Contaminants and Related Effects in Fish from the Mississippi, Columbia, and Rio Grande Basins

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The overall objectives of this project are to describe the occurrence and distribution of contaminants and their effects on fish at selected sites in the Mississippi River, Columbia River, and Rio Grande basins; to quantitatively evaluate the performance of aquatic methods used by the U.S. Geological Survey (USGS) Biomonitoring of Environmental Status and Trends (BEST) program; and to evaluate potential collaborations with the USGS National Stream Quality Accounting Network (NASQAN-II) and National Water Quality Assessment (NAWQA) programs. Fish were collected in 1995 at 46 sites in the Mississippi River basin (*n*=1,338); in 1997 at 16 sites in the Columbia River basin (*n*=560) and 10 sites in the Rio Grande basin (*n*=368); and in 1996 from a reference site in West Virginia (*n*=39). Sites were located at historic National Contaminant Biomonitoring Program stations in all three basins; at NASQAN-II sites in the Columbia and Rio Grande basins; and at NAWQA sites in the Mississippi Embayment and Eastern Iowa Basins study units within the Mississippi River basin. The primary species targeted at each site were common carp (*Cyprinus carpio*) and largemouth bass (*Micropterus salmoides*). Other species, mostly other black basses (*Micropterus* spp.), percids (*Stizostedion* spp.), salmonids, suckers (Catostomidae), and catfish (Ictaluridae) were collected as alternates, depending on habitat and location. Individual fish (about 40 per site) were analyzed for reproductive biomarkers (plasma vitellogenin and sex steroid hormones), histopathological alterations, macrophage aggregates, hepatic EROD activity, plasma lysozyme activity, and general fish health measures (organosomatic and ponderal indices, observations of grossly visible lesions, deformities, and parasites).

Organochlorine (pesticides and total PCB's) and elemental (heavy metals and metalloids) contaminant analyses and the H4IIE bioassay for dioxin-like activity were performed on fish samples composited by species and sex. DDT residues (mostly as *p,p'*-DDE) in fish remained sufficiently high to represent a hazard to sensitive species of fish-eating birds at sites in all three basins. Toxaphene residues also remained evident at sites in the lower Mississippi and Rio Grande basins. The combined results of organochlorine chemical, H4IIE bioassay, and biomarker analyses indicated the presence of other organic contaminants in the lower Mississippi valley. Cyclodiene pesticides (dieldrin, endrin, and chlordane) were present in many agricultural areas, especially in the Corn Belt. Concentrations of these pesticides also were elevated near Memphis, Tenn., where there is a point source. Selenium concentrations were sufficiently high to constitute a hazard to piscivorous fishes and wildlife at one site in the upper Arkansas River, where levels have been increasing for approximately 10 years, and at several sites in the central Rio Grande basin. Mercury concentrations were higher in the predator species than in bottom fish and were elevated at one site in the Rio Grande and two in the Columbia basins. In the Mississippi basin, the occurrence of vitellogenin in plasma and of ovarian cells in the testes of male fish from several sites, along with abnormal ratios of sex steroid hormones, suggest that fish from some sites are exposed to endocrine-modulating substances. Biomarker results for the Columbia and Rio Grande basins are still pending.

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