The Glade

The Newsletter of the Missouri Chapter of the Society for Conservation Biology

Volume 1, Number 1 **October 1998**

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Editor's Corner

The Missouri Chapter of the Society for Conservation Biology (MOSCB) is now a reality! So far, over eighty-five people from across the state have expressed interest in joining the organization, and we anticipate this number growing with the circulation of the first edition of the newsletter (The Glade). Thanks to everyone for your interest and support.

MOSCB is only a fledgling organization and, as such, is still undefined in regards to many of its functions. Its main goal is to increase communication among conservation biologists throughout the state. However, it is not yet clear what steps we should take to reach this goal. It is now time to begin fleshing out the foundation that is now in place. There is a tremendous opportunity for creativity in developing this organization. Please get involved, whether it's by starting up a speaker series in your area, taking on a board position, or passing on word of MOSCB's existence to to others who may be interested.

In the process of putting together this first edition of The Glade, those of us involved were again reminded of why this organization is so direly needed. Looking over the newsletter, we realized that all of the authors are from the University of Missouri-Columbia, and that most of the announcements involve the Columbia/Jefferson City area. This was not intentional, but that's how it turned out. The reason for this is simple. We are from Columbia and this is who we know. Hopefully, through the creation of MOSCB, this will change and the network of people with whom each of us interact will continue to grow.

Announcements and Notes

♦ The results of the MOSCB board elections are:

President - Dr. Mary Ratnaswamy, Assistant Professor
Department of Fisheries and Wildlife, University of Missouri-Columbia, Columbia, MO

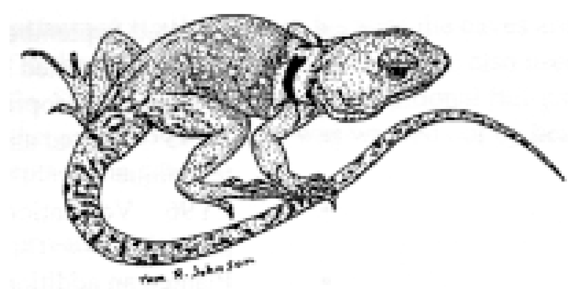
Vice President - Dr. Gerardo R. Camilo, Assistant Professor
Department of Biology, Saint Louis University, St. Louis, MO

Treasurer - Mark MacKay, Graduate Student
Department of Fisheries and Wildlife, University of Missouri-Columbia, Columbia, MO

Secretary - Dr. Kimberlie McCue, Conservation Biologist
Missouri Botanical Garden, St. Louis, MO

Communications Chair - Rich Pagen, Graduate Student
Department of Fisheries and Wildlife, University of Missouri-Columbia, Columbia, MO

Congratulations to the new board and thanks to everyone for participating in the election process.



♦ St. Louis University is starting an undergraduate conservation biology and applied ecology program. The first freshmen class will start in January, given that the first semester is identical for all biology majors. For more information, contact Gerardo Camilo (camilogr@SLU.EDU).

♦ December 28, 1998 will mark the 25th anniversary of the Endangered Species Act. MDC plans to hold events and activities which will carry on throughout 1999 across the state to commemorate this landmark piece of legislation. For more information, contact Carol Davit (573-751-4115, x874).

♦ The 1999 Missouri Natural Resources Conference will be held February 1-3. Visit the MNRC website for more information (http://www.conservation.state.mo.us/mnrc/mnrc99.html).

♦ The Conservation Forum will be held on October 6, 1998. This is the second annual forum of presentations and displays presented by leading St. Louis conservation organizations including Missouri Botanical Garden, Saint Louis Zoo, MO chapter of TNC, and the International Center for Tropical Ecology. The forum will be held on October 6 from 5-10pm at The Living World, St. Louis Zoo. Tickets are $7.50/person. For more information, contact Bernadette Dalton at UMSL (314-516-6203).

♦ The MOSCB web page can be used by members to advertise speakers or other events of interest to conservation biologists in the state. Send your announcements by email to Rich Pagen at moscb@showme.missouri.edu.

