APPENDICES

Appendix 1. Length, weight and age (determined from otoliths) for burbot taken from Okanagan and Skaha lakes, 1971.

Station	Date	Length (mm)	Weight (gm)	Age
Okanagan North	Aug 9	451	786	5+
	"	680	1942	9+
	"	759	3300	10+
	Nov 3	570	1045	5+
	"	639	2050	9+
	"	673	2250	9+
	"	700	2250	9+
	Nov 16	85	4	1+
	"	124	13	2+
Okanagan Whiteman	Aug 6	398	464	3+
	Oct 29	524	1125	4+
	"	602	1590	10+ ?
	"	640	2260	5+
	"	650	2171	7+
	"	670	1804	10+ ?
Okanagan Centre	May 16	649	1833	8+
	Aug 4	675	2320	9+
	"	735	2283	9+
	Oct 21	649	1950	7+
Okanagan Kelowna	Aug 3	212	57	2+ ?
	Oct 18	220	63	3+
	May 13	157	30	1+
	"	212	83	1+
Okanagan Peachland	Jul 19	272	127	4+
	"	400	404	4+
	"	518	907	5+
	"	576	1096	7+
	"	648	1895	8+
Okanagan South	May 10	112	10	1+
	"	127	17	1+
	Jun 11	898	5000	14+
	Jul 23	400	416	3+
	"	580	1280	9+
	"	657	1820	11+
	"	672	2285	11+
	Oct 12	505	905	4+
	Nov 21	281	156	1+
Skaha South	Jul 27	682	2355	6+

Appendix 2. Methods of analysis for chlorinated hydrocarbons and heavy metals used for 1971 Okanagan Basin Study.

I Chlorinated Hydrocarbons

Ten grams of tissue, made up of equal portions from each individual fish represented in the sample, were added to 20 ml aceto nitrite in a high speed blender. A double extraction was made for each analysis.

1. Extraction procedure for insecticides, fungicides and herbicides.

(a) Chlorinated hydrocarbon and organophosphate insecticides, 2,4-D and 2,4,5-T acids and esters.

(i) McCloud, H. A. (compiled and edited) 1969. Canada Food and Drug Directorate: Analytical methods for pesticide residues in food. Queens Printer, Ottawa. (procedures 5.1 and 5.2).

(ii) Johnson, L. Y. [ed] 1965. Pesticide analytical manual. United States Department of Health Education and Welfare, Food and Drug Administration, Washington, D. C. (procedure 2.21).

(iii) Mills, P. A., J. H. Onley and R. A. Gaither. 1963. Rapid method for chlorinated pesticide residues in non-fatty foods. Journal of the Association of Official Agricultural Chemists. 46:186-191.

(b) Atrazine, Sevin and Captan

(i) Direct extraction from tissue with chloroform.

(c) Tordon

(i) Saha, J. G. 1967. Determination of the herbicide Tordon (4-amino-3,5,6-trichloropicolinic acid) in soil by electron capture gas chromatography. Journal of the Association of Official Agricultural Chemists. 50:637-641.

2. Partition procedures.

(i) McCloud, H. A. (compiled and edited) 1969. Canada Food and Drug Directorate: Analytical methods for pesticide residues in food. Queens Printer, Ottawa (procedures 6.1 to 6.6).

3. Clean-up and Separation procedures (column chromatography).

(i) McCloud, H. A. (compiled and edited) 1969. Canada Food and Drug Directorate; Analytical methods for pesticide residues in food. Queens Printer, Ottawa (procedures 7.1 and 7.2).

4. Determinative procedure

(i) All analyses were done using a Micro-Tech 220 gas chromatograph with electron capture and flame photometric detector.

II Cadmium, Copper, Lead, Mercury, Zinc.

Atomic absorption measurements were made on a Jarrell Ash 82-500 spectrophotometer.

Reagents:

(1) Mercury Reducing Solution - To a 1-liter volumetric flask add 11g sodium chloride, 50g hydroxylamine sulphate, 140g stannous chloride and 100 ml 18N sulphuric acid. Dilute to volume with deionized water and mix. (Solution will be cloudy but clears with filtration.)

(2) Mercury Standard Solutions

(a) Stock Solution - 1000 ug/ml Dissolve 0.1354g $HgCl_2$ in 5% (v/v) nitric acid in a 100 ml volumetric flask and dilute to the mark.

(b) Intermediate Solution - 10 ug/ml Pipet 1.0 ml of stock solution into a 100 ml volumetric flask and dilute to the mark with 5% nitric acid solution.

(c) Working Solution - 0.1 ug/ml Pipet 2.0 ml of intermediate solution into a 200 ml volumetric flask and dilute to the mark with 5% nitric acid solution.

(3) Copper and Cadmium Solutions

(a) Stock Solution - 1000 ug/ml Dissolve 1.0 g of the cadmium or copper metal in a 1-liter volumetric flask and dilute to the mark with 5% nitric acid.

(b) Intermediate Solution - 100 ug/ml Pipet 10.0 ml of stock solution into a 100 ml volumetric flask and dilute to the mark with 5% nitric acid solution.

