

Environmental Contaminants and their Effects on Fish in the Colorado River Basin

Introduction

Fish in the nation's rivers are exposed to many classes of environmental contaminants. Some of these contaminants accumulate in fish tissues and are passed on to consumers, such as other fish, wildlife, and humans. These compounds, and many others which do not accumulate in tissues, may weaken the fish's ability to maintain healthy and viable populations. By measuring the effects that contaminants have on fish, as well as contaminant concentrations in tissue, we can evaluate the quality of the habitat relative to contamination. In the summer and fall of 2003, the U.S. Geological Survey evaluated the effects that contaminants have on organisms by

measuring several physiological and biochemical functions in resident fish species in the Colorado River Basin.

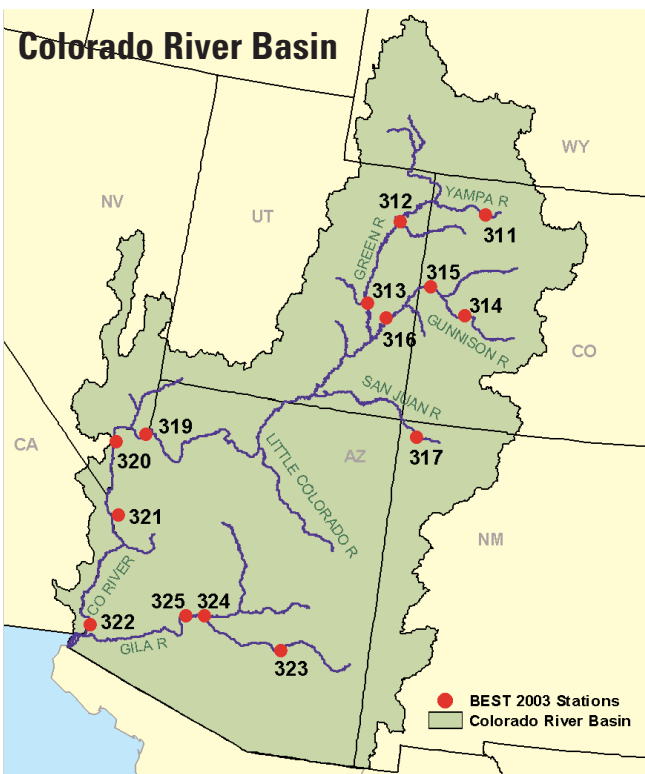
Assessing contaminant effects in the Colorado River Basin is important for the protection of species dependent on the unique ecosystem and the people utilizing its resources. Sources of contaminants in the Colorado River Basin include agriculture and irrigation return flows, mining activities, and isolated point sources associated with municipal and industrial activities. Previous studies have identified contaminant problems associated with high levels of selenium, copper, and other metals, and organic pesticides in the Colorado River Basin.



Electrofishing at Station 316 near Moab, UT.

regarding contaminant threats to biological resources. Because fish are prey for many organisms, including raptors (eagles, osprey), mammals (otters, mink), and humans, assessing contaminants and their effects on fish can provide an indication of the potential effects of contaminants on these fish-eating organisms inhabiting the basins.

This project is conducted by the USGS Biomonitoring of Environmental Status and Trends (BEST) Large River Program. BEST has collected similar information from fish in the Mississippi, Columbia, Rio Grande and Yukon River Basins.



Objectives

The objectives for examining fish in the Colorado River Basin are to document the occurrence of contaminants and their effects throughout the basin, to compare biomonitoring results from the Colorado River Basin to other major river basins in the United States, and to establish benchmarks for the measurement of long-term trends. This project will help determine how fish are affected by water quality in the Colorado River Basin and aid resource managers and researchers identify and prioritize investigations



A largemouth bass collected in the Colorado River downstream of Grand Junction, CO.

