Web Summary Report

NCER Assistance Agreement Annual Report Summary

Period Covered by the Report: 2003
Date of Report: October 2003
EPA Agreement Number: R82941091-02
Title: Developmental Stability in Amphibians as a Biological Indicator of Chemical Contamination and Other Environmental Stressors
Investigators: Whiteman, Howard H., Loganathan, Bommanna G.
Institution: Murray State University
Research Category: EPA EPSCoR
Project Period: October , 2001 through September 30, 2004

Objective of Research: We proposed to evaluate the potential of using developmental stability as a biological indicator of anthropogenic and natural stress in amphibians. Amphibians are ideal biological indicators, because their semi-permeable epidermis and complex life cycle expose them to multiple stressors in both aquatic and terrestrial environments. Because of this, amphibians should be among the first vertebrates affected by anthropogenic stressors in either of these environments. Furthermore, some of the same stressors affecting amphibians are known to have negative effects on other species, including humans. Although we proposed to evaluate a wide range of possible stressors, a major thrust of this project is to correlate amphibian developmental stability with contaminant levels accumulated in their tissues. We hypothesized that amphibian developmental stability would decrease with increased levels of anthropogenic (contaminants, land use practices) and natural (population size and density) stressors. Our specific goals are to: (1) correlate the effects of environmental stressors with amphibian developmental stability; (2) evaluate the effect of species, life history stage, trophic level, and habitat type on measures of developmental stability; and (3) develop methods for separating the effects of anthropogenic and natural stressors.

Progress Summary/Accomplishments: In Year 2 of this grant, our research continued in earnest with the recruitment of a quality graduate student (Ms. Beth Kobylarz) concentrating on asymmetry analysis and a postdoctoral student working on contaminant analysis. Specifically, we processed two species of amphibians, bullfrogs and spotted salamanders for developmental stability; contaminant analysis is currently being conducted on these animals. We completed statistical analyses of our earlier asymmetry results and should have a manuscript submitted during Spring 2004 (see below). Three other graduate students have become involved in this project: Ms. Christy Meredith has conducted experiments on the effects of nitrate on amphibian development, completed her M.S. during Fall 2003, and will be submitting her work to Ecological Applications during Spring 2004. Ms. Jessica Boynton joined our group in Fall 2003, and with funding from the Kentucky Space Grant Consortium has been analyzing our developmental stability results from a GIS perspective. Most recently, Mr. I-Lun Chien has joined the project to complete the remaining contaminant analysis.

Publications/Presentations:

Publications:

Manuscript in preparation:

1. Loganathan, B.G. and H. H. Whiteman. PCB congeners and chlorinated pesticide concentrations in amphibians collected from western Kentucky. In preparation for Int. J. Anal. Chem.

2. Benson, A. R., Whiteman, H. H., J. B. Boynton, M. Dotson, and R. Cates. Developmental stability as an indicator of amphibian population health. In preparation for Conservation Biology.

3. Meredith, C. S. and H. H. Whiteman. Lethal and sublethal effects of nitrate on amphibian embryos and larvae. In preparation for Ecological Applications.

Presentations:

1. Whiteman, H. and Loganathan, B.G. 2002. EPA-EPSCoR Project Status. Presented at 8th Annual Kentucky EPSCoR Conference. October 20-21, 2002.

2. Loganathan, B.G. and Whiteman, H. 2002. PCB congeners and chlorinated pesticide concentrations in amphibians collected from western Kentucky. Poster presented at 8th Annual Kentucky EPSCoR Conference. October 20-21, 2002. Poster #: 14.

3. Whalen, M.M. and Loganathan, B.G. 2002. Immunomodulation of human natural killer cell cytotoxic function by triazine and carbamate pesticides. Poster presented at 8th Annual Kentucky EPSCoR Conference. October 20-21, 2002. Poster #: 15.

4. Boynton, J. and H. Whiteman. 2003. Utilization of remote sensing to model current and future threats to amphibian populations in western Kentucky. 10th Symposium on thee Natural History of Lower Tennessee and Cumberland River Valleys, Land Between the Lakes, March 21-22.

5. Boynton, J. and H. Whiteman. 2003. Using remote sensing and GIS to model habitat change and fragmentation in western Kentucky. Joint Meeting of Ichthyologists and Herpetologists, Manaus, Brazil, June 26-July 1.

6. Meredith, C. and H. Whiteman. 2003. Response of amphibian embryos and larvae to increasing nitrate concentrations: sublethal and lethal effects at levels found in agricultural run-off. Society for Conservation Biology, University of Minnesota-Duluth, June 29-July 2.

Future Activities: We are currently collecting larger numbers of bullfrog adults in an effort to correlate asymmetry with age, contamination level, and the presence of corticosterone, a known stress hormone. We are also currently collecting tissue samples of other species for contaminant processing, and completing the contaminant analysis.

Supplemental Keywords: amphibians, bioindicators, contaminants

Relevant Web Sites: http://www.mursuky.edu/qacd/cos/hbs/epaepscor-program.html