

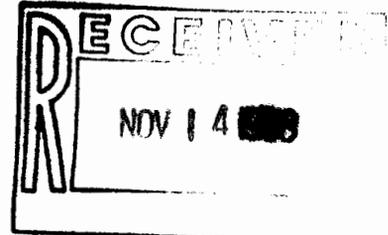
entropy

- Superfund
- Hazardous Waste
- Risk Assessment
- Facility Siting
- Chemical Analysis and Interpretation
- Community Relations and Right-To-Know

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November 7, 1988

Alaska Department of Fish and Game
Division of Sport Fish
Box 3-2000
Juneau, Alaska 99802-2000



CONCERNING: Scientific Collection Permit Number 88-202
Johnson Creek ADF&G stream # 115-20-10070

Hello:

In fulfillment of the requirements of permit 88-202 I am submitting a detailed report showing: numbers, species, dates, disposition of each specimen, and places collected.

I am glad to report the fish I collected and analyzed from Johnson Creek fish are safe for human consumption, containing less than one tenth the amount of mercury allowed by the Food and Drug Administration.

If you have any questions please feel free to call.

Sincerely,

Carl Reller

Carl Reller
Principal, entropy

cc: John Barnett
Curator American Inc.

X.C. FWS. Contaminants, SEES
FWS. Raptor Mgt.

