



## Columbia Environmental Research Center

### Publication Brief

# Widespread Occurrence of Intersex Bass Found in U.S. Rivers

Intersex occurrence in freshwater fishes was evaluated from 111 sites between 1995 and 2004 for nine river basins in the United States. This evaluation is a synopsis of the data collected during the Biomonitoring of Environmental Status and Trends Program (BEST) of the U.S. Geological Survey, consisting of the Mississippi, Columbia, Rio Grande, Yukon, Colorado, Mobile, Apalachicola, Savannah, and Pee Dee river basins.

Intersex was defined for this evaluation as gonads with mixed germ cells of both sexes, when oocytes were observed within testicular tissue or when spermatocytes were observed within ovarian tissue.

Sampling sites were located on the mainstem and large tributaries in each basin without regard to contaminants; however, the sites did represent a range of contaminant sources. Most fish were captured by electrofishing, hook-and-line and nets. Target species were largemouth bass, smallmouth bass, and common carp.

Testicular oocytes (predominantly male testes containing female germ cells) were the most pervasive form of intersex observed. The intersex condition was observed in 25% of the fish species collected (largemouth bass, smallmouth bass, channel catfish and common carp), and in fish from 31% of the sites. Intersex was most prevalent in male largemouth bass (18% of all individuals; 44% of sites) and male smallmouth bass (33% of all individuals; 44% of sites). The incidence of intersex was greatest in the southeastern United States, with intersex largemouth bass present at all sites in the Apalachicola, Savannah, and Pee Dee River Basins.

Intersex was not observed in spotted bass, hybrid largemouth/spotted bass, striped bass, white bass, hybrid striped/white bass, burbot, flathead catfish, northern

pike, largescale sucker, longnose sucker, white sucker, or brown trout. However, sample sizes were notably low for some of these species.

Sites with intersex bass did not have significantly greater concentrations of legacy chemical contaminants. However, these statistical associations were confounded by the study design including chemical analysis of composite fish tissue samples and non-quantitative assessment (presence/absence) of the intersex condition.

The baseline incidence of intersex gonadal tissue in black basses and other freshwater fishes is unknown, but intersex prevalence may be related to collection season, age, and endocrine active compounds in the environment.

The cause(s) of intersex in these species is unknown. It remains to be determined whether the observed intersex in largemouth and smallmouth bass developed during sex differentiation in early life stages, during exposure to environmental factors during adult life stages, or both.

#### Conclusions:

- The occurrence of intersex differed among species collected from large U.S. rivers.
- In the U.S., largemouth and smallmouth bass would be good candidates for monitoring changes in and severity of intersex because of their broad distribution and apparent sensitivity or susceptibility to this condition.
- The results are significant in that it is the first to document the widespread occurrence of intersex in black basses in the United States.

- Intersex in fish did not appear to be limited to locations with suspected sources of endocrine active compounds.
- Further studies are needed to determine the mechanisms responsible for and environmental factors contributing to intersex in these species and the implications of this condition for fish populations.
- The cause(s) for the widespread occurrence of intersex in largemouth bass from the southeastern U.S., and elsewhere, warrants further investigation. Diagnosis of this condition is important, because, if the primary causes are endocrine active compounds, then the widespread occurrence of intersex in fish would be a critical environmental concern.

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