(2-4): 53-79.

A new genus and species of Ranidae (Amphibia, Anura) from south-western India

Alain Dubois, Annemarie Ohler & S.D. Biju

A new genus (*Minervarya*) and species (*M. sahyadris*)of Ranidae is described from Karnataka and Kerala in south-western India. The new genus appears to belong in the subfamily Dicroglossinae. It shares with the genus *Fejervarya* Bolkay, 1915 the presence of fejervaryan lines on both sides of the belly, but differs from the latter genus in several respects, particularly in possessing a rictal gland at the mouth commissure and a white horizontal band along the upper lip, two characters that are common in the Indian Raninae but otherwise absent in the Dicroglossinae. It appears to be the fifth genus/subgenus of Ranidae endemic of southern India.

Current Science, 2001, 80(7): 887-891

A new species of frog in the genus *Nyctibatrachus* (Anura: Ranidae) from Western Ghats, India

S.V. Krishnamurthy, A.H. Manjunatha Reddy & K.V. Gururaja

A new species of *Nyctibatrachus* (*N. hussaini*) is described from the Western Ghats part of Kudremukh National Park, Karnataka, South India. This torrent species is differentiated from all known species in the genus by its very large size (SVL: snout vent length range 52-84 mm), stout body, rough and highly wrinkled dorsum, presence of two prominent folds in the tympanic region, prominent vomerine teeth located horizontally on highly-elevated strong ridges situated far behind the choanae. Hindlimb is short, tibio-tarsal articulation reaching the tympanic region, tips of fingers and toes dilated into prominent discs with circum-marginal grooves. Prominent and highly developed tubercles equal to the size of their respective terminal phalangial discs are present. The new species is compared with closely related congeneric species (*N. humayuni*, *N. major* and *N. vasanthi*). It markedly differs in colouration, size of tubercles, length of the forelimb, hindlimb, foot and tibia (calculated as a percent of respective SVL) with a high degree of squared Euclidean dissimilarity.

Journal of South Asian Natural History, 2001, 5(2): 121-133

***Ramanella nagaoi*, a new tree-hole frog (Microhylidae) from southern Sri Lanka**

Kelum Manamendra-Arachchi & Rohan Pethiyagoda.

A fourth species of *Ramanella*, *R. nagaoi* sp. nov., is described from Sri Lanka. The new species is distinguished from *R. obscura* and *R. palmata* by the rudimentary (vs. well developed) webbing on its toes. It differs from *R. variegata* by its dark-brown (vs. white in *R. variegata*) belly; smaller eye diameter (30.6-34.6% of head length, vs, 38.0-41.9%); and greater internarial width (25.0-27.5% of head length, vs. 19.0-23.3%). The tadpole and vocalization of both sexes of the new species, which is known only from type locality, the Kanneliya Forest Reserve (6,025 ha, alt. ca. 150 m, 06º15'N, 80º20'E), near Galle, Sri Lanka, are described. Both metamorphs and tadpoles of *Ramanella nagaoi* were recorded only from tree hollows containing water in this small fragment of rain forest in southern Sri Lanka.

Journal of South Asian Natural History, 2001, 5(2): 191-199

***Polypedates fastigo*, a new tree frog (Ranidae: Rhacophorinae) from Sri Lanka**

Kelum Manamendra-Arachchi & Rohan Pethiyagoda

We describe *Polypedates fastigo* sp. nov., the fifth species in this genus to be reported from peninsular India and Sri Lanka. It is distinguished from all other *Polypedates* in this region except *P. longinasus* by its elongate head (head width 73.0-77.8% of head length, vs. 81.3-102.6% in *P. eques, P. cruciger* and *P. maculatus*) and its greater head length (41.5-44.5%, vs. 32.8-41.0% of SVL). It differs from *P. longinasus* by its greater orbit diameter (36.0-40.5% of head length, vs. 32.5-35.0%); its lesser eye-to-nostrill distance (26.8-29.3% of head length, vs. 32.8-33.3%); and lesser snout length(42.0-45.7% of head length, vs. 47.2-49.7%). Additionally *P. fastigo* differs from *P. eques* by having a black line on the lower flank, connecting the axilla and groin: in *P. eques* this is either absent or present only as a band of blackish dots. The new species is known only from a small patch of privately-owned forest adjacent to the Sinharaja World Heritage Site.

An examination of its holotype demonstrates that *Polypedates biscutiger* Peters, 1871 is in fact a synonym of P*. cruciger*.

S.D. Biju *... continued from last page*

and taxonomic study of anurans of this region resulted in collecting more than 200 species, about twice the above number. Published works have reported only 52 species of the Old World tree frogs from India (*Chirixalus*: 4, *Nyctixalus*:1, *Philautus*: 25, *Polypedates*: 5, *Rhacophorus*: 16 and *Theloderma*: 1) but the present study reveals that more than 100 'species' of this group are present in the Western Ghats alone. Four new genera and about 115 new species from the Western Ghats are still awaiting scientific identity. Most of them belong to the shrub frog genus, *Philautus* (Biju, unpublished data).

Field survey was conducted giving special attention to the breeding behaviour and reproductive biology. The life cycle of 31 species of anurans was studied; they include one species each of *Euphlyctis, Hoplobatrachus, Micrixalus, Microhyla, Minervarya*, two species of *Indirana*, three species of *Nyctibatrachus*, and 21 species of Rhacophorids/nes. Rhacophorids/nes studies include *Rhacophorus calcadenisis, R. lateralis, R. malabaricus, Polypedates maculates, P. pleurostictus, P. pseudocruciger*, four undescribed species of *Philautus*, two undescribed species of *Polypedates* and nine other undescribed species belonging to different genera in Rhacophoridae/nae.

Journal of South Asian Natural History, 1999, 4(1): 1-11.

South Asian Amphibia: a new frontier for taxonomists

Alain Dubois

Books reviewed:

Dutta, Sushil K. 1997. Amphibians of India and Sri Lanka (Checklist and bibliography). Bhubaneswar, India, Odyssey Publishing House, [i-iii] + 1-342 + I-xxii.