Mercury in Fish from Johnson Creek

Carl Reller

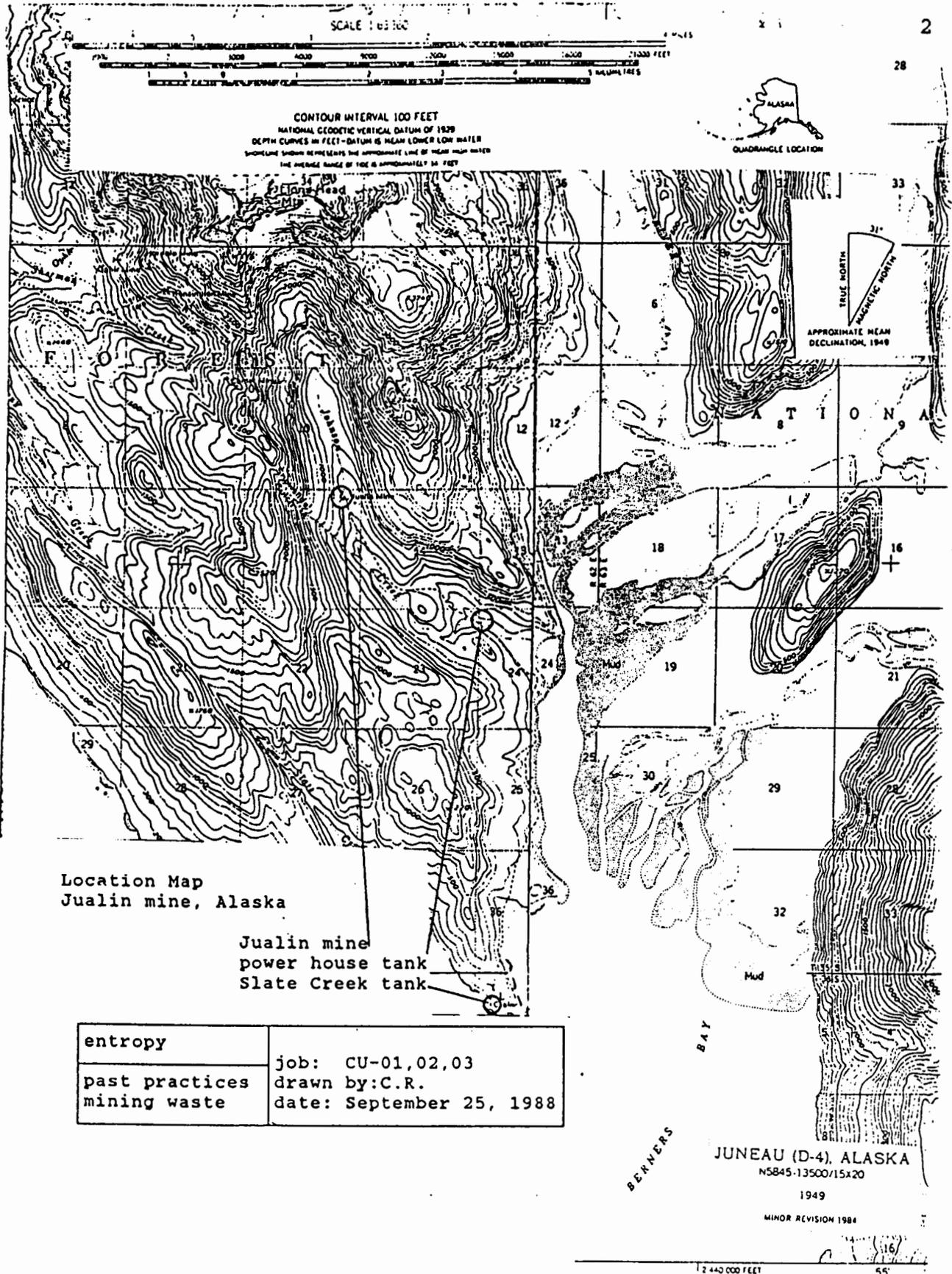
November 8, 1988

ABSTRACT

Curator American Inc. was concerned that past waste management practices (1896 - 1928) caused mercury to enter the food chain, placing fish consumers at risk. Although mercury was found in all the fish, concentrations are near naturally occurring levels. All fish analyzed were safe for human consumption.

INTRODUCTION

Toxic wastes contaminate most mine sites in southeast Alaska. Because past waste management practices of the old Jualin mine are unknown, Curator American Inc. asked entropy to conduct a site investigation (Location Map) for residual contaminants, including mercury in the Johnson Creek stream bed.