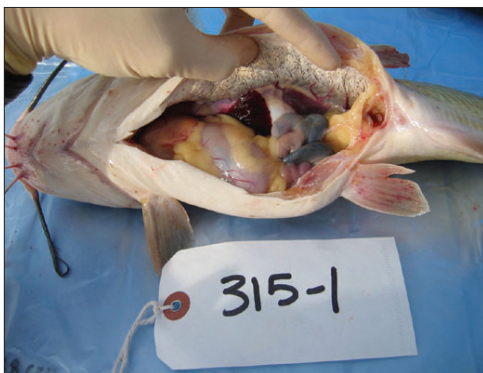
Sampling

Resident fish were collected from 14 sites distributed throughout the Colorado River and its tributaries (Gila, Salt, Green, San Juan, Gunnison and Yampa Rivers). The target species for this study were common carp (*Cyprinus carpio*), black basses (*Micropterus* sp.), and channel catfish (*Ictalurus punctatus*). However, alternate species were collected if target species were not present at a site. These alternative species included white sucker (*Catostomus commersoni*), brown trout (*Salmo trutta*), and flathead catfish (*Pylodictis olivaris*).



Field processing station.

The goal for each site was to collect 10 male and 10 female fish of each species (maximum of 20 fish per species) for a total of 40 fish per site depending upon the presence and abundance of fish. Fish were collected by electrofishing and examined, measured and dissected. Samples of blood, liver, kidney, spleen, gonads, and scales were collected for biomarker analyses and histopathological examination. After samples were prepared, the whole-body fish carcass was frozen until chemical contaminant analysis.



Internal view of channel catfish.

Total Station Counts of Fish Collected in the Colorado River Basin in 2003

Station Number	Carp	Bass	Catfish	Sucker	Trout
311 - Craig, CO	1	20	--	19	--
312 - Vernal, CO	20	14	11	--	--
313 - Ruby Ranch, UT	21	--	18	--	--
314 - Delta, CO	21	--	--	--	21
315 - Grand Junction, CO	20	12	5	--	--
316 - Moab, UT	20	--	24	--	--
317 - Farmington, NM	20	--	20	--	--
319 - Pearce Ferry, AZ	17	--	--	--	--
320 - Willow Beach, AZ	20	--	--	--	--
321 - Needles, CA	20	20	--	--	--
322 - Yuma, AZ	20	20	--	--	--
323 - Hayden, AZ	20	9	11	--	--
324 - Phoenix, AZ	20	2	15	--	--
325 - Arlington, AZ	20	20	--	--	--
Species totals	260	117	104	19	21

Analyses

Each fish will be analyzed for overall condition, histological (tissue) examination of selected organs, indicators of immune, reproductive and endocrine responses, and specific assays that indicate exposure to specific classes of chemicals. These measures respond to a wide suite of contaminants and will increase our understanding of the exposure of the organism to biologically available contaminants. In addition, fish will be composited by species and gender and analyzed for metals, PCBs, DDT, and other pesticides.

Products

After completion of sampling, laboratory analyses, and data interpretation, the data and results will be compiled into a final report documenting the findings. Assessments will be made to examine the fish data relative to contaminant sources in the Colorado River Basin, examine the ability of the biomarkers to predict contaminant gradients in the environments, and evaluate the relation between ambient water quality data and residue and biomarker data from fish. Data and study results will be available on the BEST program web page <<http://www.cerc.usgs.gov/data/best/search/>>. Project results will be presented at professional meetings and published in professional journals.

Schedule

All field work (fish sampling, processing, tissue collection) was conducted in the fall

of 2003. Laboratory analyses are scheduled to be completed by June 2004. A final report is expected January 2005. At that time all data and study results will be available on the BEST Program web site <<http://www.usgs.best.gov>>.

Cooperators

This project is part of a nationwide, large river monitoring network conducted by the BEST Program. Field sampling and fish processing were conducted by USGS biologists, with assistance from biologists from the U.S. Fish & Wildlife Service, California Division of Fish & Game, and Colorado Division of Wildlife. Chemical and biological analyses of fish tissues will be conducted by USGS laboratories in Missouri (Columbia Environmental Research Center), West Virginia (Leetown Science Center), and Florida (Integrated Science Center) and by the University of Florida, Gainesville.

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Colorado River Basin Data online:

<<http://www.cerc.usgs.gov/data/best/search/>>

Additional Information on the BEST Program is available at:

<<http://www.best.usgs.gov>>