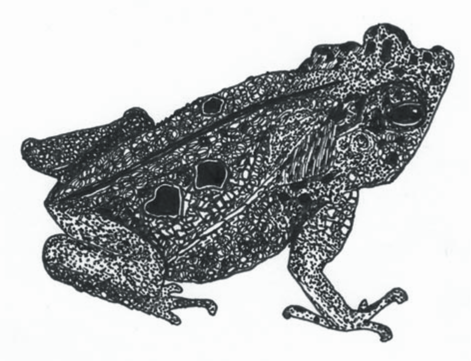


Bufo margaritifera by John Wilkinson

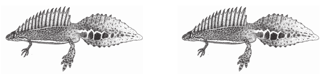
ISSN 1026-0269

FROGLOG

Newsletter of the Declining Amphibian Populations Task Force

February 2003, Number 55.

The Himalayan Newt (*Tylototriton verrucosus*), an Endangered Species of India



By Daniele Seglie & Prof. Debjani Roy, DAPTF Seed Grant Holders 2002

Tylototriton verrucosus is the only species of the order Caudata in the Indian subcontinent. It is reported from the mountainous region of southwest China, North Vietnam, Thailand, Burma, Bhutan, east Nepal and northeast India.

Although the Himalayan newt is listed under the endangered category of the India Wildlife (Protection) Act of 1972, the actual conservation status of this species has not been systematically investigated. The lack of precise knowledge on life history, morphology and distribution prevents the formulation of any long-term conservation action plan. To fill this information gap, Professor D. Roy and M. Mushahidunnabi conducted a survey in the Darjeeling District from 1998 to 2000 with assistance from WWF for Nature, India. During this period 23 habitats of *T. verrucosus* were identified.

In June 2002, under the permission of the Chief Wildlife Warden of the state of West Bengal, another intensive survey was conducted to examine the status of breeding sites and to evaluate the decline of this species, in order to formulate further action plans for the conservation of the animals. The study area covered during the survey of June 2002 was approximatively 800 km^2 in the Darjeeling District, West Bengal, India. The area is located on the Himalayan flanks in one of the biodiversity hotspots and wilderness areas identified by Conservation International.

T. verrucosus occurs in all the types of aquatic lentic habitats investigated - permanent ponds, swamps, rain puddles and artificial fishing ponds, but the majority of the breeding sites are temporary ponds with very low depth.

Despite the relative abundance of *T. verrucosus* in the area (as a matter of fact all the suitable sites examined are inhabited by the species), the habitats are disappearing at a dangerously rapid rate: about 30% of the sites found from 1998 to 2000 were destroyed before June 2002. The most common cause of destruction is the draining by local people for utilizing the land for cultivation. Furthermore, 50% of the remaining sites are under threat of destruction as a consequence of the development of tourist and economic activities in the area.

The India Wildlife (Protection) Act of 1972 only protects the animals against wildlife trafficking and does not prevent habitat loss. The Social Forestry Department of the Darjeeling Gorkha Hill Council has undertaken some initiatives to preserve the habitats of the Himalayan newt (like periodical surveys of some of the breeding ponds) but, due to the lack of funds, these actions aren't sufficient to grant a long-term protection of the sites.

From the observations collected during the survey evidencing a rapid population decline, we suggest to insert *T. verrucosus* in the Red List of IUCN. Furthermore, the focusing of international attention on the conservation problems of this species will help the local conservation organisations and authorities to get funds for the protection of the breeding sites.

Recommendations for future conservation plans include:

-To insert *T. verrucosus* in the IUCN Red List to focus the attention of National and International organisations on the conservation of this species.
-To guide the local authorities in the protection of the threatened sites in the Darjeeling District.
-To plan interventions of pond restorations.
-To collect data in the regions where presence of this species is argued or anecdotally reported (Sikkim, Arunachal Pradesh, Meghalaya, Manipur). Reliable data on the extent of occurrence and area of occupancy of the Himalayan newt will allow assessment of the risk of extinction in the whole Indian territory.
-To collect data on life history, biology and population structure in the Indian Himalayan region to better plan the long-term conservation of *T. verrucosus.*

Acknowledgements.
We thank Prof. C. Giacoma for valuable suggestions and opinions. Our best thanks to Mr. Bijoy Tamang, for field assistance, and to his family for hearty hospitality.

