CONTAMINANT CONCENTRATIONS AND BIOMARKERS IN NORTHERN PIKE AND LONGNOSE SUCKERS COLLECTED FROM THE YUKON RIVER


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Abstract

The biomonitoring of Environmental Status and Trends (BEST) program measured tissue concentrations of selected contaminants and evaluated biomarker responses in northern pike (Esox lucius) and longnose suckers (Catostomus catostomus) from the Yukon River basin, Alaska. Sampling stations covered a distance of 1135 river miles and included the village of Eagle near the eastern border with Canada to the Bering Sea village of Kotlik. Organic and inorganic contaminants were measured in whole-body composite fish samples. Selenium in pike and suckers and mercury in pike were the only inorganic contaminant concentrations that exceeded criteria thresholds. Concentrations of Se and Hg were greatest at sites located in tributaries of the Yukon River near Fairbanks. The H4IIE bioassay did not detect dioxin-like activity in any of the samples. Mean microsomal EROD activity ranged from 0.71 to 17.5 pmol/min/mg protein in pike and 3.8 to 10.0 pmol/min/mg protein in suckers. Estradiol levels were uninduced in male pike and male sucker from sites in the central region of the Yukon River. Reproductive biomarkers (gonadosomatic index and vitellogenin) were not elevated for pike or suckers. Fish health indicators (external lesions and somatic indices) and immune system indicators (macrophage aggregate parameters) were also evaluated in this study. Previous contaminant studies in this basin have focused on issues concerning subsistence fishing in villages or chemical contamination on national wildlife refuge. The BEST program data will aid in establishing a reference data set for contaminants and biomarkers in fish throughout the Yukon River in Alaska.

Introduction

The BEST large river program measures and assesses contaminants and biomarker responses on selected species and habitats at broad geographic and temporal scales (Figure 1). Sources of contaminants in the Yukon River Basin (YRB) include mineral ore mining and smelting, oil and gas drilling and production, and road salt runoff. Mercury bioaccumulation from oceanic sources via sea雾s into the YRB (Kriisplant and others, 2003). However, only limited data exist on contaminant concentrations in salmon, and to a lesser extent, resident fish in the Yukon River, and little or no information on contaminant effects on fish.

Our objectives were to:

- Document contaminant occurrence, and their effects throughout the YRB
- Compare biomonitoring results from the YRB to other major US river systems
- Establish a reference data set for contaminants and biomarkers in fish in the YRB in Alaska

Materials and Methods

Ten locations within the YRB were sampled in the summer of 2002 (Figure 2). At each sampling station, 40 fish were collected (10 of each gender, 2 species) by hook and line, gill nets, or fyke nets. Target fish species included northern pike and longnose sucker. Burbot (Lota lota) were collected as an alternate predator species. Fish were processed soon after capture. The suite of field and laboratory methods selected respond to a wide variety of contaminants (Table 1). A total of 217 fish were collected.

Results and Discussion

Organochlorine (OC) pesticides, total PCBs, and toxaphene concentrations were below quantification limits or wildlife criteria thresholds. H4IIE rat hepatoma bioassay did not detect dioxin-like activity in any samples. All inorganic concentrations were below threshold criterion except for Hg and Se (Figure 3). Pike from The Bridge (304), Fairbanks (305), Nenana (306), Tanana (307), and Galena (308) exceeded 0.03 μg/g, a Hg concentration associated with reproductive impairment in toms (Barr, 1986). Fish from Eagle (301), Canyon Village (302), and The Bridge (304) had fish with Se concentrations exceeding 0.6 μg/g, which may be toxic to piscivorous wildlife (Lemly, 1996). Microsomal EROD levels were uninduced at most stations. Vitellogenin concentrations in males and females were not elevated. Other reproductive indicators (GSI and atresia) were normal. No intersexed fish were identified (Table 2).

Estradiol/11-ketotestosterone ratios exceeded 1.0 in male fish from The Bridge (304), Nenana (306), Tanana (307), and Galena (308) (Figure 4).

Fish health examinations determined most abnormalities were attributed to lesions on the body surface (Figure 5). Macroaggregate (MA) parameters were similar within species among stations.

Conclusions

Most OCs and inorganic contaminants are not of concern in the YRB. Hg concentrations were greatest near Fairbanks and surrounding tributaries, and Se concentrations were greatest in the upstream YRB.

Most biomarker results did not indicate exposure to contaminants. Estradiol levels were high in males from stations located near Fairbanks and surrounding tributaries. Histopathology results will aid in identifying abnormalities described in the fish health assessment.

Most reproductive and immune fish health indicators did not indicate exposure to contaminants.

Citations


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