Dutta, Sushil K. & Manamendra-Arachchi, Kelum. 1996. The amphibian fauna of Sri Lanka. Colombo, Sri Lanka, Wildlife Heritage Trust of Sri Lanka, 1-232.

ABSTRACTS FROM THE FOURTH WORLD CONGRESS OF HERPETOLOGY

The Fourth World Congress of Herpetology, a mega-event in the herpetological world, was organised between 2-10 December 2001 at a beautiful beach resort in Bentota, Sri Lanka. Anslem de Silva, the Conference Director, Founder of Amphibian and Reptile Research Organisation of Sri Lanka, had made excellent arrangements. The symposium was affected by a few issues -- lack of expected number of participants (only 209 attended out of the 800 odd expected initially), the aftermath of September 11 and very few South Asian participants due to prohibitive costs. The report of the symposium will be published later. A selection of Abstracts from the symposium, relevant to the South Asian region, is printed here. The symposium will publish the proceedings, which can be ordered from Anslem at a later date.

Reproduction in captivity of four species of direct-developing frogs from Sri Lanka (Anura: Ranidae: Rhacophorinae: *Pseudophilautus*)

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The recent discovery of a remarkable radiation of more than 100 species of direct-developing tree frogs (Ranidae: Rhacophorinae: Pseudophilautus), together with the fact that 19th century museum collections together with data from recent surveys suggest that widespread extinctions have occurred, raise new concern for the conservation of Sri Lanka's Amphibia. With more than 100 species, *Pseudophilautus* dominates the island's anuran fauna. Although these frogs are ubiquitous in Sri Lanka's humid forests, their habitat has been reduced from ca. 15,000km^2 to less than 1,000km^2 during the past 150 years. Additionally, several species are restricted to fragments of forest <10 km^2. As such, further extinctions can be expected unless urgent measures are taken to conserve this unique fauna. Here we report for the first time, (an overview of) reproduction and development in captivity of four species of Sri Lankan direct-developing *Pseudophilautus* at the Wildlife Heritage Trust's breeding centre at Agarapatana, Sri Lanka (1,650m).

The frogs were all collected from the secondary forest surrounding the breeding centre. Sexes were maintained separately in 75x75x45 cm (wxdxh) glass terrariums provided with approx. 10cm deep soil substrate liberally scattered with leaf litter. Branchlets were provided for them to perch on, and water was sprayed frequently on the substrate so as to keep it palpably damp at all times. The frogs were fed mainly with wild-collected grasshoppers dusted with multivitamin powder. Male advertisement calls intensify with the onset of rains. On such occasions, whenever a gravid female was available, 2-3 males were introduced into her terrarium. On most such occasions, while the male continued to vocalize from its perch, no mating occurred. When mating did occur (N=22 clutches for the 4 species), the procedure was much the same. (a) The gravid female would approach and climb on to the male's perch, sometimes articulating a faint response call; (b) amplexus then takes place, and vocalization ceases; (c) the pair, still in amplexus, descend on to the substrate, where, (d) using her hands, the female excavates a 0.5-3.5cm deep hollow in which the eggs are subsequently deposited; (e) the male then disengages and leaves the female to mix the eggs in the damp soil and then cover them over with a 5-30 mm layer of soil. Stages d-e take 1-3.5hr, while a-e could take upwards of one day.

The transparent eggs were preserved in a 50/50 v/v mixture of 10% formaldehyde and 70% ethanol periodically during development, which took 35-54 days, depending on the species. Fully-formed froglets emerged from the egg, with or without the tail completely re-absorbed. They began to feed on termites once the yolk sac was completely absorbed, 7-9 days after emerging from the egg.

Development in the Sri Lankan species studied differs from that in *Eleutherodactylus coqui*, the only other endotroph for which there are published data, principally by the forlimbs being subdermal until well after the hindlimbs have emerged (Gosner stage 42 cf. Townsend stage C).

We acknowledge the Department of Wildlife Conservation Sri Lanka for permitting and part-funding of this study. The first author thanks the Durrell Wildlife Conservation Trust for a fellowship in 2000 on endangered species management.

Table 1. Clutch size and development period for the four species of *Pseudophilautus* reported in this study

	Ps. "tempo"	Ps. "gold-eye"	Ps. "anthro"	Ps. "fergie"
No. of clutches	13	7	1	1
No. of eggs/cluth	9-37	47-62	30	91
Devt. period (days)	39-45	35-44	54	43

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On the origin of South Asian ranid frogs

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The Ranidae (Anura, Amphibia), with about 1,000 species, form one of the largest amphibian (meta) families. Within this assemblage, various taxonomic classifications have been proposed and criticized on the basis of multiple phenotypic criteria. Similarly, although most authors agree on a Gondwanan (African) origin of Ranidae, the nature of the dispersal and/or vicariant event that have shaped their subsequent differentiation remains highly debated. Here we report on phylogenetic analyses of about 3kb of mitochondrial and nuclear DNA sequences from multiple lineages of Madagascan and Asian Ranidae. In agreement with several recent molecular studies, our analyses do not support a traditional grouping of ranids (i.e., according to ecomorphs) and reveal a number of convergent adaptive radiations. We demonstrate various occurrences of co-variation between larval and adult traits: i.e., adult and larval stages each evolved sets of characters which are not only convergent between independent lineages, but also allowed both developmental stages to invade the same adaptive zone (Bossuyt & Milinkovitch, 2000). These covariatons, that probably are the byproducts of independent selective pressures on larval and

adult characters, have strongly misled phylogenetic inference based on morphology. Using a molecular-clock independent approach for inferring dating information from molecular phylogenies, we also estimated divergence times of the major nodes in our phylogeny. These analyses indicate that multiple lineages of ranids originated on drifting India and survived Deccan Traps volcanism across the KT boundary (65 mya) on this subcontinent. The collision between the Indian and Eurasian plates was followed by out-of-India dispersal of three ranid lineages (Dicroglossinae, Rhacophorinae, Raninae) whereas three other lineages (*Micrixalus*, *Indirana*, *Nyctibatrachus*) probably never dispersed successfully out of the subcontinent and represent the current higher taxonomic level endemics of the Western Ghats of India (Bossuyt & Milinkovitch, 2001). The observation that the above mentioned subfamilies not endemic to India currently present a peak of biodiversity in the Oriental realm is compatible with India being the center of dispersal from which they colonized other parts of the world.