♦ If you are interested in writing an article or submitting an announcement for a future issue of The Glade, please contact Rich Pagen (address listed above).

♦ Please visit the MOSCB web page for more detailed information and announcements: http://www.missouri.edu/~moscb/index.html

Population Recovery Analysis

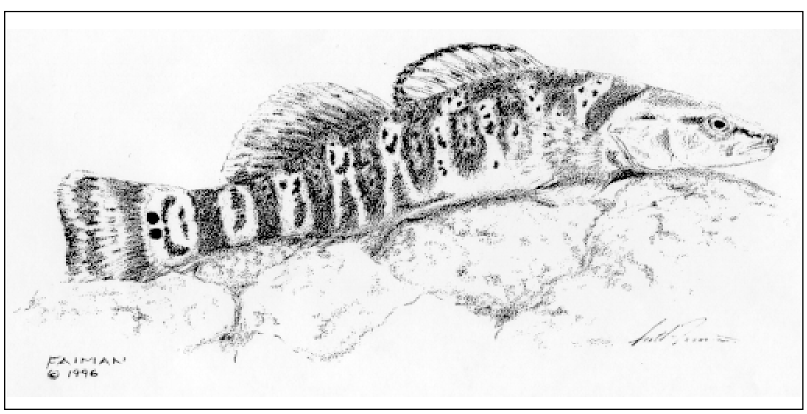
Mark R. Ryan, The School of Natural Resources, University of Missouri, Columbia, MO 65211 - Mark_Ryan@muccmail.missouri.edu

Concern about the conservation of endangered species has prompted the development of a substantial literature on the dynamics of small populations. Over the last 30 years, conservation biology produced important conceptual frameworks from which to understand population performance when numbers of individuals are small and declining. Gilpin and Soule (1986) articulated extinction vortices to help explain why, at low numbers, population decline could accelerate. Classic studies of population persistence (e.g., Shaffer 1983, 1985) resulted in quantitative formalization of the Minimum Viable Population (MVP) concept. The process of evaluating threats to the persistence of small or rapidly declining populations and the probability of persistence has been codified in Population Viability Analysis (PVA; see Soule 1987). The body of work on small population biology has contributed substantially to the conservation of endangered species. However, an essential element of the population dynamics of small populations has been largely neglected. The long-term conservation of many endangered species can be achieved only by increasing the size of their populations. I believe there are compelling reasons to study the behavior of small populations during the growth phase, and especially the effects of different management strategies on population dynamics. Such efforts will elucidate different risks to population persistence, and quantitative assessment of population management effects will make conservation expenditures more efficient. I refer to these more formal analyses of the recovery process as Population Recovery Analysis (PRA).

The lack of attention to the population recovery phase may result from assumptions that the behavior of a population is similar, regardless of whether trajectory is up or down. However, the recovery phase is likely to be very different from the decline phase. The reversal of population trajectory will be the result of two primary conditions: the relaxation of limiting factors actively depressing the population, and the proactive application of management to enhance population growth. Whereas the relaxation of limits may result in population growth that mirrors in the opposite direction the decline phase, many population characteristics will differ. For example, age structure of identically-sized, small populations will likely differ considerably during decline and growth phases. The presence of more individuals in young-aged cohorts during recovery will affect not only population growth rate, but vulnerability of the population to age-specific threats (e.g., pollutants, predation, disturbance), community interactions (e.g., competition with other rare species), and sensitivity to management actions. Even more significant will be the introduction of management actions and their unique, stochastic effects on population growth.

I believe the conservation of endangered species would greatly benefit from analyses that include quantitative evaluation of the limits to population growth under different management options and intensities, estimates of time to achieve recovery (which affect the probability of success) under different management scenarios, and even the feasibility of recovery.