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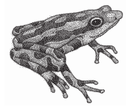

Pathogens and Amphibian Declines

By James P. Collins

Emerging infectious diseases, especially those caused by fungi (chytrids) and viruses (ranaviruses), are among the suspected causes of amphibian declines. In 1998 an international team developed a research program that integrated disciplines from molecular biology to global change to address the question: Why are pathogens causing some amphibian population to decline, even to extinction? Two grants from the U.S. National Science Foundation's (NSF) Integrated Research Challenges in Environmental Biology (IRCEB) program have funded the collaborative research projects of 26 principal investigators plus their graduate students and postdoctoral associates. Alliances have also been forged with other investigators funded through a joint NSF/National Institutes of Health program for the Ecology of Infectious Diseases and another NSF-funded program, Research and Analysis Network for Neotropical Amphibians (RANA).

In many populations, hosts and pathogens coexist and each shows regular increases and decreases in population size. At times, however, a pathogen nearly or completely decimates its host population. Our first grant ("Host-pathogen biology and the global decline of amphibians," 1999-2002) tested the basic mechanisms underlying each of these patterns using amphibians as a model. The leading questions were: How do pathogens influence host population dynamics? Are these newly introduced pathogens, or has the virulence of historically benign amphibian associates changed? Have recent environmental changes altered amphibian-pathogen interactions? The team of molecular biologists, immunologists, pathologists, population ecologists and epidemiologists is using experiments and observations in the field and laboratory to answer these and related questions. Partially because of the different roles they apparently play in declines, we initially hypothesized that ranaviruses have an older relationship with amphibians, but that chytrids have recently evolved pathogenicity or are newly introduced. However, ranavirus and chytrid phylogeographic analyses both suggest recent and possibly anthropogenic spread. Thus, we consider both ranaviruses and the chytrid fungus *Batrachochytrium dendrobatidis* emergent amphibian pathogens. The complete genetic sequence of *Ambystoma tigrinum* virus is now completed, opening the possibility of searching the genome for pathogenesis genes.

A second research award ("Emerging wildlife diseases: Threats to amphibian biodiversity," 2002 – 2005) was made recently. It builds on projects in the first grant to test how extinction, disease, and environmental change are linked. Do novel, highly virulent pathogens increase the chance of extinction? Does the health of the host change the risk of infection? Are there environmental conditions that increase the likelihood that animals become ill? An expanded international team will continue using experiments and observations in the field and laboratory to answer these and related questions. Modeling is a central element of the new award that will enhance our ability to integrate diverse biological sub-disciplines.

We welcome collaborations with other investigators studying pathogens and amphibians. Our experience is that researchers and students derive great benefits from being part of a larger set of interactions. It also seems clear that, in addition to the efforts of individual investigators, we need interdisciplinary research and training strategies for analyzing the declining amphibian problem in an integrated way. Our webpage address is: **http://lifesciences.asu.edu/irceb/amphibians/**

Zimbabwe's Fast Track Land Re-Settlement and its Impact on Amphibians

From a correspondent in Zimbabwe

Zimbabwe's fast track land re-settlement programme has received considerable world attention, mainly because of its impact on the human population involved. There has been, however, a considerable modification to the environment which has impacted all life forms, including amphibians. Indigenous forest is being destroyed at an alarming rate. Uncontrolled fires have burnt out a high percentage of the former commercial farming areas. Where ploughing is taking place, little consideration is being taken of soil conservation practices. Stream bank cultivation, formerly illegal, is now widespread. As most grazing has been destroyed by fire, serious overgrazing of what grassland remains is commonplace.

All of these factors will inevitably lead to soil moisture deficits, excess run-off of rain water, siltation of rivers and dams, diminished water tables and progressive desertification. This is bound to adversely affect amphibian populations.

For a number of years, a population of *Bufo fenhouloti* (a toad with a specialised habitat requirement) has been observed. This particular population occurred on an isolated, large granite outcrop on a former commercial farm. They breed in seepage water from "sponges" of vegetation growing in hollows and crevices in the rocks. Due to excessive grazing pressure these sponges are rapidly being destroyed and less and less seepage is occurring. Trees growing in cracks in the rocks are being cut down for firewood which, again, alters the rainfall infiltration and increases runoff.