Bossuyt, F. & M.C. Milinkovitch (2000). Convergent adaptive radiations in Madagascan and Asian ranid frogs reveal co-variation between larval and adult traits. *Proceedings of the National Academy of Science USA* 97(12): 6585-6590

Bossuyt, F. & M.C. Milinkovitch (2001). Amphibians as indicators of early tertiary "out-of-India" dispersal of vertebrates. *Science* 292: 93-95.

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Northeast India is one of the biodiversity hotspot conservation sites of the world

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An attempt has been made to evaluate the amphibian fauna of this region. A total of 72 species so far been reported from all the states of northeastern India *viz*. (Assam, Meghalaya, Arunachal Pradesh, Manipur, Mizoram, Nagaland & Tripura) of which 28 species are known only from the original record. After Boulenger (1890) practically no comprehensive work has been carried out on the amphibian fauna of this region, except a number of stray papers. However, Chanda (1994) has published a detailed account of 54 species known from this region. In the present study attempt has been made to make an up-to-date account of the species so far known from different areas of northeastern India.

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A preliminary report on the amphibians found in Batticaloa, east coast of Sri Lanka

Meena Dharmaretnam and Vijitha Meiyalaghan

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Batticaloa (07^{0}43'N, 81^{0}42'E) is one of the site sampled under the survey conducted by the Wildlife Heritage Trust. They have reported three species belonging to Ranidae. We report here species belonging to Microhylidae, Rachophoridae, Bufonidae as well as Ranidae collected from Batticaloa. Species of Microhylidae are distributed near wetlands (lagoons and marshy areas). *Ramanella variegata* naturally found in rough barks of trees has found new habitats in cisterns and sink overflow holes in houses near marshy areas. They reproduce in the cisterns and sink overflow holes in houses near marshy areas. They reproduce in the cisterns and forage outside nocturnally. Species of Rhacophoridae are widely distributed in Batticaloa District in damp domestic sites. Species belonging to Ranidae are common in the freshwater streams and paddy fields in the westside of the Batticaloa Lagoon.

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Estimating extinction risk in amphibians: models versus reality in Crested Newt populations (*Triturus cristatus*)

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Population Viability Analysis (PVA) provides a tool for assessing the risk of extinction in threatened species, but has rarely been applied to amphibian populations. This may be because reliable demographic and environmental data are difficult to obtain for many amphibian species, and this makes the construction of meaningful predictive models problematical. We used existing life history data on the population biology of the Crested Newt (*Triturus cristatus*) to construct stochastic models of extinction risk in metapopulations suffering from various degrees of habitat fragmentation. We compared the predictions of these models to population persistence observed in the field. The models predicted that isolated populations have a high extinction risk. Although the extinction risk declines with increasing population size, even relatively large populations are more likely than not to go extinct over a 50 year period if they remain isolated. The risk of extinction is reduced in large metapopulations with low dispersal between patches, and in small metapopulations with high dispersal between patches. Out of 51 ponds surveyed in a fragmented landscape in Kent, 13 supported great Crested Newts. These 13 ponds were clustered into three groups, comprising four, three and six populations respectively. Multiple logistic regression showed that the presence or absence of Crested Newts was explained by a combination of habitat and isolation variables. Consequently, some ponds within the system have suitable aquatic and terrestrial habitat for supporting Crested Newt populations but are unable to do so because they are isolated. Field observations therefore confirm the predictions of the models that isolated populations have a low viability. Habitat management therefore needs to be combined with landscape management if viable populations of Crested Newts are to be maintained.

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Amphibian conservation: ecological characteristics and scientific globalisation

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Amphibian diversity and their threats are not uniformly distributed over latitudinal and altitudinal gradients. Biodiversity is concentrated in developing tropical countries, where loss of habitat through large-scale deforestation and anthropogenic development projects (ie. dam construction projects) are continuing at a rapid rate, particularly at low altitudes. These threats are compounded by unexplained declines recorded in high altitude populations where no direct anthropogenic impacts are evident. These declines have been associated with changing weather patterns, increased UV radiation and emerging diseases however there is no compelling explanation to date.

Conservation priorities on a regional scale should also consider the ecological characteristics of amphibians that may influence their survival. These include:

1. Altitudinal gradients of amphibian species diversity. We examined the altitudinal distribution of amphibians (see figure below) and found species richness is highest between 0 and 1,000m altitude. Deforestation rates in the remaining lowland

forests are higher than in montane regions severely threatening areas that contain the highest species richness.

2. Habitat Specialisation: threatened species are usually associated with specific vegetation types that are geographically restricted (eg. rainforest and coastal health communities). These species are often vulnerable to extinction due to loss of habitat and/or their restricted geographic range.

3. Breeding Habitat Specialisation: threatened amphibians breed in ephemeral ponds/wetlands, upland stream habitats or montane habitats (eg. alpine health) that are restricted in distribution.

4. Stream dwelling amphibians are directly influenced by activities in the upper catchment.

5. Unexplained declines in Australia, Spain and the Americas have been associated with low fecundity, stream-breeding amphibians and most reported from high altitude populations.

Combining these approaches, amphibian biologists should focus on (1) preserving remaining mid-low altitude (<1,000m asl) habitats, (2) identify and protect species associated with rare vegetation communities, (3) identify and protect species associated with restricted breeding habitats (eg. small isolated ephemeral ponds and wetlands), (4) plan for integrated catchment management ensuring the long-term protection of catchment integrity, riparian zones and connectivity of habitat fragments, and (5) monitoring low fecundity stream-breeding amphibians at high altitudes to detect population declines.