The recovery process, when it is mostly a function of proactive management, will be highly dependent on inputs (money, labor, habitat manipulation, etc.). Designing optimal management solutions will increase efficiency of conservation efforts. Management efforts that do not produce population growth may be wasted conservation resources. Quantitative PRA can identify thresholds below or above which management effects on population growth are negligible. Such analyses can



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Arthropod Indicator Taxa and Scale of Observation

Jan Weaver, Division of Biological Sciences, University of Missouri-Columbia, Columbia, MO 65211 - weaver@biosci.mbp.missouri.edu

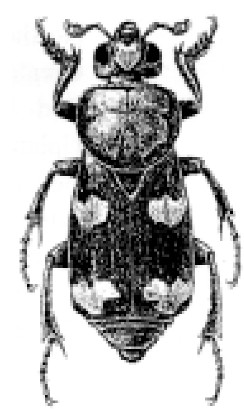
Arthropods, because of their small size and abundance, are good indicators of biodiversity. For example, richness of co-occurring taxa can be predicted from the richness of an indicator (Pearson 1992), priority (Oliver 1993), or target (Kremen 1994) taxon. Erwin (1982) based his estimate of 30,000,000 tropical arthropods on the assumption that beetles comprised 40% of described taxa. However, May (1992) warned that taxon relationships could vary in space, leading to uncertainty in richness estimates. One problem is that richness estimates are linked to areas of a particular size, so richness is dependent on scale of observation. If different taxa accumulate species at different rates as area increases, then relative richness of a taxon will vary with area size. To be useful, an indicator has to be independent of sample size (Noss 1990), so it is critical to measure the influence of scale on indicator taxa.

One test is to use a hierarchical design so that small scale richness estimates can be aggregated into larger scale estimates. I sampled leaf litter arthropods as part of the Missouri Ozark Forest Ecosystem Project (MOFEP), which was intended to examine logging effects on forest communities. Litter samples of 0.02 m^2 were nested within 5 x 5 m plots which were nested within stands ranging from 7.3 to 13.3 ha. By aggregating samples into plots, stands, and a total, arthropod taxon richness could be examined across several scales.

Leaf litter samples were collected June 1-8, 1992, and arthropods were extracted in a Tullgren funnel for two days at 40° C. In the laboratory, arthropods 0.02 mm and larger were identified to morphological species. I calculated relative richness of eight indicator taxa by dividing their average richness at a particular scale by that scale's average richness.

There were 355 morphological species identified from over 100,000 individuals collected. As scale increased from sample to total, mites and springtails decreased in relative richness. Spiders, adult beetles and thrips increased in relative richness (adult beetles increased so rapidly that they went from 4% of the species in a sample to 22% of total species). Ants and larval beetles increased at first but then leveled off, and larval flies remained constant across all scales of observation. The decrease in mite and springtail relative richness indicated the same species could be found everywhere, so new samples rarely added new species. For spiders, thrips, beetles (adults and larvae) and ants, increases in relative richness indicated different species in different places.

If relative richness is dependent on scale of observation, as this study suggests, it has major consequences for the use of indicator taxa. For example, if the total relative richness of beetle species from this study, 22%, is substituted for Erwin's (1982) choice of 40%, then the estimate of tropical arthropod species richness climbs from 30,000,000 to almost 50,000,000. Clearly, if indicator taxa are used, the effects of scale on estimates of richness will have to be considered.



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Membership Information

The goal of MOSCB is to promote communication among conservation biologists throughout the state of Missouri. Membership in MOSCB is free. Send your name, address, phone number and email address to:

moscb@showme.missouri.edu

or write to the address listed on page 8. Membership must be renewed annually. Membership expires on August 1 of each year.

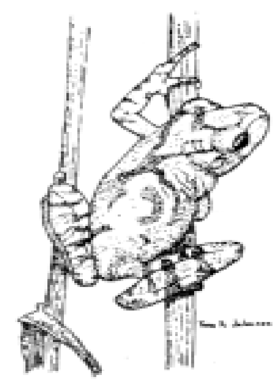
Are Small Isolated Wetlands Expendable?

