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September 8, 1983
ENW-POV-L-83-037

Mr. Paul Ehinger
Vice President
Cooper Consultants, Inc.
11675 S.W. 66th Avenue
Portland, Oregon 97223

SUBJECT: JUNE-JULY 1983 REPORT FOR
VANCOUVER LAKE RESTORATION FISH SAMPLING

Dear Paul:

This letter summarizes the results of our June and July 1983 fish sampling using beach seine, weir, and fyke and gill nets in Vancouver Lake and vicinity. The study is being performed to monitor effects of the rehabilitated lake environment on fish populations. The main objective of the June and July sampling was to determine the number of juvenile and adult salmon or trout entering Vancouver Lake and assess effects of the lake environment on migration and viability of juvenile chinook salmon and other fish species.

Fish caught were identified, counted, and released, except for a few retained for length-weight and stomach analysis. Surface water temperatures, dissolved oxygen concentrations, and water clarity were measured at each seine location. Water temperature and water clarity were collected at the Lake River weir.

SAMPLING LOCATIONS

Currently, seven locations are being sampled in Vancouver Lake and one in Lake River (Figure 1). Four locations were also sampled in the Columbia River: two at the tip of Bachelor Island and two in Bachelor Island Slough (Figure 2). During fyke net sampling additional locations were seined in the flushing channel and the Columbia River near the opening of the flushing channel.

RESULTS AND DISCUSSION

Vancouver Lake Beach Seining

Black and white crappie were the dominant species during June and up to late July, whereupon subyearling peamouth became most abundant (Tables 1-4). Carp and brown bullhead were also abundant, and yellow perch, largemouth bass, and bluegill were common.

The greatest difference between 1982 and 1983 was the low abundance of subyearling crappie in 1983. During early July 1982 over 9000 subyearling crappie were caught, compared to 300 in 1983. As the abundance of crappie is frequently reported as cyclic in nature, often because of variations in water levels during spring spawning (Beam 1983), the change between 1982 and 1983 could be entirely natural. Water level in early July 1983, the period both species of crappie spawn in Vancouver Lake, was 2-4 feet lower than July 1982. This could have adversely affected embryo and subyearling survival.

Even with the flushing channel open in June and July, the number of juvenile chinook salmon in the lake remained low and similar to 1982. Only eight juvenile chinook were caught in the lake for all seine hauls (28) during June and July, with no more than three fish captured daily.

Chinook were not confined to the flushing channel area (location V02); only three of eight fish were caught at this station. This suggests that they were not congregating at the flushing channel opening, a behavior that would be expected if the fish in the lake were either experiencing stress or could not obtain sufficient food elsewhere in the lake.

Columbia River Beach Seine Catches

At the Columbia River stations, chinook salmon juveniles were more abundant in June and July (Tables 1-4) than at any time earlier in the year. Compared to the same period in 1982, there were fewer fish, and peak abundance was several weeks later. The occurrence and abundance of fish in the study area is a function of hatchery releases, and they can change markedly from one week to the next. Peak catches in early June 1982 occurred only 5 days after the single largest hatchery release of subyearling chinook above Vancouver Lake in the Columbia River. Dawley et al. (1982) found that peak catches at Jones Beach, adjusted for downstream travel time, were timed with major hatchery releases. We have not yet received the data for this year's salmon-steelhead releases from the major Columbia River hatcheries, but it appears that peak releases may have been later.

Other abundant fish caught were yellow perch, threespine stickleback, and peamouth, all common Columbia River species.

Vancouver Lake Night Beach Seine Catches

The night seining was performed to determine whether fish catches made during the day reliably represented conditions during the night. Few differences between day and night catches were apparent in June, but were pronounced in July (Table 5). In June, slightly higher catches of black crappie and

young-of-the-year yellow perch were made during the day. Schooling inshore of small fish may have been the reason. For the other species, abundance and distribution in June were very similar between day and night. In July, markedly increased abundance of white crappie (94 vs 7) and black crappie (69 vs 4) were observed during the night. Movement of these predominantly yearling and older individuals may have been offshore during the day and inshore at night. The cause may have been water depth, for the lake was four feet shallower in July compared to June.

Vancouver Lake Gill Net Catches

The purpose of the gill net sampling was to index the abundance of potential salmon/trout predators and collect fish stomachs for food habits analysis. Catches were dominated by largescale sucker in June and black crappie in July, followed by white crappie and white sturgeon in June, and white crappie and carp in July (Table 6). Very few large potential predators of juvenile salmon and trout were present in the catch except for white sturgeon. Most of the sturgeon ranged from 45 to 60 cm in length. White sturgeon of this size typically eat fish as their major food, although they may consume mainly dead fish (Scott and Crossman 1973). Initial examination of some stomach samples from white sturgeon showed both crappie and yellow perch present. Fish catches were highest at location V02, the opening of the flushing channel. The inflowing water at this site may provide better feeding conditions, habitats, or both.

No juvenile chinook were caught by gill net at this station, which suggests few larger juvenile chinook were present. The occurrence of juvenile shad solely at this station indicates they entered the lake via the channel.