(c) Working Solution - 1.0 ug/ml Pipet 1.0 ml of intermediate solution into a 100 ml volumetric flask and dilute to the mark with 5% nitric acid solution.

(4) Lead Standard Solution

(a) Stock Solution - 1000 ug/ml Dissolve 1.5984 g of $Pb(NO_3)_2$ in a small quantity of deionized water and dilute to 1.0 liter volumetrically with 5% nitric acid solution.

(b) Intermediate Solution - 100 ug/ml Pipet 10.0 ml of stock solution into a 100 ml volumetric flask and dilute to the mark with 5% nitric acid solution.

(c) Working Solution - 1.0 ug/ml Pipet 1.0 ml of intermediate solution into a 100 ml volumetric flask and dilute to the mark with 5% nitric acid solution.

Sample Preparation

Ten grams of tissue, made up of equal portions from each individual fish represented in the sample, was weighed out; one half of this amount was used for the determination of cadmium, copper, lead and zinc, the other half for mercury.

The sample for mercury analysis was prepared as follows: Generally a 5 g sample of fish was accurately weighed and placed in a 250 ml erlenmeyer flask having a ground glass $\frac{S}{T}$ neck. To the flask was added 0.1 g vanadium pentoxide and a few glass beads. A water-cooled condenser was fitted into the top of the flask and the unit clamped over a hot plate. A 10 ml mixture of conc. H_2SO_4 (3 ml) and conc. HNO_3 (7 ml) was added via the condenser and the top of the condenser closed off with an acetone-dry-ice cold-finger. When all activity ceased in the flask, enough heat to start

reflux action was added and refluxing was continued until all solid matter was dissolved and the solution was a clear green The heat source was removed and the flasks allowed to cool. Before being dismantled the cold-finger and condenser were rinsed down with ca. 5-10 ml deionized water, which was allowed to drain into the reaction flask. The contents of each flask were then filtered into separate 25.0 ml volumetric flasks and brought to the mark with deionized water. A blank was also prepared in this manner. Analysis was carried out within 24 hours of preparation.

Fish samples for cadmium, copper, lead and zinc were prepared by dry-ashing as follows: A 35.0 g sample of the fish was accurately weighed and placed in a "Vitreosil" dish. The dish and sample were placed in a muffle furnace. The temperature was raised from ambient to 450°C very slowly and ashing was completed within 24 hours. The dish and contents were allowed to cool down in the oven after which the ash was taken up in a 10% HCl solution. This was diluted to 100 ml making the sample ready for analysis.

Procedure

Lead: Analysis for lead was carried out by the Dithizone method as per 24.045, Official Methods of Analysis of A.O.A.C.

Cadmium, Copper, Zinc: The prepared solutions were selectively analyzed for metal content by atomic absorption. A hydrogen continuum lamp was used to measure and correct for non-atomic absorption.

Element	Fuel/Oxidant	Wavelength	Scale Expansion
Cadmium	C_2H_2 / Air	ca. 2288 A	8.0 X
Copper	C_2H_2 / Air	ca. 3247.5 A	9.0 X
Zinc	C_2H_2 / Air	ca. 2138.5 A	7.0 X
Mercury	Flameless	ca. 2536.5 A	5.0 X

Mercury: The digested solution was analyzed for mercury content by flameless atomic absorption. A 5.0 ml aliquot of diluted sample was pipeted into a 4 oz jar. 15 ml of deionized water were added to the jar and a magnetic stirring bar. The jar was placed on a magnetic stirrer and clamped securely. A rubber stopper was fitted into the jar. The stopper contained three tubes - one directly from a nitrogen cylinder, one leading to the glass flow-through cell, and one from a dropping funnel holding the reducing solution. Once sealed 10 ml of reducing solution is added to the jar and all stopcocks are turned to place the gap and contents in a closed system. The magnetic stirrer is activated and stirring is maintained at a constant rate for a full two minutes. The line running from the nitrogen cylinder through the jar to the cell is then opened allowing the mercury vapour to be carried into the cell for analysis. A strip chart recorder is used in conjunction with the instrument.