Raymond D. Semlitsch and J. Russell Bodie, Division of Biological Sciences, University of Missouri-Columbia, Columbia, Missouri 65211 - rays@biosci.mbp.missouri.edu

New regulations drafted by the U.S. Army Corps of Engineers that reduce protection for “headwater” or “isolated” wetlands have sparked a controversy among environmentalists, academic scientists, other Federal agencies, and the Army Corps (Kaiser 1998). What is most evident in this debate is that small isolated wetlands will likely continue to be lost no matter what the outcome. Why is there a bias against protecting small isolated wetlands? The critical biological question is whether small wetlands are expendable, and the fundamental issue is the lack of biologically relevant data on the value of wetlands, especially so-called “isolated” wetlands of small size. Although the recently proposed legislation (U.S. Army Corps of Engineers draft proposal) actually reduces the threshold size for developing wetlands from 4.0 ha to 1.2 ha (via Nationwide Permit 26), we believe that both the current and proposed legislation are inadequate for maintaining biodiversity of wetland flora and fauna. We argue that small wetlands are extremely valuable for maintaining biodiversity in a number of plant, invertebrate, and vertebrate taxa (e.g. amphibians), and that the disappearence of small wetlands will cause a dire reduction in the ecological connectance among remaining species populations. We address briefly several issues in this essay that are critical to the debate over small wetlands (from Semlitsch & Bodie 1998): 1) the frequency and distribution of small wetlands, 2) the diversity of amphibians, and 3) changes in ecological connectance and metapopulation processes.

Determining the frequency distribution of wetland sizes more appropriately addresses the biological importance of individual wetlands than approaches concerned only with how the total area would be affected by the loss of large versus small wetlands. Our analysis of natural wetland abundance (GIS data from the Savannah River Ecology Laboratory) using isolated depression wetlands (N = 371) distributed on the southeastern Atlantic Coastal Plain as an example revealed that wetlands ranged in size from 0.22 (lower detection limit) to 78.2 ha, occurring at a density of 0.476 per km^2. The frequency distribution was highly skewed with many more small than large wetlands. In fact, 46.4% of the wetlands were 1.2 ha or less and 87.3% were 4.0 ha or less.

From an ecological perspective, small wetlands are crucial for maintaining regional biodiversity. For example, in a long-term study at a 0.5-ha Carolina bay on the Savannah River Site (SRS) (Semlitsch et al. 1996), one of the highest species diversities known for amphibians in this region was observed. This 16-year monitoring study at a small wetland known as Rainbow Bay has documented 27 species of anurans and caudates (Semlitsch et al. 1996). In addition, the study also recorded the breeding activity of 41,776 females and the production of 216,251 metamorphosing juveniles during the 16-year period. Monitoring studies of other small wetlands (.08-1.1 ha) for shorter periods of time on the SRS have yielded similar numbers of amphibians (18-22 species), thereby suggesting that the levels of species richness found at Rainbow Bay are not uncommon and are representative of small wetlands in the region.



The less-obvious consequence of losing small isolated wetlands lies in potential changes to the metapopulation dynamics of the remaining wetlands. There are two primary effects to consider (Gibbs 1993): 1) a reduction in the number or density of individuals dispersing and 2) an increase in dispersal distances among wetlands. The loss or alteration of any wetland, large or small, reduces the total number of sites at which pond-breeding amphibians can reproduce and successfully recruit juveniles into the breeding population. For amphibians, the loss of small wetlands especially may reduce the number of “source” populations because juvenile recruitment is higher at sites with intermediate hydroperiods that favor periodic drying characteristic of small wetlands (Pechmann et al. 1989). However, even at the best sites, reproductive failure in many years for nearly all species increases the probability of extinction (estimated annual reproductive failure rates 42-56% for 13 species; Semlitsch et al. 1996). Thus, the loss of small wetlands could be detrimental to rescue effects via a reduction in the population density and number of dispersing juveniles (contra Gibbs 1993).