Due to aggressive new settlers, this site is no longer available to me but I would imagine that the situation is now worse than on my last visit.

All in all, this is a man-made disaster that will have a widespread and long-term impact on Zimbabwe's fragile environment and its amphibians.

Adaptive Cluster Sampling for Amphibians

By Lee-Ann C. Hayek & Ron Heyer, Smithsonian Institution

Although amphibian fieldwork sampling needs to be done according to what we know of statistical principles, we often wish our random selection had been in a better, more productive area. Field samples are often pitiably small in number or non-informative, yet we know the amphibians are out there, somewhere beyond the boundaries of our samples. Use of the techniques of Adaptive Cluster Sampling (ACS) is one way to enhance our catch or observations for certain types of sampling techniques. Below we describe the basics of this approach and give a reference for further information.

DEFINITION Adaptive Cluster Sampling (ACS) designs are statistical strategies for the selection of initial random (unrestricted or restricted) samples of plots, areas, transects, or traps that allow for inclusion of all relevant observations (animals, calls, signs) in the vicinity of the initial sample.

PURPOSE ACS increases sampling effectiveness by taking advantage of amphibian population characteristics, which you observe in your field sampling effort. ACS allows for a more accurate statistical estimate of the population parameters for animals that are patchily distributed in the habitat being sampled.

ADVANTAGES

1. In conventional amphibian field sampling, once the random selection has been made, the amphibian fieldworker is not allowed to look beyond the pre-determined boundaries of the samples or final population estimates will be biased (see Heyer et al., 1994, especially Chapters 2 and 6).

2. In cases where the amphibians are clearly more abundant outside of the sample area boundaries, any final estimate will be an underestimate. ACS allows boundaries to be extended when high density patches are discovered during the fieldwork. ACS thus provides for better estimates of population numbers.

3. ACS provides for more efficient, smaller variance, unbiased statistical estimates of population richness or mean density.

DISADVANTAGE

Because additional samples are added next to sampling units that have the target organisms, this technique will be reliable only for non-invasive techniques where organisms are not disturbed by the sampling procedure involved. Thus, large ground litter quadrat sampling would not be appropriate, as the clearing of leaf litter outside the randomly located quadrat perimeter would disturb the amphibians in that area. The technique could be adapted for large ground litter quadrat sampling by determining what the disturbance zone would be between two quadrats and then using that distance to separate "adjacent" quadrats. In such cases, it is absolutely critical to associate these modifications with the data so that other workers can replicate studies or compare results accordingly. The technique should work best for methods such as the small quadrat sampling technique for such species as terrestrial salamanders.

GENERAL DESIGN In the field, whenever an inventory object, or an unusually large number of such objects, is located within a sample plot, areas adjacent to the plot are searched. These new areas define neighborhoods, which may contain the target objects that can then be added to the initial sample and increase the accuracy (and decrease the variance) of population estimates.

METHOD

1. A statistical sample size and method is determined, which uses unrestricted or restricted (cluster, stratification, systematic) sampling. For example, determining transects, placing box plots etc. For convenience, let us discuss the placing of box plots along a gradient (looking for specimens in leaf litter).

2. A predefined condition is defined, for example (a) in any given sample, if one salamander is observed or found; *or* (b) in a given sample, if three or more amphibians and reptiles are seen.

3. When this predefined condition is not met we continue to our next sample.

4. If this condition obtains, say we found a number of salamanders in our plot, we lay the box as close as possible to or original placement spot, in four adjacent areas - above, below, and each of the sides in some ordered manner.

5. We continue laying the plots about the four sides of each and every sample plot that meets our condition (say that we find at least 1 salamander), until we find each of the four adjacent plots to be without any salamanders. We then continue with our original sampling plan, stopping to take additional samples whenever our condition is met.

6. In this way we have not only located a patch of observation but we have included them into the sample and made an attempt to avoid a severe underestimate.

7. The added plots are included in an ordered manner and thus become part of the statistical sample.

8. The final parameter estimates are unbiased and more accurate with lower variance than if the observed patchiness had been ignored.