Scientific Globalisation. To date amphibian research has concentrated in developed countries with relatively low biodiversity, where large-scale habitat loss has occurred and only small protected areas remain (eg. USA, Australia, Europe). In contrast little research is executed in developing countries in tropical regions which contain the bulk of amphibian diversity. Scientific Globalisation is urgently required to address the lack of resources and scientific training in these countries. Herpetologists in developed countries should collaborate with colleagues in developing countries to provide resources and train future scientists.

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Amphibian declines: preventing the loss of species and population genetic diversity using cryobiology

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It is now generally accepted that there has been a major decline in amphibians in certain parts of the world over the last two decades. This decline has been particularly evident in Australia and parts of Central America. In Australia up to nine species may have become extinct, including the unique gastric brooding frogs in which larvae underwent development in the female parents stomach. As many as 20 more Australian species show signs of decline and regional disappearances. Although the causes of the decline are still poorly understood, a pathogenic Chytrid fungus is implicated in the decline of many species. Other suggested causes include various types of pollution, increased UV-B radiation associated with thinning of the ozone layer and linkage with climate change. What has been most disturbing is the loss of species from areas of pristine habitat. While it is recognized that understanding the causal mechanisms is desirable to mitigating adverse effects, some of the major postulated causes, if confirmed, are beyond short-term solutions. Irrespective of the causes, there are no clear actions which may be undertaken in the field to halt or reverse species declines.

In the face of the inevitable further loss of species and populations a pro-active program of risk assessment and implementation of contingency strategies is required. Consequently, a strong case can be made for the application of assisted reproductive technologies (ART), including the use of amphibian sperm cryopreservation, to conserve amphibian biological and genetic diversity. To optimize the benefits, amphibian ART would be applied to the management of small captive and wild populations and to the retrievable cryopreservation of amphibian cells (whether germ or somatic cells) which can generate functional organisms with full reproductive capacity. Ideally, as insurance against sudden population/species collapse there should be representative collections in frozen genome banks of all threatened/ declining species and populations.

Amphibian Embryo Cryopreservation: The ideal method of cryopreserving amphibians would be as embryos. Retrieving frozen embryos, would in most cases involve thawing the zygote or embryo and resuming growth and development. However, to our knowledge, there are no published studies of attempts to cryopreserve amphibian embryos, and there are technical reasons to believe the direct cryopreservation of ova, zygotes or whole early embryos may not be achieved in the near future. Attempts to cryopreserve fish embryos (which have similar large, yolky ova to amphibians) have proven unsuccessful after many years of research. Results from our laboratory of a variety of experiments on amphibian eggs, zygotes and embryos support this view.

Sperm Collection and Cryopreservation: Although the number of studies is small, there are now published studies to indicate the general feasibility of cryopreserving amphibian sperm with successful recovery of motility and fertilizing capacity. There are two major problems, which have to be overcome for amphibian sperm cryopreservation to be viable. First, a protocol is required for successfully freezing and thawing sperm. Second, a method of collection of sperm that does not involve killing the males. We have established a successful protocol for freezing amphibian sperm. The key features are the use of slow cooling rates (1°C/min to -8°C, then 3-5°C/min to -80°C), high concentrations of cryoprotectants i.e., DMSO or glycerol (15-20% v/v), and replacement of electrolytes with sugars (e.g., sucrose) to maintain a high diluent osmolality. Rapid cooling and low osmolality was found to be highly detrimental to sperm survival. This protocol works well on Bufo marinus and a range of Australian tree frogs.

(Hylidae) and to a lesser extent on ground frogs (Myobatrachidae). It is possible to collect and preserve amphibian sperm without killing the male, by the use of gonadotropins to induce spermiation. Using this approach we have achieved recovery of motility from several species.

Future uses of cryopreserved sperm: Because it is not possible to currently cryopreserve ova and embryos, this raises the question as to what useful contribution sperm cryopreservation on its own may make. One manipulation of the reproductive process, which is possible in the lower, but not in higher vertebrates, is androgenesis. This process, already shown to be successful in a number of fish species and one urodele, involves the fertilization of an enucleated donor egg. The resulting zygote is haploid, but is converted

to a diploid, either by various shock treatments, or introduction of a second sperm. One future direction of research would be to determine whether it is possible to use frozen sperm from one amphibian species to fertilize enucleated eggs from a sibling species. Such an approach, if successful, would allow species that have become extinct in the wild to be regenerated from frozen sperm only.

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Discovery of a remarkable radiation of direct - developing frogs in Sri Lanka

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With about 40 species recognized, the anuran fauna of Sri Lanka was, by the late 1980s, considered well known. A systematic exploration of the island begun in 1993 however, brought to light a large number of additional species. Here we report on the Ranidae - Rhacophorinae, which are represented on the island by a radiation of more than 100 species, most of them discovered through this study.

We compared sequences of c. 380 bp and c. 550 bp of mtDNA from parts of the 125 and 16S rRNA genes respectively for the 38 species of Sri Lankan rhacophorines from which viable tissue was obtained, with those of Indian and Southeast Asian rhacophorines. Phylogenetic inference was done by the Maximum Likelihood method using HKY85+ G+I substitution model with alpha shape parameter 0.53 and TS: TV = 3:4 and observed nucleotide frequencies. Material from all putative Asian rhacophorine genera was used for comparison: *Philautus*, *Chirixalus*, *Rhacophorus*, *Chiromantis*, *Polypedates*, *Theloderma* and *Buergeria*. The African ranids *Aglyptodactylus*, *Mantidactylus*, *Mantella* and *Boophis* were used as an outgroup to root the phylogenetic tree. Although four genera, all of which derive their identity from Southeast Asian type species, were hitherto recognised in Sri Lanka (*Philautus*, *Rhacophorus*, *Theloderma* and *Polypedates*) we find that all Sri Lankan rhacophorines belong to just two well-defined lineages: a foam-nesting genus of five species we assign to *Polypedates*, and a highly speciose, clearly monophyletic (bootstrap 99) radiation of terrestrial direct-developing species. The genus-name *Pseudophilautus* (Laurent, 1943) is available for the latter. We suspect that terrestrial direct development was the 'key evolutionary innovation' that led to this remarkable radiation of *Pseudophilautus*. It appears that direct-developing species have the potential to undergo rapid adaptive radiation in part through being independent of aquatic habitats, permitting their dispersal throughout the available expanse of humid-forest. The remarkable South and Central American radiation of the leptodactylid genus *Eleutherodatylus* too, may have had such a genesis. While two of the three Indian species of *Pseudophilautus*, *P. charius* and *P. signatus*, represent a sister group of the Sri Lankan clade, *P. wynaadensis* is nested firmly within it. This suggests dispersion has occurred both ways between southern India and Sri Lanka during the frequent connections that existed between the land masses until ca. 9,000 years BP. While dramatic declines in amphibian populations have been reported throughout the world, and several extinctions have occurred also in Sri Lanka during the past two centuries (probably because of habitat loss), we have failed to note any stresses on the population of Sri Lankan anurans, leading us to question whether direct-developers may be less at risk from the DAP syndrome than species dependent on aquatic habitats for larval development. We acknowledge the Department of Wildlife Conservation Sri Lanka forpermitting and part-funding of this study.