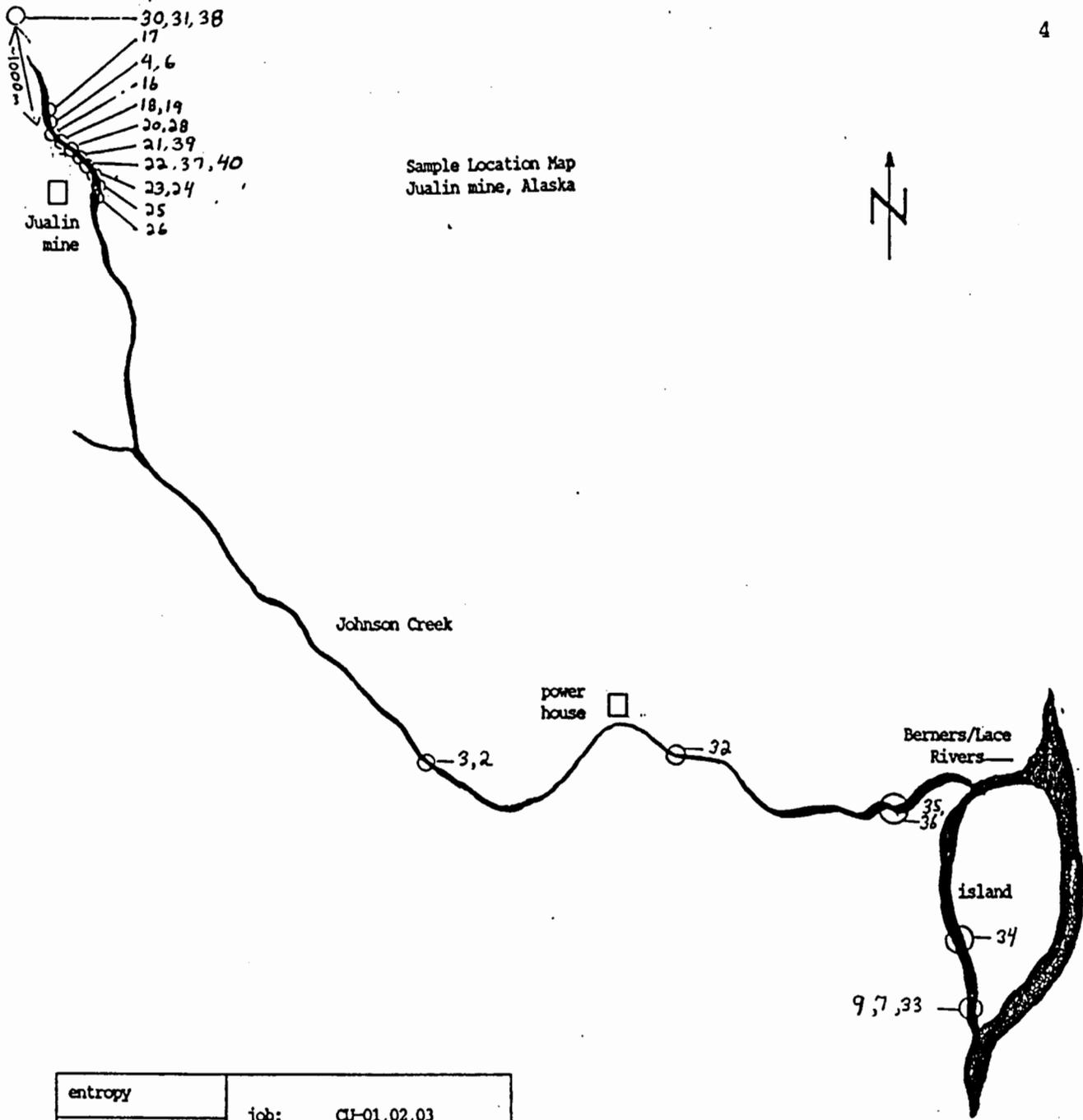


METHODS

Matrices sampled include water, stream sediment, and fish from Johnson Creek (Sample Location Map). I obtained water samples at four locations, sediment samples from sixteen places and successfully caught fish in baited minnow traps. Prior to shipment tissue samples were frozen, water and sediment samples kept cool. Standard methods of EPA publication SW-846 were followed for sampling, decontamination, and analyses.

RESULTS

All mercury data met quality control criteria (1). None of the water samples contained mercury above the detection limit (Table 1). Sediment samples revealed mercury at significant concentrations (greater than twice the detection limit) in three of twenty sediment samples (Table 2). The highest concentration of mercury in sediment appeared directly below the old stamp mill. Further downstream at 50 and 100 yards two samples showed mercury at decreasing concentrations. Three other samples collected between 50 and 250 yards down stream of the mill contained mercury at the detection limit. No other stream sediment samples contained mercury above the detection limit.



Sample Location Map
Jualin mine, Alaska



entropy	job: CU-01,02,03
past practices	drawn by: C.R.
mining waste	date: September 25, 1988

LEGEND ○ sample location
XX sample number [JU-__]

0 200 400
SCALE: meters

Table 1

Inorganic Water Sample Analyses

Analyte	Concentration ppm			
	sample numbers { JU-__ }			
	31	6	2	9
	Background	Jualin Mine	Lower Bridge	Stream Mouth
*aluminum	0.03 E	<0.02	0.03	0.04
antimony	<0.05	<0.05	<0.05	<0.05
arsenic	<0.05	<0.05	<0.05	<0.05
*barium	0.002	0.003	0.003	0.006
beryllium	<0.001	<0.001	<0.001	<0.001
boron	<0.006	<0.006	<0.006	<0.006
cadmium	<0.002	<0.002	<0.002	<0.002
*calcium	4.48	7.67	10.2	11.2
chromium	<0.005	<0.005	<0.005	<0.005
cobalt	<0.003	<0.003	<0.003	<0.003
copper	<0.002	<0.002	<0.002	<0.002
*iron	0.023	0.010	0.016	0.072
lead	<0.02	<0.02	<0.02	<0.02
lithium	<0.004	<0.004	<0.004	0.010
*magnesium	0.37	0.48	0.65	0.72
*manganese	0.001	0.001	0.002	0.006
mercury	<0.0001	<0.0001	<0.0001	<0.0001
molybdenum	<0.005	<0.005	<0.005	<0.005
nickel	<0.01	<0.01	<0.01	<0.01
potassium	<0.3	<0.3	<0.3	0.5
selenium	<0.05	<0.05	<0.05	<0.05
silica	<0.02	---	---	---
silver	<0.003	<0.003	<0.003	<0.003
*sodium	0.06	0.79	0.98	1.08
*strontium	0.024	0.042	0.055	0.066
thallium	<0.05	<0.05	<0.05	<0.05
thorium	<0.03	<0.03	<0.03	<0.03
tin	<0.01	<0.01	<0.01	<0.01
titanium	<0.005	<0.005	<0.005	<0.005
tungsten	<0.05	<0.05	<0.05	<0.05
uranium	<0.2	<0.2	<0.2	<0.2
vanadium	<0.002	<0.002	<0.002	<0.002
zinc	<0.004	0.004	<0.004	<0.004

* above method detection limit

E - The numerical value is an estimated quantity because quality control criteria were not met.