EXAMPLE For illustrative purposes, we set up a 20 x 30 grid in which numbers representing individuals were distributed in three clusters. We summarize the results of this example here and explain the example in detail, including all steps in sampling and analysis of the data, on the DAPTF web site (**http://www.open.ac.uk/daptf/index.htm**).

Our example data set contained a total of 126 specimens. We first randomly sampled 10 quadrats (= grid cells). Only one of our quadrats had two individuals. The estimate under simple random sampling for these data gives an estimated total of six specimens.

We next used the adaptive cluster sampling technique for these same ten quadrats. One of the quadrats was in one of the three clusters of specimens. The adaptive cluster sampling estimate for these data gives an estimated total of 27 specimens.

We then increased our sample size to 20 random quadrats. The 20 random quadrats found one of the other clusters. Only two quadrats had a total of six specimens from the 20 random quadrats. The estimate under simple random sampling for these data gives an estimated total of 15 specimens.

The adaptive cluster sampling data yield an estimate of a total of 40 specimens.

If neighborhood overlaps are taken into statistical consideration, the adjusted adaptive cluster sampling estimate is 176 specimens.

RECOMMENDATIONS As can be seen from the above example, for patchily distributed amphibians, the adaptive cluster sampling technique performs better than the simple random sampling method, but only the neighborhood overlap adjustment of the adaptive cluster sampling method comes close to estimating the true number of individuals in the area of interest.

If the patches can be recognized before sampling takes place, then the best technique to use is the patch sampling technique (Heyer et al. 1994: 107-109).

If the patches cannot be recognized before sampling takes place, then the adaptive cluster sampling technique will do a better job than simple random sampling. However, the user must bear in mind that even the adaptive cluster sampling technique will seriously underestimate the population size of very patchily distributed organisms unless neighborhood overlap is taken into statistical consideration.

Standard random quadrat sampling is appropriate when the distribution of amphibians is not highly clumped in the area of interest.

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USGS Press Release, December 3rd 2002

Shedding Light on Amphibian Declines: New Research Finds That Ultraviolet Radiation May Not be a Factor in Amphibian Population Declines

Two reports published in a leading science journal cast doubt on the importance of ultraviolet-b radiation (UV-B) as a factor driving amphibian population declines. Scientists with the U.S. Geological Survey (USGS), the University of Washington, and the U.S. Environmental Protection Agency just released their research findings in the journal *Ecology*.

Because UV-B has been shown in field and laboratory experiments to cause deformities and increased mortality in amphibian embryos, some scientists have contended that increases in UV-B from thinning of atmospheric ozone have contributed to declines of frog populations worldwide. However, one of the shortcomings of this earlier research has been a lack of knowledge about the actual exposure of amphibians to UV-B in their natural habitats. The research presented in the journal *Ecology* sheds light on UV-B as a factor in amphibian declines.

According to USGS research ecologist Michael Adams, "This is only the second study to look at how the distribution of amphibians relates to potential UV-B exposure. Most previous studies only addressed physiological effects of UV-B but did not provide evidence that any negative effects translated into population losses."

Research by Adams and his colleagues showed that dissolved organic matter in the water absorbs UV-B in amphibian habitats and protects 85 percent of the amphibian habitats the researchers sampled.

This study sampled 136 potential amphibian breeding sites in the Olympic Mountains of Washington and the Cascade Mountains of Oregon and measured how well UV-B could penetrate the water. The levels of dissolved organic matter found in this study were high enough to protect the majority of amphibian populations from the levels of UV-B that are known to be harmful to amphibians.

The second study, which began in 1986, discussed the breeding behavior of boreal chorus frogs at a pond in the Front Range of the Rocky Mountains west of Fort Collins, Colorado. USGS researcher Stephen Corn and his colleagues observed that the timing of breeding depended on snow. In years with below average snow frogs bred in mid-May because the snow melted earlier, and in years with heavy snow accumulation breeding was delayed until mid to late June. These observations were combined with satellite-based estimates of UV-B. The scientists found that frogs breeding in May are exposed to less UV-B than frogs that breed in June.