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Caecilian diversity in India with special reference to Western Ghats

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The audit of Caecilian biodiversity is far from a reality today. 21 species of Caecilians under 4 genera and 3 families so far known from India represents 13.65% of the 154 species of the group reported globally. As is known, Caecilians occur in moist tropics at lower and higher altitudes. Their sub-terranean habits lead one to believe that they are very rare. The taxonomy, phylogeny, ecology and biology of Indian Gymnophiona have a busy future. The species known today may be only a final total. We hardly know anything about the genetic diversity of this group.

On the 21 species of Cacilians under 4 genera recorded from India, 20 species and 3 genera are Indian endemics. 13 of these endemic species are confirmed to the Western Ghats, one of the 25 hot spots of the world. The majority of these species are restricted in their distribution to the Kerala part of Southern Western Ghats.

Distributional variations, relative abundance and ecological observations on the group and reasons necessitating their further explorations in India and Sri Lanka to assess their species diversity and relative abundance and to ensure their conservation are discussed. Further, emphasis is laid on the protection of their habitats and to asscertain the probable use of Caecilians as indicators of environmental quality.

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Looking at the burning issues of the endangered salamanders of the Himalayas, India

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The Himalayan newt *Tylototriton verrucosus* is the only member of the tailed amphibian in the Indian subcontinent. It is listed under the endangered category of the Indian Wildlife (Protection) Act of 1972. It has been reported from the high altitudes and cold climate of the Himalayan region. Inspite of being reported as early as 1907 from the Indian subcontinent there is very little in-depth and long term study from India. Most of the publications for the Indian species are confined only their distribution and patchy descriptions of their breeding pattern. Thus looking at the present status of the animals under the endangered species listed in the IUCN Red Data Book and the meager amount of information about the animal, an in-depth study of their habitat, ecology, population structure, breeding and behavioural biology was started from June 1998 with permission from the Chief Wildlife Warden of the state of West Bengal. For any in-depth study it is essential to have a clear picture about their distribution and number. Intensivesurvey was carried out in the Darjeeling district of West Bengal. Marshes, ponds, pools, shallow ditches and slow moving streams were searched during the warm ummer months, when the animals emerge from hiberanation and begin to arrive in their breeding habitat. 23 habitats in the Darjeeling district were selected after the pilot survey of June

1998. The survey was done by hand catching of adult animals and netting for juveniles. Once the habitats were selected, intensive survey was done during the summer months of 1999 and 2000. The habitat structure and number of animals present in each of the 23 habitats were recorded. To study the arrival and departure of the animals for breeding, ponds at Debrepani and Dungdungia were surveyed every week during breeding season. The survey records of 1999 and 2000 raises a very pertinent question - If the Indian salamanders were endangered, then how could alone in the Darjeeling district so many habitats with large number of animals identified? The field observations of the 2-year study clearly indicate that although the animals are known to be endangered but in reality it may not be endangered. Paradoxically the present endangered status does not encourage field or laboratory studies, resulting in little information about the biology of the Indian species. Being confined to cold climate and hilly terrain, the animals have long hibernation period with short active breeding period. Their limited duration of active and brief visibility, adds on to the belief that the animals are declining in number. At times this belief have led to the animals coining the name "Living Fossil". In neighbouring Nepal where the animals are also found in the Himalayan terrain have different colour morphs. These colour morphs have now been separated into distinct species. The Darjeeling district lying next to Nepal also shows such colour morphs. Would these then belong to the same species or different remains to be studied? Although the present observations are only for 2 years and that too confined to the Darjeeling district but it leads to very serious thoughts and will force the world herpetologists to take stock of the situation, review the present endangered status and formulate action plans for the Indian *Tylototriton verrucosus*.

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Effect of sex steroids on gonadal differentiation and sex reversal in the frog, *Rana curtipes*

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Rana curtipes is a bicoloured frog species that is endemic to Western ghats. It breeds in the streams of Western Ghats in which gonadal differentiation is of semidifferentiated type. In the present study we report the effect of sex steroids (T and E2) on gondal sex reversal and therefore sex ratio at metamorphosis in this frog. Tadpoles were treated with different doses of T and E2 during different stages of larval development for various time periods. The results indicate a dose dependent fashion of effect of these sex steroids on gonadal sex differentiation. Treatment of tadpoles with T and E2 at a dose of 50/L from stage 24-26 (before ovarian differentiation) and between stages 29-32 (before testicular differentiation) had no effect on sex reversal. But, the treatment with T and E2 at a dose of 50 /L from stage 25-45 (a stage prior to gonadal sex differentiation till metamorphosis) resulted in a significant deviation in the percentages of males to females at metamorphosis. Present investigation thus reveal the ability of sex steroids to transform the gonads in R. curtipes and that this effect results from the treatment of tadpoles from stage 25-45 but not during only stage of ovary and testis differentiation.

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Your contribution of articles, write-up, reports, project summary, abstracts etc for the next issue of FROG LEG (August 2002) is solicited. Write for amphibian conservation, studies and research in South Asia. You don't write, amphibians suffer!

