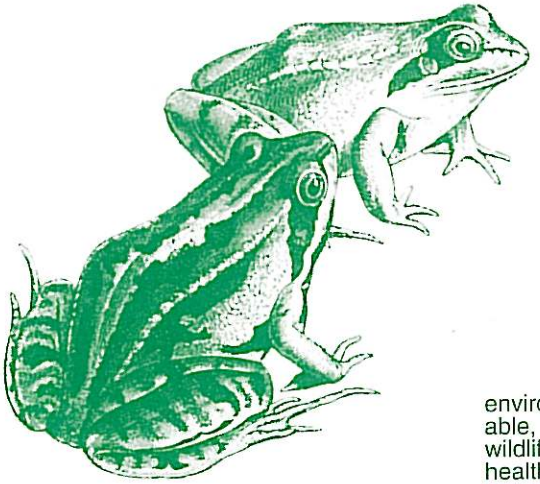

FROGLOG

IUCN/SSC Declining Amphibian Populations Task Force

March, 1993, No. 5

Coordinator's Column

D. Earl Green of the Maryland Department of Agriculture has replaced Elliott Jacobson as Chair of the Working Group on Disease and Pathology. Dr. Jacobson's academic responsibilities precluded his continuance. We are very fortunate to acquire a person with Dr. Green's expertise and commitment to the program, as evidenced by his contribution to this issue of FROGLOG.

Michael Lannoo succeeds Ronald Brandon to Chair our U.S. regional Working Group for the Central States. Dr. Brandon also encountered inflated commitments to other obligations that forced his resignation. Dr. Lannoo has been involved in monitoring amphibian populations for some years, most recently the resurvey of an assemblage previously studied by Frank Blanchard (see p.3).

Since the last issue of FROGLOG several other exceptionally qualified persons have been recruited to expand our international network of Working Groups. The names and addresses of these new chairs are presented on page 4.

Biomarkers In Wildlife

Biomarkers are physiological responses to environmental stressors that provide information about exposure and/or effects. Free-ranging wild animals are exposed to pollutants and other environmental stressors on a daily basis and integrate their responses through time. Additionally, they often are much more sensitive to disturbances in the environment than are humans. As such, they can serve as early warning indicators of environmental degradation. It is desirable, however, to assure preservation of wildlife species, that the monitoring of health and contaminant exposure utilize techniques that are nondestructive.

An international workshop was convened by the University of Siena, Italy, to discuss the state-of-the-art and future research directions for development of nondestructive biomarkers in vertebrates. Scientists from Britain, Spain, Italy, Denmark, France, and the U.S.A. attended the meeting, including a senior wildlife scientist from the EPA Corvallis laboratory. A report of the proceedings is being written with a target publication date of March 1993.

Salamanders Surprise Scientists

The California tiger salamander (*Ambystoma californiense*), a state species of special concern and candidate for federal listing has demonstrated some unexpected features in results obtained from studies by scientists at the Hastings National History Reservation; this according to a report published in the University of California Natural Reserve System, Transect, 1992, Vol. 10(2).

The species was once widespread in temporary ponds in the Central Valley and Inner Coast Range, but has been reported in decline for at least ten years. In the spring of 1990, Brad Shaffer (U.C. - Davis) initiated a survey of the species to determine its status. Salamanders were located in only 70 of 350 ponds sampled.

Dr. Shaffer and his colleagues are studying the genetics of specimens from various localities in an attempt to analyze population movements and speciation. In one pond more than 250 adults and 500 young of the year appeared; about ten times the projected number. For several weeks following breeding, the adults time after time went in and out of the pond, "perhaps to feed on land," while "the young left the pond continuously over a period of several months" rather than just after heavy rainstorms.

Preliminary results indicate populations experience many local extinctions and recolonizations, with frequent migrations from pond to pond. Shaffer has concluded that the practice of preserving a single pond may not prevent extinction of a population and that larger tracts, with interconnected pond systems, are essential as sources of recolonization.

Management of Amphibian Populations

Even the most current publications relating to wildlife management techniques essentially ignore the existence of amphibians. Reasons for this omission can be traced to the historical association of "wildlife" ecology with such agencies as departments of agriculture, and fish and game, that are primarily concerned with the management of species having more obvious economic and/or recreational importance.