Lake River Weir Catches

The weir sampling sought to estimate the degree to which adult salmon and trout were entering Vancouver Lake via Lake River. Weir catches were dominated by white and black crappie; there were neither salmon nor steelhead in the catch (Tables 7 and 8). Consequently few, if any, salmon or steelhead were being attracted into Vancouver Lake during June and July, two months when important runs of steelhead trout and sockeye salmon were moving upstream in the Columbia. This has been an extremely poor year for steelhead in the Columbia River, so lack of these fish during 1983 is not as good an indicator of their lack of attraction as it might be in years of larger runs. On the other hand, sockeye were fairly abundant. One cutthroat trout was gilled in the weir in late July. This fish was possibly a sea run fish heading for Burnt Bridge Creek. The relatively cool, wet summer may have constituted a lesser temperature barrier to any salmon or trout attracted into Lake River.

Two white sturgeon were caught in the weir in June, but none in July, the same trend as the gill net catches. Their presence in the trap suggests they may enter the lake via Lake River as well as the flushing channel.

Vancouver Lake Flushing Channel Fyke Net Catch

A fyke net was installed at the lake side junction of the flushing channel to estimate the number and species of salmon and trout entering the lake. Black crappie were the most abundant fish caught in June and July. Few chinook salmon juveniles -- the only salmonid collected -- were captured in either sampling period (Table 9). Because of the net's location, many fish captured may have entered from the lake rather than through the flushing channel. The net was placed on the lake side of the flushing channel where large eddies may have carried lake residing fish into the net. That 90 percent of the black crappie were caught after dark suggests that disoriented fish, which moved inshore to feed at night, were carried into the net. Common Columbia River species that typically are more abundant in the river than black crappie, such as peamouth and northern squawfish, had low abundance in the fyke net catches. Moreover, black crappie were not abundant in beach seine sets made concomitant to fyke net sampling in the flushing channel and adjacent river. Apparently most of the captured fish moved inshore to feed at night and were swept into the net. Juvenile chinook salmon appeared an exception; based on beach seine and fyke net catches, they entered the trap directly from the flushing channel.

Fyke net efficiency estimates (Table 9) indicate a relatively large proportion of the fish entering the lake were caught. Because so few chinook salmon were available for testing net efficiency, the estimates of efficiency may be in error for this species. Efficiency estimates for crappie may be more reliable because of larger sample sizes. Although crappie behavior and swimming ability may differ from chinook salmon, the consistency of the efficiencies between June and July suggests that the net caught about 30 percent of the fish entering the flushing channel. Assuming all chinook salmon caught went through the culverts and that the June chinook salmon catch efficiency (14.6 percent) applies for both June and July, a conservative estimate of the number of chinook salmon entering the lake through the flushing channel during June and July would be approximately 7037. This number is small compared to the number of salmon released into the Columbia River. For example, in 1982 over 37 million fall chinook were released into the Columbia River above Vancouver Lake from Washington hatcheries alone.

Chinook salmon entering the flushing channel may have passed through the lake and Lake River to the Columbia River. Unfortunately, so few salmon entered the lake that the planned study of their fate, after being marked, was unwarranted.

Additional Columbia River and Flushing Channel Beach Seine Catches

Because it appeared that few salmon or trout were entering the lake via the flushing channel, additional beach seining was undertaken in the channel and the Columbia River to determine the abundance and distribution of fish in the area (Table 10). The abundance of chinook salmon in the flushing channel in June was about five times higher than in July (15.5 fish vs 3.0 per seine haul). Also, the catch in Columbia River backwaters (low energy environments)[1/] was about 4 times higher in June than July. Fyke net catches of chinook salmon also were about 3 times higher in June than July. Catches for unprotected beaches (i.e., high energy environments) (Davis Bar and Frenchman's Bar) were nearly the same for both months, suggesting that fish abundance in backwaters may be a better indicator of what is entering the lake. Another factor possibly affecting whether the fish enter the lake is fish size. Larger salmon tend to stay further away from shore than small fish according to Dawley et al. (1982). Beach seine catches of juvenile chinook averaged 73 mm and 92 mm fork length in June and July, respectively. This helps explain why fewer fish may have been present in protected areas, including the flushing channel, during July than in June. Although water temperatures would also have affected distribution, the difference between open beaches and backwater areas was less than 1°C both months.

Water Quality

Lake clarity ranged from 17 cm to a depth of 60 cm during June and July and was generally lower than the same period in 1982 (Tables 11-14). Apparently fine particulates from the bottom are still being churned into the water column, presumedly by wave action. The river was much clearer, with clarity ranging from 70 to 140 cm. Temperature in the lake was typically greater than 20°C and reached 26.6°C in late June. Water temperatures for each period averaged about 22-23°C. Except for late June, water temperatures were typically below lethal levels. July water temperatures were cooler than in 1982, probably the result of the cool summer weather. The Columbia River temperatures were about 17-21°C during this period, with a gradual increasing trend from early June to late July temperatures.

Water temperature and clarity at the Lake River were within the range of those found in the lake. They were often lower than temperatures measured at the beach seine locations, even when samples were taken at short intervals. Apparently cooler water either from Lake River or the bottom of Vancouver Lake are entering Lake River.