A comparison of amphibian diversity in Kandyan home garden agro-ecosystems of central Sri Lanka

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Kandyan home gardens constitute an agro-ecosystem type that is unique to Central Sri Lanka. These home gardens consist of mixed vegetation types that are beneficial to humans, either as food or as timber. The vegetation exhibits vertical stratification, and affords adequate cover to the soil, preventing soil erosion. Most of these home gardens are contiguous with rice fields, which are a man-made temporary wetland ecosystem. The mixture of vegetation in Kandyan home gardens has contributed to a rich faunal diversity. The present study was intended to compare amphibian diversity associated with five Kandyan home gardens located at Ampitiya (500m a.s.l), in the Kandy District, which differed in cropping patterns, surrounding landscape and vegetation types. The survey extended from March to August 1999, covering a period of six months. Visual Encounter Studies [VES] were made by random visits during the study period, from 10.00 am to 01.00 pm in day time and during 6.30 pm to 7.30 pm in the evening at all 5 sites. Amphibians were documented in $50m^2$ plots, placed in random locations of each home garden. A total of 20 plots were surveyed in each site, during the study period. The status of five environmental and anthropogenic variables (vegetation, micro-habitats, surrounding land-use, disturbance and agro-chemical usage) associated with each home garden was assessed qualitatively. The data gathered was analyzed using ecological diversity indices.

Table 1. Species composition and relative abundance of amphibians associated with Kandyan Home Gardens

Species	Relative Abundance (%)
Bufo melanostictus	27.7
Ramanella obscura	03.6
Limnonectes limnocharis	21.9
Limnoectes corrugatus	05.1
Hoplobatrachus crassus	0.72
Euphlyctis cyanophylctis	09.5
Philutus hypomelas [E,T]	0.72
Philautus leucorhinus [E]	01.5
Philautus variabilis	12.4
Polypedatus cruciger [E,T]	8.02
Philutus (Kirtixalus) fergusonianus [E,T]	05.8
Ichthyophis glutinosus [E,T]	03.0

A total of 12 species of amphibians, belonging to 4 families were recorded from the kandyan home gardens surveyed (Table 1), and these represent approximately 20% of the amphibian species in Sri Lanka. The total included 7 endemic species, all of which are considered as nationally threatened. The Common House Toad - *Bufo melanostictus* was the most common species, followed by the Common Paddy Field Frog - *Limnonectes limnocharis*. Of the 5 home gardens surveyed, the one that exhibited the highest amphibian diversity had the highest vegetation composition and coverage, and lowest human related disturbance. Conversely, the home garden that showed the lowest amphibian diversity was poor in vegetation composition and coverage, had a high level of disturbance and also had a high level of agro-chemical inputs. This study enabled to document the variation of amphibian diversity associated with a man-made agro-ecosystem, and also understand the underlying causes for such variations.

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The evolution of courtship in salamanders of the Tylototritone/Echinotriton group

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In the majority of urodeles fertilisation is internal but sperm transfer is indirect, via a spermatophore which is deposited near the female. Courtship in salamandrid salamanders involves mating behaviours in which the male actively captures the female on its ventral surface (*Mertensiella*, *Salamandra*, *Chioglossa*, *Pleurodeles*, and *Tylototriton*), dorsal surface (*Notophthalmus* and *Taricha*) or tail (*Euproctus*). Capture of the female by the male is absent in other genera (*Triturus*, *Cynops*, *Paramesotriton*, *Neurergus*, *Pachytriton*), and absence of capture is considered the ancestral condition for Salamandrids. How these various behaviours have evolved is under debate, but the discussion is hampered by incomplete or absent ethograms for salamandrina, *Tylototriton* and *Echinotriton*. Our project focuses on the reproductive biology and sexual behaviour of species of the *Tylototriton*/ *Echinotriton* group. The poster presents a number of characteristic behaviour patterns in the courtship of *Tylototriton* and *Echinotriton*.

Courtship in *Tylototriton* probably shows both inter-and intra-specific variation. In *T. verrucosus*, for instance, ventral amplexus has been described, but also tail-fanning and spermatophore transfer without preceding capture of the female. Courtship and mating may take place in water (*T. verrucosus*, *T. Kweichowensis*, *T. taliangensis*) or also on land (*T. shanjing*). Eggs may be laid in water or also on land.

The courtship of *Echinotriton* takes place entirely on land. The courting pair moves round in circles, as is known in *Tylototriton* species, but at a much slower pace. During this manoeuvre the animals align their bodies in such a way that the female is led over the spermatophore. The male marks a trail by secreting a mucous substance from his cloaca. This thread of mucus probably serves the female as an orientation towards the spermatophore and may be an adaptation to mating in absolute darkness.

Provisional data suggest that in the *Tylototriton*/ *Enchinotriton* group, the courtship mode of ventral amplexus is a plastic behaviour pattern, limited to mating in water, whereas the absence of amplexus is related to mating on land. Further observations in the natural habitat and systematic, experimental study of courtship behaviour should provide detailed ethograms, which are needed to compare the behavioural repertoies of a larger group of taxa, and interpret the differences in a phylogenetic context.

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Observations on the larval biology and life history of the ranid frog *Nannophrys ceylonensis*

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Nannophrys ceylonensis is an endemic and threatened ranid frog species in Sri Lanka. The genus is unique to Sri Lanka in having semi-terrestrial tadpoles, which were first described and illustrated by Kirtisinghe (1958). Additional details were published by Clarke (1983), based solely on preserved tadpoles.

Nannophrys is found in several restricted locations in the lowland wet zone of Sri Lanka. Adults and tadpoles are found in similar habitats, i.e., on wet rock surfaces. Both Kirtisinghe and Clarke have identified adaptations of the tadpoles to semi-terrestrial life. These include a reduced tail fin, absence of spiracular and anal tubes, ventral mouth disc, mandibles that are laterally compressed to form a beak-like structure and stout hind limbs. Little, however, is known about the oviposition, egg and nest characteristics of anurans with semi-terrestrial tadpoles, including *Nannophrys*.

