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CHRISTINE O. GREGOIRE
Director

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STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
7171 Cleanwater Lane, Building 8, LH-14 • Olympia, Washington 98504

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TO: Carl Nuechterlein

FROM: Art Johnson and Dave Serdar

SUBJECT: Metals Concentrations in Lake Roosevelt (Columbia River) Largescale Suckers

We have obtained some limited data on lead, mercury, and cadmium concentrations in bone, liver, and muscle tissues from largescale suckers (*Catostomus macrocheilus*) collected from Lake Roosevelt. Previous data showed high whole fish concentrations of lead and cadmium in this species (Johnson *et al.*, 1988). Largescale suckers from Lower Arrow Lake were also analyzed for purposes of comparison. Lower Arrow Lake is the Columbia River reservoir above the Cominco smelter at Trail, British Columbia.

Figure 1 shows where the fish were collected. The samples were obtained during September 1989 and kept frozen until dissection and analysis in July 1990. Five fish were analyzed from each lake. The Lower Arrow Lake specimens were provided by Rick Crozier, B.C. Ministry of Environment. The fish were dissected at the Ecology/EPA Manchester Laboratory using acid-washed, stainless steel instruments and frozen in teflon jars. The bone samples consisted of caudal vertebrae; muscle samples were skinless fillets.

The tissues were analyzed at the Battelle Marine Sciences Laboratory in Sequim, Washington. They were freeze dried, percent solids determined, and ground. All samples were acid digested in a teflon bomb for analysis of mercury by cold vapor AA (muscle), and lead (bone) and cadmium (liver) by graphite flame AA. Analytical methods are described in Tetra Tech, Inc. (1986). Note that the data are reported on a dry weight basis.

Two standard reference materials were analyzed (Table 1). Except for two lead values in DORM-1, relative percent difference was within 17% of the certified values. The two high lead values could be due to contamination. The lead data are not, however, significantly compromised since the field samples contained either very high lead levels or low lead levels equal to or lower than the apparent lead contamination level. Based on triplicate analyses of selected Lake Roosevelt samples, the precision (standard deviation) of the data reported here was +/-1.24 mg/Kg for lead, +/-0.8 mg/Kg for cadmium, and +/-0.03 mg/Kg for mercury.