Table 2

Stream Sediment Mercury Analyses

Sample Number {JU-__ }	Mercury ppm	Distance from Mill Negative Values Upstream yards
30	<0.13	- 1000
17	<0.06	- 100
4	<0.07	- 30
16	* 15.0	0
18	* 3.31	50
19	0.07	50
20	0.06	80
28	<0.07	80
21	* 0.32	100
22	<0.06	200
23	<0.06	250
24	0.06	250
25	<0.06	300
26	<0.06	400
3	<0.19	2,500
32	<0.15	3,500
36	<0.23	4,000
34	<0.06	4,900
7	<0.07	5,000
33	<0.06	5,000

* Significantly Above Background

Five baited minnow traps caught 15 fish at four locations (Table 3), 11 specimens were retained (Photograph) and three released unharmed. It takes an average of 68 minutes to catch a fish in a successful trap. Fish tissue analyses showed mercury at low concentrations - safe for human consumption - in all samples. The highest mercury levels are in coho at the stream mouth, where mercury was detected in neither the water nor sediments. The lowest tissue mercury levels are found above known mining influences, also where mercury was found in neither the water nor sediments. Directly below the mill, where mercury was detected in the sediments (but not the water), fish tissues contained intermediate levels of mercury.

The fish samples are from three distinct locations (Table 4); above known mining influences (sample 38), within a contaminated stream bed (samples 37, 39, 40), and several miles down stream (sample 35). Between sample 38 and samples 37, 39, and 40 stands a three foot barrier falls (remnants of a dam).

Table 3
Fish Species and Trap Locations

Fish	Number Analyzed	Sample Number	Location
<u>Salvelinus malma</u> (Dolly Varden)	2	37	below mill
	2	40	same as 37
	2	38	above mill
	2	39	below mill
<u>Oncorhynchus kisutch</u> (coho salmon)	3	35	stream mouth

Table 4
Concentration of Mercury in Fish

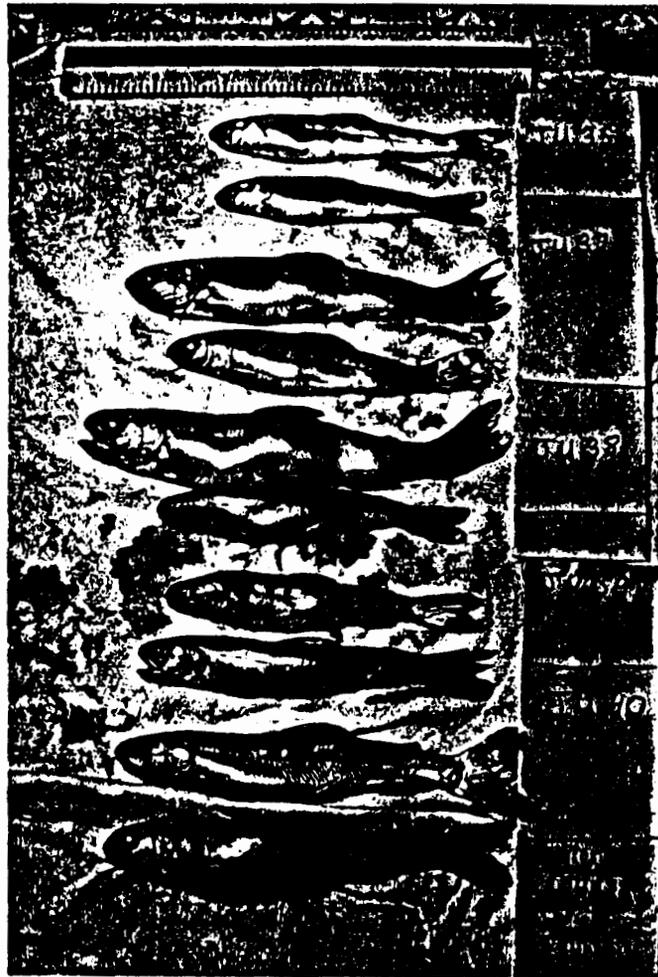
Sample Number {JU-__ }	Mercury ppm - dry weight	Distance from Mill Negative Values Upstream yards
38	0.044	- 1000
39	0.117	50
37	0.067	200
40	0.07	200
35	0.11	4000
	0.082 average	