Here we present some preliminary observations of the life history of *Nannophrys ceylonensis* and compare those with the sympatric ranid *Limnonectes kirtisinghei*, which has a typical pond dwelling tadpole.

Larvae were collected from either exposed rock surfaces in streams or rock surfaces along road cuts. Two populations were observed in Labugama (150 m altitude), one in bodinagala (60 m) and one in Kithulgala (150 m) during December 2000-June 2001. Upon capture, the snout-vent length (SVL) and tail length (TL) of the tadpoles were measured, and the tadpoles were staged according to Gosner (1960). To determine an approximate growth pattern in wild populations, at least ten individuals from each location were measured at each stage. Following measurement, the tadpoles were released.

Moist rock surfaces, from water flow or seepage, were checked weekly for the presence of egg masses. When eggs were found, they were removed carefully and their diameter was measured.

We found a total of eight clutches. Two of these clutches were in deep crevices and could not be accessed. Mean clutch size was 26.3 with a range of 17-57. Mean egg diameter per clutch ranged from 4.5-5.0 mm. Five of the six clutches were guarded by a female. One female laid three clutches, over nine weeks, producing smaller eggs each time. Males were also occasionally found near eggs. Temperature and relative humidity at the sites varied between 27-30 C and 77-84% respectively.

Part of each clutch was removed and transported to the laboratory. The eggs were pigmented and surrounded by a gelatin-like covering (mean thickness of covering, 1.1 +-0.1 mm). In the lab, the larvae hatched at stage 21 with external gills. The mean SVL and TL of hatchlings was 3.7 +- 0.2 mm and 6.8 +- 0.3 mm respectively.

For the tadpoles measured in the field, SVL and TL data were compared using ANOVA to see whether there were differences in size between the wild populations. There was no significant difference in growth of tadpoles among the four field population (SVL and TL, $P>0.05$). Since we could not maintain natural food and temperature regimes for larvae raised in the laboratory, they were not compared with the wild populations in the statistical analysis.

However, the pattern of growth was similar in the wild populations and in the lab population. The greatest increase in SVL and TL was observed at stages 40 and 25-26 respectively. The absorption of the tail began between stages 38-40. We have observed some differences in growth compared to *Limnonectes kirtisinghei* larvae, which hatch at stage 15. The greatest increase in the SVL to *L. kirtisinghei* tadpoles was observed at stages 29-30 and in the TL it was at stages 27-28 (Wickramasinghe *et al.*, 2001). The Longest tail length was achieved at stage 40. Reabsorption of the tail began at stages 40-41. In *Limnonectes*, the tail: body ratio increased

from 0.46 (stage 19) to 1.6 (stage 40), whereas in *Nannophrys* the ratio was always >2 at all stages.

These results indicate that *N. ceylonensis* produce relatively large eggs in small clutches and hatch at a amore advanced stage compared to *L. kirtisinghei*. The development pattern for the tadpole differs from that of more typical aquatic larvae. Moreover, maternal care of the eggs is present.

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Comparison of the amphibian faunas of southern and South-East Asia

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The amphibian fauna of tropical and subtropical Asia is known to be among the most diverse on earth. Two regions are rather well marked in terms of geological history, vegetation and biota. Southern Asia as used here covers the Indian Subcontinent, defined as extending from the southern slopes of the Himalayas, south to the Indian Peninsula, and from the Balochistan highlands to the mountainous country of north-eastern India. It includes the countries of Bangladesh, Bhutan, mainland India, Maldives, Nepal, Pakistan and Sri Lanka. South-east Asia includes the mainland portion to the east of the Indian Subcontinent, from Myanmar, east through Indo-China and Indo-Malaya, including the islands situated on the Sunda Shelf, the Philippines and Sulawesi, but excluding those on the Sahul Shelf. Inger (1999) recorded approximately 650 nominal species from these two regions (although the manuscript went to press in 1994). Many additional taxa have since been recorded since, especially from the hill country of Sri Lanka, where intensive sampling has taken place. The present paper compares the amphibian fauna of southern and south-eastern Asia.

The fauna of both regions are composed of a widespread lowland fauna and a more restricted (including regional endemic) montane fauna. Taxa common to both regions include human commensals as well as species complexes that require taxonomic revision. A number of south-east Asian lineages show disjunct distribution in south Asia. which are considered relatively recent invasion and extinction of intervening populations due to climate change. South-east Asia, with a land area slightly larger than south Asia (4,489,496 sq km vs 4,073, 044 sq km) has a significantly larger amphibian fauna (445 vs 258 nominal species). The richness of the south-east Asian fauna is attributable to the rapid pace of evolution on islands and their emigration to the adjacent mainland, as opposed to the presumably low levels of speciation on the South Asian mainland.

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Amphibian name changes -- how comfortable are we?

Sanjay Molur

I have had some interesting discussions with field and laboratory amphibian biologists in India about the changes in amphibian taxonomy and nomenclature. "Taxonomic changes are understandable, but nomenclatural changes are too confusing and we do not agree to the recent changes in generic names. We feel Boulenger is the best and we prefer his names". This argument is good and if the International Committee of Zoological Nomenclature's diktat were to be followed to the letter, this argument could hold its own. However, only a few actually mind using the new changes, while most are not concerned what names they use, as long as the old name is refered to along with the new name at least once in the text.

This interesting debate is not restricted to amphibians. Groups as popular and widely studied as primates also suffer the same dilemma: biologists have the same grouse, and many hate taxonomists for that. I understand fully well the reasons given by a field biologist - - who can keep up with so many name changes? Look at our good old Indian Bull Frog, *Rana tigerina*. First, the specific name was misspelt and so corrected from *tigrina* to *tigerina*. Then the generic name of *Rana* replaced with *Occidozyga*, which was later replaced by *Euphlyctis* and finally now a more permanent(?) name of *Hoplobatrachus* has been retained. How many of us have the patience to read through all the literature pertaining to the changes, or the confidence to believe a particular taxonomist? And, to add to the confusion and disbelief, we also have other taxonomists writing against the proposed name changes. All valid stuff, but all too confusing too.