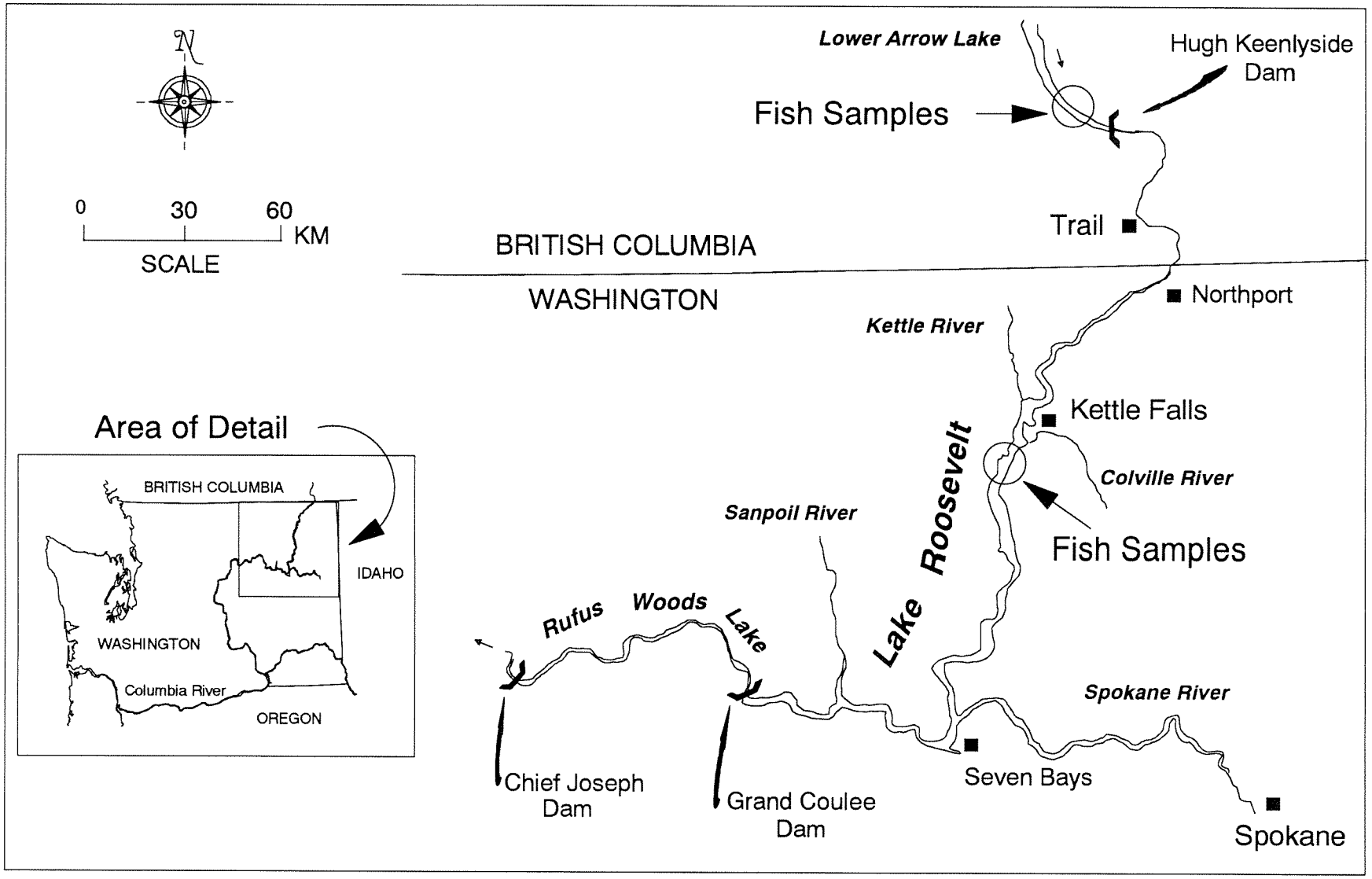


Figure 1. Location of Largescale Sucker Samples

Table 1. Analysis of Standard Reference Materials (mg/Kg, dry weight).

| Standard Reference Material | Metal Concentrations | | |
|---|---|---|---|
| | Lead | Mercury | Cadmium |
| Nat. Res. Council Canada DORM-1 (dogfish muscle) | 0.38 | 0.812 | 0.081 |
| | 0.87* | 0.762 | 0.079 |
| | 0.79* | 0.770 | 0.077 |
| Certified Value = | 0.40 | 0.798 | 0.086 |
| RPD = | 5.0% | 2.1% | 8.1% |
| Nat. Res. Council Canada DOLT-1 (dogfish liver) | 1.13 | not analyzed | not analyzed |
| Certified Value = | 1.36 | -- | -- |
| RPD = | 17% | -- | -- |

* Not included in RPD (relative percent difference)

Table 2. Metal Concentrations in Largescale Suckers (mean ±SD in mg/Kg, dry weight; n=5).

| Tissue | Metal Analyzed | Lake Roosevelt* | | Lower Arrow Lake* | |
|---|---|---|---|---|---|
| | | % Solids | Metal Concentrations | % Solids | Metal Concentrations |
| Bone | Lead | 40.8 | 36.9 ± 11.9 | 33.0 | 0.35 ± 0.10 |
| Muscle | Mercury | 21.9 | 1.59 ± 0.23 | 20.1 | 1.17 ± 0.42 |
| Liver | Cadmium | 32.3 | 10.0 ± 2.8 | no samples | |

* mean total length = 488mm mean weight = 1608g
** mean total length = 398mm mean weight = 686g

The results are in Table 2. The most noteworthy finding was the extremely high concentration of lead in bone samples from the Lake Roosevelt fish. This was two orders of magnitude higher than bone samples from Lower Arrow Lake (36.9+/-11.9 vs. 0.35+/-0.10 mg/Kg). The significance of this level of contamination remains to be determined. Several studies report reductions in mechanical properties of bone (e.g. strength, elasticity) in fish from lead-rich environments, but do not provide data on lead concentrations in bone (Hamilton and Haines, 1989; Dwyer *et al.*, 1988).

Muscle tissue samples from Lake Roosevelt suckers appear to have slightly higher mercury concentrations than suckers from Lower Arrow Lake (1.59+/-0.23 vs. 1.17+/-0.42 mg/Kg), but the difference was not statistically significant (Wilcoxon rank sum test, $p < .05$). Suckers are probably a poor indicator for mercury, not being a predator species.

The condition of the Lower Arrow Lake fish did not allow the livers to be analyzed for cadmium. Although the cadmium concentrations in the Lake Roosevelt liver samples appear elevated when compared to other studies (Eisler, 1985), additional data are needed to put these results in perspective.

Previous Ecology analyses of metals in Lake Roosevelt fish have been limited to muscle tissue and whole fish. A more detailed assessment of metals concentrations in various organs of Lake Roosevelt fish species and their impact on fish health should be given a high priority when future studies are planned.

AJ/DS:krc

cc: Carol Jolly

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