A recent article on management of amphibian and reptile populations by Norman J. Scott, Jr., and Richard A. Seigel (1992. Wildlife 2001: Populations. Edited by D.R. McCullough and R.H. Barrett. Elsevier Science Publ., Ltd. Essex, England. pp. 343-367) presents a lucid analysis of the economic status and management strategies of herptile species, from which have been excerpted these data and policies relating to amphibians:

Scott and Seigel estimate the total value of amphibians imported to the U.S.A. in 1989 as specimens or products to be in excess of $25 million. Major hazards to frogs and toads include unregulated harvests and habitat destruction. Meat consumption is a primary threat to some, such as the giant salamanders of Japan and China (*Andrias* sp.). Frog legs (*Rana* sp.) are consumed at the rate of three to four thousand tons per year in France, most being shipped from Bangladesh and Indonesia. The U.S.A. imports between one and two thousand tons annually. An estimated total of 200 million pairs of frog legs of Asian species are consumed in the U.S.A., Europe and Australia.

Most management practices of amphibians have focused upon maintaining harvest quotas and captive rearing of rare and endangered species. The Federal Register of 1991 listed 10 frog and 9 salamander populations as being legally protected by the U.S. Endangered

Species Act of 1973, but with few exceptions have any endangered species been successfully managed.

Management research has been much affected by government policies, which in turn are influenced by regional or national political and economic conditions rather than biological concerns. Detailed ecological studies are needed for many species: the ranid frogs have been identified as one resource in critical need of attention.

Because amphibians are ectotherms ("cold-blooded") they differ (with reptiles) from other terrestrial animals. As a consequence of this important character, resource management practices may vary from those appropriate to birds and mammals (endotherms or "warm-blooded"). Ectotherms typically have a lower metabolic rate (10-20%), and a daily energy requirement of 3-4% compared to that of similar sized endotherms. Thus, by becoming inactive they can survive prolonged periods of unfavorable environmental conditions, doing without food, in some cases for years. Their net energy conversion may be as high as 98%; thirty-five times more efficient than in endotherms. The importance of amphibians and reptiles in the food web of most biological communities is seldom recognized.

There are other important biological considerations applicable to management practices for amphibian populations. They are often subject to wide fluctuation in the apparent densities of populations, both seasonally and over longer periods; thus monitoring population size for short periods is likely to produce biased data. The use of two distinct and distant habitats during breeding and non-breeding periods is also a common feature. Because of reduced parental care (only 10% of amphibian species) there is low survival among eggs and larvae of pond breeders (about 6%). Determining the causes of mortality at these stages is difficult but important to identifying the character of population declines. (See accompanying article in this issue by D. Earl Green.)

There is considerable variation in ages at which sexual maturity is attained: from 0.7 to 12.0 years in salamanders; 0.75 to 6.0 years in frogs and toads. Although longevity records range from 5 to 55 years for specimens in captivity, these spans are probably much less in nature.

Frequency of reproduction is also an important consideration. Whereas some salamanders in the temperate zones deposit a single egg clutch in alternate years, some tropical anurans reproduce several times a year.

Theoretical models have shown that certain ectotherms establish stable populations when predators are eliminated, and possibly maintain their reproductive rate while population sizes increase: these are characteristics not typical of birds and mammals.

Thus, the implications for management of amphibian species may require different plans than those typically applied to game species. Although the adults of frogs, toads and salamanders are more commercially valuable, it is the harvesting or exploitation of adults that should be regulated: eggs and larvae have very low survival rates, whereas adults tend to have a prolonged reproductive life.

Accurate estimates of population sizes in most amphibian species are often difficult to obtain, and adequate methods for monitoring of many species have yet to be developed.

Formulation of standardized inventory and monitoring procedures is urgently needed to permit comparison of data among different localities and groups, as well as over time. A group of scientists at the Smithsonian Institution and the U.S. Fish and Wildlife Service are now completing such a document. Such data are essential as management tools. However, many of the protocols are still untested and will necessarily require continued evaluation and refinement.