So, who do we follow? There are arguments for and against following the new changes, again both equally valid. One of the more common complaints by people who are constantly surprised by name changes is "... but we do not get the literature pertaining to the changes in names of amphibians found in our region. Most of the publications on taxonomic changes are published in expensive journals abroad or in foreign languages". A very valid point again. Is there no way out of this mess?

While preparing for the South Asian Primate Conservation Assessment and Management Plan (CAMP) workshop, I compiled a table of taxonomic differences between two taxonomists for primates of the region. I'll not go into the details of that, but what was surprising to most primatologists in the workshop was the fact that a species as common as the Common/Hanuman Langur is actually composed of 11 subspecies or 9 species, depending on the taxonomist you wish to follow. I'll include here a small portion of the text from Colin Groves in his book **Primate Taxonomy** (2001, Smithsonian Institution Press, 350pp.), where he addresses this particular issue of taxonomists and name changes vis-a-vis field biologists.

"*The relationship between taxonomy and nomenclature is often misunderstood. If systematics, in a sense, may be said to be a reflection of the real world, nomenclature (the naming of organisms) is a system invented by the human mind, to be of service in systematics. We may grumble about taxonomists "always changing the names," but there are two good reasons for doing so.*

Because of new discoveries or hypotheses about interrelationships, alterations in classifications are necessary. Taxonomy, like other fields of biology (ecology, ethology, physiology, genetics), is a dynamic science. Classifications

continued next page last column...

AMPHIBIAN HANDS-ON TRAINING WORKSHOP

The Declining Amphibian Populations Task Force – South Asia (DAPTF-SA), Kerala Agricultural University (KAU), Conservation International/Global Amphibian Specialist Group (CI/GASG), Friends of Rare Amphibians of the Western Ghats (FRAWG), Conservation Breeding Specialist Group – India (CBSG-I), Conservation Breeding Specialist Group – South Asia (CBSG-SA), Wildlife Information Liaison Development (WILD) Society and Zoo Outreach Organisation (ZOO) are happy to announce the second Hands-on Training workshop in amphibian field techniques, taxonomy and identification. The 4-day field techniques workshop will be held from the 24-28 June 2002 at the College of Forestry, Kerala Agricultural University, Vellanikkara Campus, Thrissur, Kerala.

The first hands-on training workshop was conducted in December 1998 at Kempholey Forest in Karnataka where we had a group of 35 participants. We had promised to organize this workshop last year at Assam and Dr. Saibal Sengupta had made all arrangements for the workshop. Unfortunately, we had to cancel at the last minute due to non-availability of funds and other problems. This year we are in a better position to organize the workshop but due to logistical problems we are yet again organizing it in southern India. The College of Forestry, Kerala Agricultural University has kindly come forward to be the host and co-organiser of the workshop.

Please note that this Hands-on Training workshop is held just before the Conservation Assessment and Management Plan and Global Amphibian Assessment (CAMP-GAA) workshop (pages 4 & 5, this issue), which is from 1-5 July 2002 at Coimbatore. The two workshops are different and this letter of invitation/nomination is for the hands-on training workshop only.

Since the hands-on workshop is to train field biologists in standard methods of amphibian field studies with some emphasis on field identification, taxonomy, pathology, calls, etc., it is best suited for students new to the field, or those who would want to improve their knowledge in the above subjects. The invitation, however, is going out to all amphibian network members. So, as there are limited seats available at the workshop (maximum 30) the participation interest form should be sent at the earliest.

Those of you who are attending the CAMP-GAA and want to attend the training workshop also, you are most welcome. Since Thrissur and Coimbatore are only 3 hours from each other, you will have two days (29/30 June) to visit areas in the region. You can come back for the CAMP-GAA workshop on 1 July. Those of you not interested in the hands-on workshop, or have limited time for only the CAMP-GAA workshop, please feel free to nominate your students or friends working on amphibians for this workshop. To help you prioritise between the two workshops, please see which condition applies best to you amongst these:

1. If you have field experience and information to contribute to the status and distribution of amphibians in South Asia, you should attend the CAMP-GAA workshop.
2. If you have the above experience and plenty of time and wish to learn techniques, you are most welcome to join the hands-on workshop also, but not at the cost of the CAMP-GAA workshop.
3. If you are just starting new, please join the hands-on training and not the CAMP-GAA.
4. If you are one of the many students working in a lab or with a team of amphibian biologists in an area, then please decide which one of your team members will attend the CAMP-GAA and which one the hands-on training.

Accommodation and food will be provided by the organisers, but travel will have to be borne by the participants. There is no travel support for the workshop or registration fee.

If you are interested in attending, please write to us for a participation form. Looking forward to seeing you at Thrissur and Coimbatore.

Sincerely,

Sanjay Molur
Co-chair DAPTF-SA, and on behalf of the Organising Committee

Organising Committee
Dr. Sushil Dutta, Mr. P.O. Nameer, Dr. Claude Gascon, Mr. Fred Swengel, Ms. Sally Walker, Mr. Sanjay Molur

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S. Molur ... continued from last page ...

are not engraved in stone, nor should they be; it is unfortunate that advances in the taxonomic field, unlike those in ecology and other disciplines, often require changing the names we give to species. If Callithrix pygmaea *turns out to reflect present-day understanding of the relationships of the pygmy marmoset more accurately than does* Cebuella pygmaea*, then it is annoying for a while (especially for a field-worker publishing on the species), but that is the way it must be, and the irritation felt by the field-worker will pass quickly. Indeed, new predictions, to be tested in the field, may well emerge from the reclassification.*

But, in addition, new discoveries about the way our predecessors played the nomenclature game can cause changes. The rules of nomenclature are as objective as any legal system; they were drawn up to make things easier for us, and on the whole they do. Where they do not, anyone may make an application to the International Commission on Zoological Nomenclature to suspend the rules in a given instance, and the case will then be judged on its merits".

While I appreciate concerns from both sides, my aim is to contribute to lessening the gap by circulating information, reprints, etc to all on the network. The responsibility also should be shouldered by you by supplying me and others with a copy of all recent publications (yours or others). Further, if you have concerns, please write them for this Newsletter.

frog leg

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