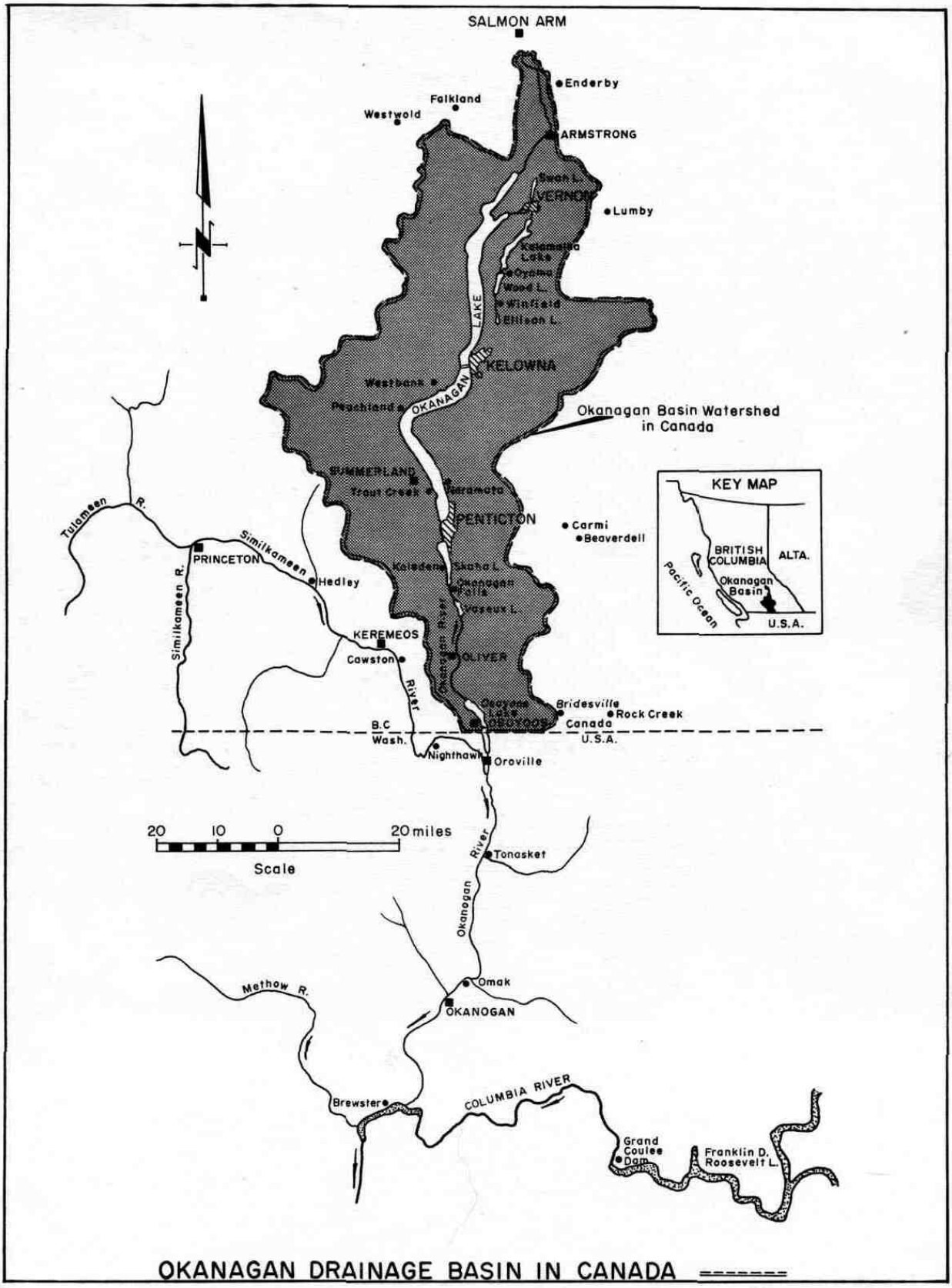
Appendix 3. Daily counts (1971) of spawning kokanee in some streams of the Okanagan basin.

DATE OF COUNT	LAKE: STREAM:	KALAMALKA COLDSTREAM	OKANAGAN VERNON	OKANAGAN EQUESIS	OKANAGAN WHITEMAN	OKANAGAN MISSION[1]	OKANAGAN POWERS	OKANAGAN TREPANIER	OKANAGAN PEACHLAND	SKAHA OKANAGAN RIVER (between Okanaga and Skaha Lake)
Sept. 14						1,156				
15						4,973				
16						4,599				
17						13,819				
18						16,994	28	0	46	
19		0	0			15,635				
20						15,405				
21						44,075				
22						21,500				
23						7,950				
24		0	0			10,925				
25			25			6,470	605	168	1,792	
26						12,730				16,000
27						15,240				
28						17,700				
29						27,030				
30						20,650	2,440	2,011		
Oct. 1						25,350			10,125	
2		0				19,700				
3						24,275	5,090	5,400	11,630	
4						13,250				
5		0	93			8,550				
6						2,500	5,295	5,120	12,500	
7						1,724				
8						2,000				
9		80	340							
10										
11										
12									9,850	
13							4,550	5,005		
14		6,040	635	12,000						
15										
16										
17										
18							2,460	5,800	10,650	
19										
20		20,600								
21			450							
22								5,150	15,100	
23										
24										
25										
26		26,700	350							
27				3,400				1,840	10,850	
28										
29										
30										
31		26,000							11,100	
Nov. 1										
2										
3										
4										
5		26,500							7,000	
6										
7										
8										
9										
10										
11										
12		16,500								
13										
14										
15										
16										
17										
18		8,000								

[1] Numbers passing the fish-counting fence which is shown in Fig. 15.

Appendix 4. Mean lengths and weights based on kokanee males and females of each population. Mean number of eggs per female.

Stream	Mean Length (mm)	Mean Weight (gm)	Mean Number of Eggs per Female
Coldstream	215	100	240
Equesis	254	158	-
Mission	260	183	480
Powers	259	177	530
Trepanier	260	183	490
Peachland	258	178	410
Trout	245	-	-
Okanagan	330	346	990



OKANAGAN DRAINAGE BASIN IN CANADA =======