Amphibian Decline Symposium

The December, 1992, issue of the Journal of Herpetology, 26(4), includes the complete "Symposium: Amphibian Declines and Habitat Acidification," presented during the 1991 joint annual meetings of the Society for the Study of Amphibians and Reptiles, and Herpetologists' League, at The Pennsylvania State University. Edited by the co-conveners, William A. Dunson and Richard L. Wyman, the eleven articles by 20 authors provide information not only relevant to amphibian declines, but also of value in determing the importance of amphibian species as biological indicators of changes in ecosystems.

Canada's Monitoring Strategy

The DAPTF Canadian Working Group has published the proceedings of its 1991 workshop, "Declines in Canadian amphibian populations: designing a national monitoring strategy." This document (Occasional Paper No. 76 of the Canadian Wildlife Service, 1992, edited by Christine A. Bishop and Karen E. Pettit) includes the contributions of 31 investigators, organized into four parts: 1) Status of knowledge on amphibian populations in Canada; 2) Factors that affect amphibian survivorship in the context of a national monitoring strategy; 3) Monitoring amphibian populations; and 4) Recommendations.

For all Task Force Chairs and Coordinators this report may well serve as a model of organization and documentation. Copies can be obtained (without cost) by calling 819-953-1412, 819-997-1095 or writing, Publications, Canadian Wildlife Service, Environment Canada, Ottawa, Ontario K1A 0H3, Canada.

Diagnostics, Deaths and Declines

Dr. D. Earl Green, Chair of the DAPTF Working Group on Disease and Pathology, has provided the following summary of his more detailed report on "Diagnostic Assistance for Investigating Amphibian Declines and Mortalities." Copies of the expanded version are available from the Coordinator's Office upon request.

"When investigating a declining population or mass mortality event, eggs, larvae and adults should be sought as specimens. Animals may be normal, sick, dead and decomposed. Amphibians which appear sick in the field are probably critically ill; such animals can be expected to live for only a few minutes or few hours. The field investigator must decide whether to perform field dissections and collect organs for various diagnostic tests, or collect whole animals and submit them to a diagnostic laboratory. Animals should be divided into a minimum of five groups for various diagnostic and documentary evaluations.

These five categories are:

1) Voucher and electrophoretic specimens (live, sick or very recently dead animals); electrophoretic specimens should be purged of ingesta when possible and then frozen;

2) Blood tests (serology, hematology and serum chemistries) require live animals (normal and sick animals);

3) Necropsy, histology, cultures and other diagnostic tests submitted to a diagnostic laboratory (normal, sick and recently dead animals); avoid freezing carcasses intended for necropsy or histology; freezing is acceptable for most cultures; if live animals can be submitted to a diagnostic lab, then group #2 above may be omitted but be sure to specifically request collection of serum; for larger amphibians (over 50 grams) pieces of organs may more easily be collected in field dissections and appropriately preserved by freezing or immersion in formalin; swabs with self-contained transport media for bacterial and fungal cultures can be very helpful if field dissections are attempted; if it is not feasible to transport live animals to a diagnostic lab, then refrigerate carcasses on wet ice; if carcasses cannot be transported to a diagnostic lab within four to five days, then freeze some carcasses for cultures and place some carcasses immediately into formalin;

4) Parasite identification usually requires fixation of organisms (host carcasses or parasites) in 70% ethanol;

5) Toxicology (all life-stages and categories of carcasses are acceptable); freezing of tissues or carcasses is best;

soil samples may be collected into plastic bags and frozen; water samples or specimens for analysis for petroleum products (e.g., "oil spills") require the use of special containers - acid-cleaned, opaque glassware; if collecting water from a stream, consider collecting multiple samples at intervals upstream and downstream from the casualty site.

Optimal usefulness of animals and carcasses for various diagnostic tests can be summarized as follows:

1) Normal (healthy-appearing) live animals: vouchers, serology, and all other diagnostic tests.

2) Sick live animals: serology, bacteria cultures, fungus cultures, protozoology, virus cultures, necropsy, histology, toxicology.

3) Recently dead (no evidence of decomposition) animals: necropsy, histology, virus cultures, parasitology, toxicology.

4) Decomposed carcasses: toxicology, very limited histology.

5) Frozen carcasses:
If animal was euthanized: bacteria cultures, fungus cultures, virus cultures, some parasitology, toxicology.
If found dead: virus cultures, some parasitology, toxicology.

6) Refrigerated carcasses:
If animal was euthanized: necropsy, histology, virus cultures, some protozoology, parasitology, toxicology.
If found dead: necropsy, histology, parasitology, toxicology, possibly virus cultures.

