



Conserving The Nature of America

Assessing Pollutant Sensitivity of North Carolina's Threatened and Endangered Fishes

The U.S. Fish and Wildlife Service and partners are assessing the impacts of pollutants on North Carolina's federally-listed threatened and endangered fishes through captive propagation, toxicity testing, water quality monitoring, and risk assessment. The work examines protection afforded by water quality standards and develops new tools for water quality managers.

A significant milestone was recently attained with our cooperators' publication of toxicity data for the endangered Cape Fear shiner (*Notropis mekistocholas*), the threatened spotfin chub (*Hybopsis monacha*) and the endangered shortnose sturgeon (*Acipenser brevirostrum*). All papers* appeared in the journal ***Archives of Environmental Contamination and Toxicology (AECT)***:

Spotfin chub



* **Dwyer et al. 2005a. Assessing contaminant sensitivity of endangered and threatened aquatic species: Part I. Acute toxicity of five chemicals. *AECT* 48: 143-154.**

* **Besser et al. 2005. Assessing contaminant sensitivity of endangered and threatened aquatic species: Part II: Chronic toxicity of copper and pentachlorophenol to two endangered species and two surrogate species. *AECT* 48: 155-165.**

* **Dwyer et al. 2005b. Assessing contaminant sensitivity of endangered and threatened aquatic species: Part III. Effluent toxicity tests. *AECT* 48: 174-183.**

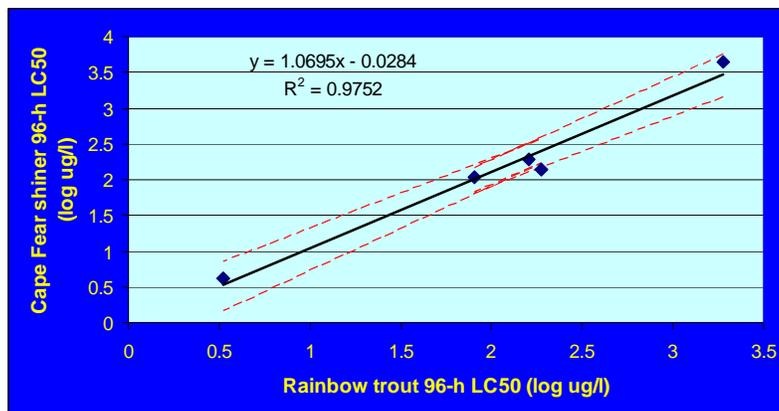
Among the direct results are the following observations:

- No single species was the most sensitive to all chemicals. Among North Carolina's listed fishes, the shortnose sturgeon appears the most sensitive to pollutants.
- Among potential surrogate species, the rainbow trout was more similar to listed fishes in its response to pollutants than the fathead minnow.
- Effluent toxicity tests using the water flea, *Ceriodaphnia dubia*, as a test organism tended to be protective of listed fishes, reinforcing the value of using multiple species in effluent assessments.
- When captive or locally abundant populations of listed fish are available, consideration should be given to direct testing to establish pollutant limits.

In addition, a relative assessment of species sensitivities to an individual contaminant allows us to assess risk from other chemicals for which data are lacking. One application is development of interspecies correlation models which use the wealth of toxicity data for commonly tested surrogate species (like rainbow trout and fathead minnows) to predict toxicity to endangered fish. For example, data from Dwyer et al. (2005a) were used to estimate the correlation between chemical sensitivity of Cape Fear shiner (which has only been tested for five chemicals) and rainbow trout (a species for which hundreds of other chemicals have been tested). By plotting toxicity values of the surrogate species against toxicity values of Cape Fear shiner, a model of interspecies toxicity can be developed:

96-hour Median Lethal Toxicant Concentration (LC50, the concentration of a toxicant that causes mortality in 50 percent of exposed organisms) for the endangered Cape Fear shiner and the surrogate rainbow trout (data are ug/L)

| Chemical | Rainbow Trout | Cape Fear Shiner |
|-------------------|---------------|------------------|
| Carbaryl | 1880 | 4510 |
| Copper | 80 | 110 |
| 4-nonylphenol | 190 | 140 |
| Pentachlorophenol | 160 | 190 |
| Permethrin | 3.3 | 4.2 |



From that relationship, water quality managers and risk assessors can predict the Cape Fear shiner's toxicity to many other pollutants, such as the following pesticides used in North Carolina:

| Pesticide | Rainbow Trout 96-hr LC50 (ug/L) | Predicted Cape Fear shiner values (ug/L) | |
|--------------|------------------------------------|--|-------------------------------|
| | | 96-hr LC50 | Lower 95% Confidence Interval |
| Malathion | 200 | 270 | 180 |
| Glyphosate | 13000 | 23500 | 8400 |
| Naled | 195 | 260 | 170 |
| Diazinon | 90 | 115 | 80 |
| Chlorpyrifos | 7.1 | 8 | 4 |

Multiple models for spotfin chub and shortnose sturgeon are available from these data. The series of papers also provides species-specific factors to estimate low- or no-effect concentrations in short-term exposures from these estimated lethal concentrations. There are also data to estimate concentrations that would and would not impact growth of early life stages of these fishes. All of these can help assess existing water quality standards and help derive site-specific standards for protection of North Carolina's listed fishes.

The reports are available from the USFWS at <http://nc-es.fws.gov/ecotox/>. For more information, contact Tom Augspurger, U.S. Fish and Wildlife Service, Raleigh, NC (919/856-4520 x.21 or tom_augspurger@fws.gov)