Another study by scientists at Oregon State University had shown that boreal toad eggs developed in shallower water in years with low snow accumulation. Because penetration of UV-B in water diminishes with increased water depth, scientists in that study had suggested that toad embryos received greater UV-B exposure in low water years and that the UV-B exposure could be a factor in the species' decline.

"The results of our study suggest that the timing of breeding must also be taken into account, and that the earlier breeding after dry winters may alleviate some of the UV-B exposure resulting from shallower water," Corn said.

Biologists from the USGS are helping determine why amphibians are disappearing in the United States and across the globe. Research by these scientists and others has identified many deadly viral infections as well as the chytrid fungus as factors in some amphibian die-offs and population declines. Scientists are actively investigating a suit of hypotheses that could help explain these worldwide declines, including global change, contamination from pesticides and other chemicals, increased exposure to ultraviolet radiation due to ozone thinning, and the spread of non-native predators. Many biologists suspect that a combination of factors may be responsible.

Die-offs are of great concern because amphibians may be good barometers of significant environmental changes that may go initially undetected by humans. Amphibians, unlike people, breathe at least partly through their skin making them much more sensitive to environmental disturbances.

In 2000, the USGS initiated the Amphibian Research and Monitoring Initiative, a national effort to detect trends in amphibian populations and conduct research into causes of declines. This week scientists and collaborators are meeting at the San Diego Zoo to exchange information and plan activities for 2003.

Other contributors to the research published in *Ecology* include USGS scientists Erin Muths, Christopher Pearl and Bruce Bury; Wendy Palen and Daniel Schindler of the University of Washington; and Stephen Diamond of the U.S. Environmental Protection Agency.

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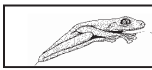

Froglog Shorts

DONATIONS We gratefully acknowledge receipt of these donations, received prior to January 17. **Individuals:** Kraig Adler, David P. Badger, Craig Bienz, Marilyn & Randy Blasus, Malcolm R. Braid, Bayard Brattstrom, Robert T. Brooks, Alan Byboth, Helene Cooper, Andrew J. Crawford, Elizabeth Davidson, Ted M. Davis, Kevin De Queiroz, Arthur C. Echternacht, Sandra Essbauer, Evan C. Evans, Robert Gunderman, Julian R. Harrison, Jane D. Hey, Ronald Humbert, Richard Hunnewell, Robert Inger, Jerry Johnson, Elizabeth Kaeding, Fred Kraus, Nancy Karraker, Beth E. Leuck, Michael Lodato, John McGrath, Karen Menczer, Richard Montanucci, John C. Murphy, Neiko Murphy, Richard Nord, Kelly O'Neill, Stephane Ostrowski, Thomas K. Pauley, F. Harvey Pough, A. Stanley Rand, Terri Roth, Rudolfo Ruibal, Anthony Russell, Richard D. Sage, David A. Saugey, Danna Schock, David M. Sever, Max Sparreboom, Albert Spencer, Raymond J. Stein, Glenn Stewart, Edward Styskel, Mills Tandy, Heather Brooke Taylor, Rodger Waldman, Peter R. Warmy, Richard Zweifel. **Institutions:** Center for North American Herpetology, Chicago Herpetological Society, Conservation International, Charles D. Sullivan Co. Inc., JETT, San Antonio Zoo.

Call for papers and registration for the Seventh Meeting of the DAPTF, **Southwestern U.S.** Working Group: March 10, 2003, Arizona-Sonora Desert Museum. Would all persons wishing to present papers relating to amphibian research in Arizona or New Mexico and/or wishing to attend the meeting, please e-mail **careng8@yahoo.com** for details. In addition, Partners in Amphibian and Reptile Conservation (PARC) will be holding an organizational meeting for the Arizona working group on March 11th, also at the Desert Museum.

RANA and the US National Science Foundation grant DEB-0130273 helped support the publication of this issue.

FROGLOG is the bi-monthly newsletter of the Declining Amphibian Populations Task Force. *Articles on any subject relevant to the understanding of amphibian declines should be sent to:*
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Funding for FROGLOG is underwritten by the Detroit Zoological Institute, P.O. Box 39, Royal Oak, MI 48068-0039, USA