7) Eggs: vouchers, toxicology, histology, protozoology, possibly bacteria cultures, possibly fungus cultures, possibly virus cultures."

Seventy Year Redux

Seventy years after Frank Blanchard's study of the amphibians and reptiles of Dickinson Co., Iowa (1923. Univ. Iowa Studies in Nat. Hist. 10:19-26), Michael J. Lannoo, Kenneth Lang, Tim Waltz and Gary Phillips resurveyed the region. Five species reported by Blanchard persist: the eastern tiger salamander (*Ambystoma t. tigrinum*), American toad (*Bufo americanus*), western chorus frog (*Pseudacris t. triseriata*), gray treefrog (*Hyla versicolor*), and the northern leopard frog (*Rana p. pipiens*). Two species reported by Blanchard were not collected: the mudpuppy (*Necturus maculosus*) and ironically, Blanchard's cricket frog (*Acris crepitans blanchardi*). Two species not collected by Blanchard were found: the Great Plains toad (*Bufo cognatus*) and the bullfrog (*Rana catesbeiana*). The plains toad probably has migrated into Dickinson Co. from the west. The bullfrog was introduced by state fisheries biologists. From descriptions of the turn-of-the-century commercial "frogging" industry in Dickinson Co., Lannoo and his colleagues estimate that the number of leopard frogs has declined by at least two, and probably three, orders of magnitude, reflecting the loss of wetland habitat. Most of the remaining wetlands in this county are now protected. In their opinion, the most immediate threat to the existing populations of native amphibians comes from the impact of the introduced bullfrog. This project marks the beginning of a continuous program of amphibian monitoring in the region.

Peruvian Populations Studied

Dr. Lily O. Rodriguez recently published the results of her 13 month field study on anuran populations in Amazonian Peru, comparing inhabitants of a floodplain with those in an upland forest [1992. Structure et organisation du peuplement d'anoures de Cocha Cashu, Parc National Manu, Amazonie Péruvienne. Rev. Ecol. (Terre Vie). Vol.47:151-197.].

The combined assemblage was represented by 81 species, 26 genera and five families. A majority of diurnal species occured in the upland forest, though each of the two habitats had 20 terrestrial species and 12 food specialists (primarily ant eaters). Relative abundance curves for both habitats were much the same; however, these curves differed for the shared species.

Most species were small, although snout-vent lengths ranged from 13.5 mm (*Eleutherodactylus* cf. *carvalhoi*) to 136 mm (*Leptodactylus pentadactylus*): 80% weighed in at less than 10 g.

No one species represented more than 15% of the relative abundance in either habitat, nor were there significant differences when the numbers of species were grouped by reproductive mode. But when the relative abundances of individuals were arranged by modes of reproduction, meaningful distinctions were noted among all species other than those depositing egg masses on vegetation overhanging water, and those building terrestrial foam nests without free larvae.

In a comparison between the Cocha Cashu floodplain and Santa Cecilia, Ecuador (87 anuran species), no differences in number of species by reproductive mode could be detected. But (except for dendrobatids) all relative abundances of individuals by mode of reproduction were different between these two locations.

Density estimates obtained by censusing of calling males and sampling of forest litter plots did not coincide. Forest plots exhibited an uneven distribution pattern in which the estimates, though similar to other Amazonian sites, were lower than those for Central America. Most species were observed in transect studies. Pit-falls proved successful in trapping nocturnal, terrestrial species. None of the methods used here to estimate diversity and density were adequate to sample the entire assemblage.

Local climatic conditions were not the only factors contributing to anuran species diversity in the tropical rainforests. The importance of historical events and especially of riverine dynamics on heterogeneity in the Upper Amazon was stressed.

Dr. Rodriguez is with the Museo de Historia Natural, Universidad Nacional Mayor de San Marcos, Lima, Perú.

A Word on Awards

Since our announcements of funding opportunities (see FROGLOG Nos. 2 and 3) we have received numerous applications for Task Force Seed Grant support as well as inquiries regarding other programs, particularly those administered by the U.S.A. National Science Foundation.