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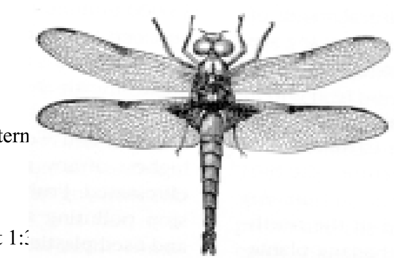
Small Wetlands (Continued from page 5)

To illustrate the second effect, we again use the example from the 371 depression wetlands on the SRS in South Carolina. We examined how the loss of individual wetlands affects the straight-line distance to the nearest wetland. The average distance to the nearest wetland directly affects the probability of migration and recolonization, and consequently, the chance of population rescue from extinction. It is also important to note that many pond-breeding salamanders, and possibly many anurans, are philopatric to natal ponds and do not emigrate long distances (most <200 m; Semlitsch 1998). In fact, an estimate of genetic-neighborhood size for wood frogs averages only 1126 m, suggesting that migration and gene flow are near zero at these distances (Berven & Grudzien 1990). From our example, we show that the loss of small wetlands would dramatically increase the nearest-wetland distance from the initial 471 m (including all 371 wetlands) to 666 m with the loss of all wetlands <1.2 ha (proposed protection threshold) and to 1633 m with the loss of all wetlands <4.0 ha (current protection threshold) in size.

We conclude that small isolated wetlands are not expendable if our goal is to maintain present levels of species biodiversity. This brief essay gives some of the details of why both current and proposed legislation are inadequate for maintaining regional wetland biodiversity in at least one important group of vertebrates, amphibians. This is especially disheartening in light of the many reports of declining amphibian populations world-wide, and in particular, because of habitat loss in the southeastern U. S. (Dodd 1997). At the very least, based on these data, regulations should protect wetlands as small as 0.2 ha until additional data are available to directly compare diversity across a range of wetland sizes. Furthermore, in order to protect ecological connectance and source-sink dynamics of species populations, we strongly advocate that wetland legislation focus not only on size but also on local and regional wetland distribution. For instance, a 1.0-ha wetland isolated by 1000 m may have more rather than less biological value than a 1.0-ha wetland with neighboring wetlands 100-200 m away. We hope that our comments stimulate new efforts into generalized areas of research that include analyses of how biodiversity relates to wetland size and spatial distribution, and how metapopulation processes are affected by the loss of wetlands, both large and small.



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U 0f MO-Columbia Conservation Biology Seminar Series

Sept. 10 - **Dr. Steve Chaplin**, Midwest Director of Science, The Nature Conservancy "Ecoregional-based conservation for Midwestern prairie systems"

Oct. 1 - **Dr. J. David Allan**, Dept. of Natural Resources, University of Michigan "The stream and its valley revisited: A landscape perspective on human impacts upon river systems"

Nov. 12 - **Dr. Edward DeFabo**, George Washington University Medical School "Impact of increased UV-B radiation due to stratospheric ozone depletion on the biosphere"

Dec. 10 - **Dr. Barbara S. Durrant**, Head, Reproductive Physiology Division, Center for Reproduction of Endangered Species, Zoological Society of San Diego "Sperm safari: reproductive physiology research at the San Diego Zoo"

Jan. 14 - **Dr. Cynthia Carey**, Department of Environmental, Population and Organismal Biology, University of Colorado "World-wide amphibian declines: Potential causal links"

Feb. 18 - **Dr. John Seidensticker**, National Zoological Park, Washington, D.C. "Tiger conservation in human dominated landscapes"

Mar. 11 - **Dr. Mary E. Power**, Department of Integrative Biology, University of California-Berkeley *to be announced*

Apr. 8 - **Dr. H. Ronald Pulliam**, Insitute of Ecology, University of Georgia, Athens *to be announced*

May 6 - **Dr. Malcolm L. Hunter, Jr.**, Department of Wildlife Ecology, University of Maine, Orono "Lessons from nature: Using ecosystem processes as models for managing natural resources"

All seminars take place at 4pm in 100 Stewart Hall on the U of MO-C campus

Recovery Analysis (Continued from page 3)

yield cost-benefit data predicting outcomes of management actions, identify optimal spatial or temporal application of management, and contribute to priority setting in conservation decision-making.