Table 5
Mercury in Fish

Fish	Mercury Concentration ppm
Food and Drug Administration Action Level	1.0
Coho Salmon from Lake Erie composite of edible tissues	0.51 - 0.69 range
canned salmon	0.21 mean +/- 0.05 S.D. 0.13 - 0.31 range
Johnson Creek Fish	0.082 mean 0.044 - 0.117 range

Dolly Varden and Coho Smolts

Caught in Johnson Creek



The two fish at the top (JU-35) are coho smolts, the others are Dolly Varden.

Photograph by Carl Reller
on 09 JUN 88

DISCUSSION

All the literature I reviewed showed mercury above the detection limit in all fish sampled. If total mercury is less than 0.2 ppm, fish are considered to be at a "low concentration". Below this level little if any increase in mercury body burden is seen with an increase of size or age (2, 3, 4). Apparently below 0.2 ppm fish reach a dynamic equilibrium, excreting as much mercury as they uptake.

Mercury in fish tissue partitions in the following order:

(10 ppm) spleen - brain - liver - muscle - bone (0.3 ppm).

high
accumulation
tissue

low
accumulation
tissue

CONCLUSION

None of the fish analyzed from Johnson Creek contained a level of mercury exceeding Food and Drug Administration standards (Table 5). It is not possible to conduct a rigorous statistical analysis on such a small sample size; however, from my observations and review of the data I do not believe Johnson Creek fish exhibit a significant bioaccumulation of mercury due to stream sediment contamination.

REFERENCES

1. Reller, C. Past Practices: Waste Management at the Jualin Mine, Alaska. 1988; Curator American Inc.
2. Sachinath, M. Mercury in the Ecosystem, 1986; Trans Tech Publications, Switzerland.
3. Mercury in the Environment. U.S. Geological Survey Professional Paper 713.
4. Food and Drug Administration. Action Levels for Poisonous or Deleterious Substances in Human Food and Animal Feed. 1980; AG7408.09.

FIELD NOTES on FISH SAMPLES

sample number: JU-35
 time and date collected: 14:31 09 JUN 88
 matrix: tissue
 matrix description: 3 coho salmon smolts (Oncorhynchus kisutch)
 method of collection: baited minnow trap
 location description: 1500 meters above JU-33, west bank
 analysis: mercury
 other observations: minnow trap #5, fished 81 minutes caught 7 coho, released 4 unharmed

sample number: JU-37
 time and date collected: 16:43 09 JUN 88
 matrix: tissue
 matrix description: 2 Dolly varden (Salvelinus malma)
 method of collection: baited minnow trap
 location description: eddy of boiler at location JU-22
 analysis: mercury
 other observations: minnow trap #3 fished 337 minutes, two fish caught and both retained

sample number: JU-38
 time and date collected: 17:25 09 JUN 88
 matrix: tissue
 matrix description: 2 Dolly varden (Salvelinus malma)
 method of collection: baited minnow trap
 location description: same as JU-30
 analysis: mercury
 other observations: minnow trap #1, fished 423 minutes two fish caught and both retained

sample number: JU-39
 time and date collected: 17:56 09 JUN 88
 matrix: tissue
 matrix description: 2 Dolly varden (Salvelinus malma)
 method of collection: composite from two baited minnow traps
 location description: one fish from 1 meter above camp bridge one fish from below old dam at JU-19
 analysis: mercury
 other observations: minnow trap #8 fished 60 minutes, minnow trap #9 fished 62 minutes; two fish caught both retained

sample number: JU-40
 time and date collected: 17:53 09 JUN 88
 matrix: tissue
 matrix description: 2 Dolly varden (Salvelinus malma)
 method of collection: baited minnow trap
 location description: same as JU-37
 analysis: mercury
 other observations: minnow trap #7 fished 64 minutes