Two Seed Grants have been recently awarded. Dr. Cynthia Carey of the University of Colorado at Boulder, Colorado, U.S.A., has been awarded $1,000 for support of her research on the "Role of Disease and Environmental Stress on Amphibian Declines and Extinctions." Dr. Sergius Kuzmin of the Russian Academy of Sciences in Moscow, is a DAPTF Director and Organizational Chair for the Commonwealth of Independent States. He has been awarded $1,000 to assist in the difficult task of organizing and activating a communications network among the numerous Coordinators in those states that comprised the former Soviet Union.

At present another 12 Seed Grant proposals are undergoing evaluation by DAPTF Directors; their final actions are pending. Several proposals have been returned without being reviewed for either of two reasons: the research project was not clearly defined or, more frequently, the budgetary requests exceeded the approximate $1,000 limit established by the Directors. A single waiver to this limit has been authorized: $3,000 is being contributed to the Smithsonian Institution to subsidize distribution costs for the soon to be issued "Measuring and Monitoring Biological Diversity: Standard Methods for Amphibians."

To those persons who are non-residents of the U.S.A. and who wish to be eligible for research support from the U.S.A. National Science Foundation, please pay particular attention to the following criterion: it is requisite that a person who is associated with a ***Non-Federal Government*** agency or institution in the U.S.A. be identified as the Principle Investigator or a Co-Principle Investigator for the proposal to qualify.

America's (*Sic*) Biodiversity Agenda

The U.S. Departments of Agriculture and Interior have released a joint report, "America's Biodiversity Strategy: Actions to Conserve Species and Habitats." The report outlines actions taken by the two departments to enhance biological diversity. Examples include (a) establishing specially protected areas or habitats on about 10% of the U.S. land mass; (b) special considerations for biodiversity on the 20% of the U.S. land mass owned by the Federal government; (c) reducing wetland conversion through conservation reserves, wetland reserves, "swampbuster," and similar programs; (d) acquiring sensitive lands; (e) restoring degraded habitats; (f) enacting laws and policies to conserve fish, wildlife, and plant species; and (g) *ex situ* conservation of species and germplasm in zoos, botanical gardens, and other off-site locations.

Although the report focuses on "set-asides," it recognizes that private landowners own the majority of the U.S. land mass and their involvement will be critical to the success of any conservation efforts. The authors also recognize that "the challenge is to conserve biological diversity consistent with human social and economic well-being." Although availability of the report is limited, a copy may be requested by writing: Director, Office of Program Analysis, U.S. Department of the Interior, 1849 C Street NW, Washington, DC 20240, U.S.A. For more information, contact: Dr. Ben Wigley at 803-656-0840.

Relict Ranges and Old-Growth Forests

Hartwell H. Welsh, Jr. reports on relict amphibians and old-growth forests in Conservation Biology (1990. Vol.4, No.3:309-319). Terrestrial and aquatic herpetofauna were sampled over a three-year period to examine the importance of forest age to herptiles. Fifty-four terrestrial and 39 aquatic sites in Douglas fir-dominated and mixed evergreen forest were located in southwestern Oregon and northwestern California. Mean ages of trees ranged from 30 to 560 years. Thirty one species of amphibians and reptiles were found in 93 localities.

Only three species occurred primarily at older forest sites: the Del Norte salamander (*Plethodon elongatus*), the Olympic salamander (*Rhyacotriton olympicus*), and the tailed frog (*Ascaphus truei*). Paleoecological evidence elucidates the historical association of these three amphibians and the extant elements of ancient primeval coniferous forests of the Pacific northwest. The life histories and habitat requirements of these species suggest that they are scarce in younger forests because of microclimate and microhabitat conditions they require generally exist only in older forests. The long term stability of these species in northern California and southern Oregon will depend upon developing forest practices that protect the critical environmental conditions.

ISSCA Publishes *Alytes*

The International Society for the Study and Conservation of Amphibians is a nonprofit organization that publishes the journal *Alytes*, featuring original studies in English, French, or Spanish. Subscription costs and membership are $54.00 for individuals and $108.00 for institutions. Address to J. P. Caldwell, Okla. Mus. Nat. Hist., University of Oklahoma, Norman, Oklahoma 73019, U.S.A.; in French francs to ISSCA, Laboratorie des Rept. et Amphib., Mus. nat'l. d'Hist. nat., 25 rue Cuvier, 75005, Paris, France.

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