Population Recovery Analyses, although not explicitly labeled as such, have been done. Risk analyses and especially Maguire's (see 1997) decision analyses are, in some cases, forms of PRA. Ruggiero et al. (1994) presented a framework for PVA that included qualitative assessment of how reproduction and mortality were likely to be affected by management activities. Ryan et al. (1993) estimated time to reach established recovery goals for piping plovers (*Charadrius melodus*) based on how quickly proactive management was applied. They demonstrated that a 5-year delay in management to produce 1% population growth resulted in a 67-year delay in achieving recovery. Haig et al. (1993) conducted a genetics-based PVA for red-cockaded woodpeckers (*Picoides borealis*) and evaluated 2 translocation enhancement strategies for increasing the probability of population persistence. Recently, Roloff and Haufler (1997) proposed formal assessment of habitat potential for population viability planning.

I believe that changing the focus of study of small population biology from the decline phase to the growth phase will yield substantial insights into the dynamics of endangered species populations. Population Recovery Analyses will contribute greatly to more efficient, and hence successful, endangered species recovery efforts.

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Conservation Biology Program at the University of Missouri-Columbia

Background

The underlying goal of this program is to promote communication among individuals working in the area of conservation biology at the local, national, and international level, to enhance the education of graduate students in the field of conservation biology, and to stimulate research collaborations among local, state, national, and international groups in conservation biology.

Graduate Program

The program offers an area of specialization in conservation biology within existing Masters or Doctoral degree programs in any one of three academic departments at MU. Cooperation among faculty offers the unique opportunity for cross-training in a number of areas including population biology, ecological genetics, community ecology, ecotoxicology, restoration ecology, resource management, and agroeconomics. Our faculty represent three departments at MU (Biological Sciences, Fisheries & Wildlife, and Forestry) as well as numerous Federal and State agencies (U.S. Forest Service; Cooperative Fish and Wildlife Research Unit, U.S.G.S.; Ecological & Contaminants Research Center, U.S.G.S.; Missouri Department of Conservation Research Unit). In addition to receiving financial support through fellowships, scholarships, graduate research or teaching assistantships, we are able to offer Conservation Biology Summer Research Fellowships to a number of top students annually. These

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Graduate Program (Continued from page 3)

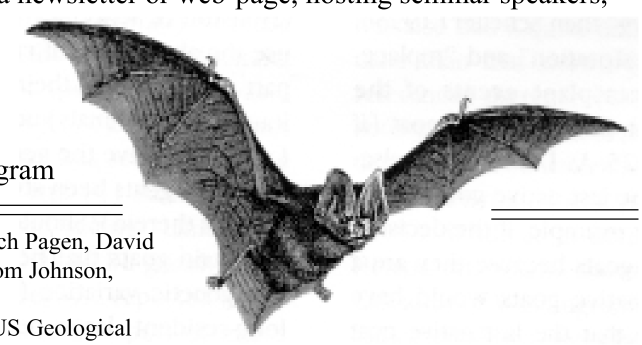
competitive fellowships are offered to facilitate field research at local or regional field sites, as well as international sites. For information about pursuing a graduate degree in the conservation biology program at MU, please visit our web page (http://www.missouri.edu/~conserv) or contact us at1-800-553-5698 or nemerich@biosci.mbp.missouri.edu.

General Membership

The Conservation Biology Program is seeking applications for general membership. The program is open to professionals in the Columbia area working in conservation biology. The program is designed to promote communication among members working on broad aspects of common problems in conservation thereby leading to new opportunities for research collaborations and graduate training. For more information regarding becoming a member, contact Ed Little (573-875-5399) or Mark Ryan (573-882-9425).

Your participation in this new program is vital to its success. We seek members across a broad range of disciplines that are dedicated to excellence and are willing to play an active role in processes such as mentoring graduate students, promoting intercommunications through a newsletter or web-page, hosting seminar speakers, planning symposia, and applying for extramural training grants. Please visit our web-page for more information (http://www. missouri.edu/~conserv).

-- Raymond D. Semlitsch, Chair, Conservation Biology Program



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