1/ Low energy environments have considerable protection from waves and currents, and are typically quiescent. High energy environments behave inversely.

Dissolved oxygen levels in the lake were adequate to maintain healthy fish populations and were generally 1.0 mg/l lower than the Columbia River for the corresponding sampling period.

Very truly yours,

ENVIROSPHERE COMPANY

Rick D. Cardwell, Ph.D.
Program Manager

Literature Cited

Beam, J.H. 1983. The effects of annual water level management on population trends of white crappie in Elk City Reservoir, Kansas. North American Journal of Fisheries Management. 3:34-40.

Dawley, E.M., R.D. Ledgewood, T.H. Blahm, and A.L. Jensen. 1982. Migrational characteristics and survival of juvenile salmonids entering the Columbia River estuary in 1981. Coastal Zone Estuarine Studies.

Scott, W.B. and E.J. Crossman. 1973. Freshwater fishes of Canada. Fisheries Research Board of Canada, Bulletin 184. Ottawa, Canada. 966 pages.

RDC:lj1/4063A

Attachments (Tables and Figures)

cc: [redacted]
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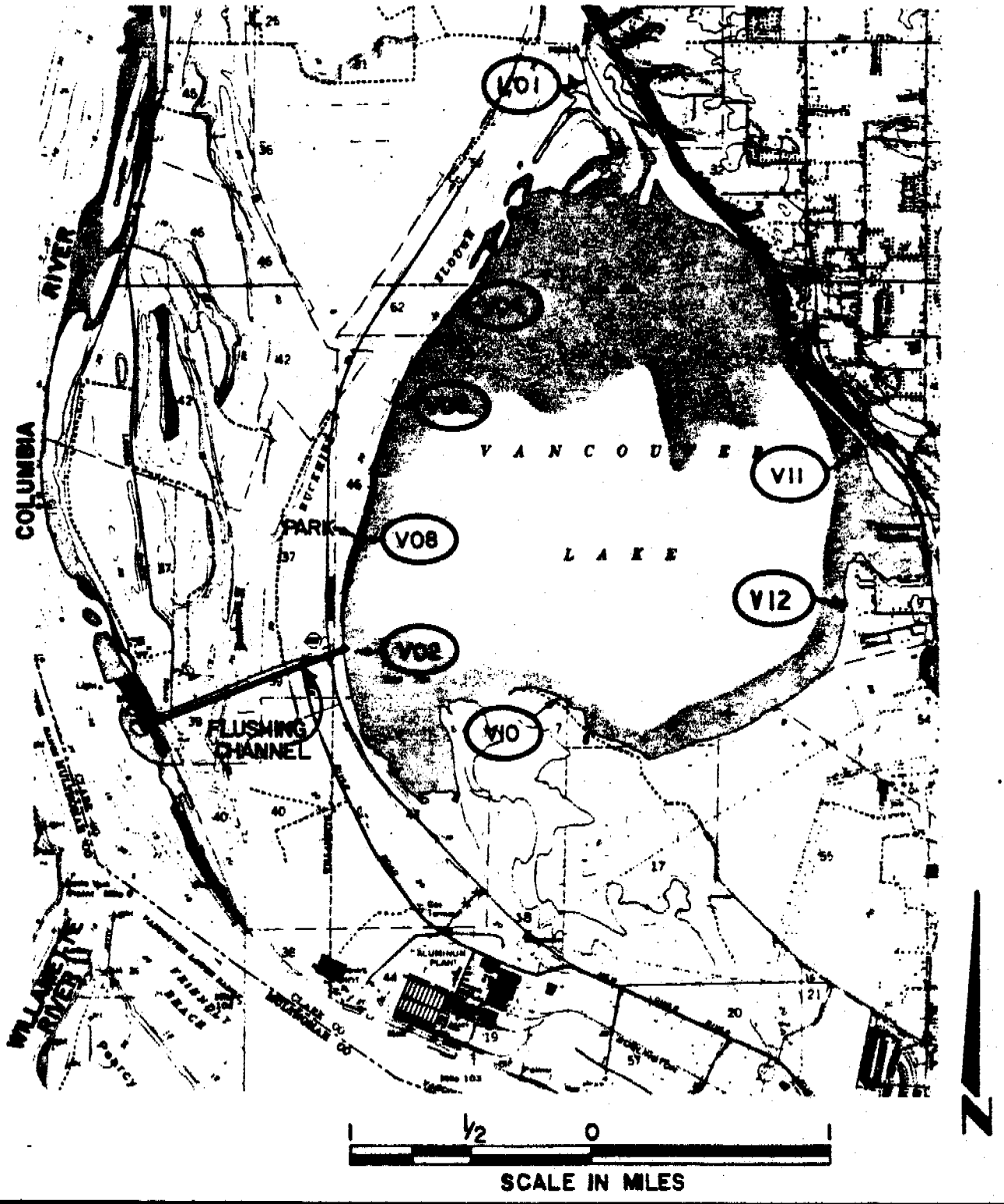
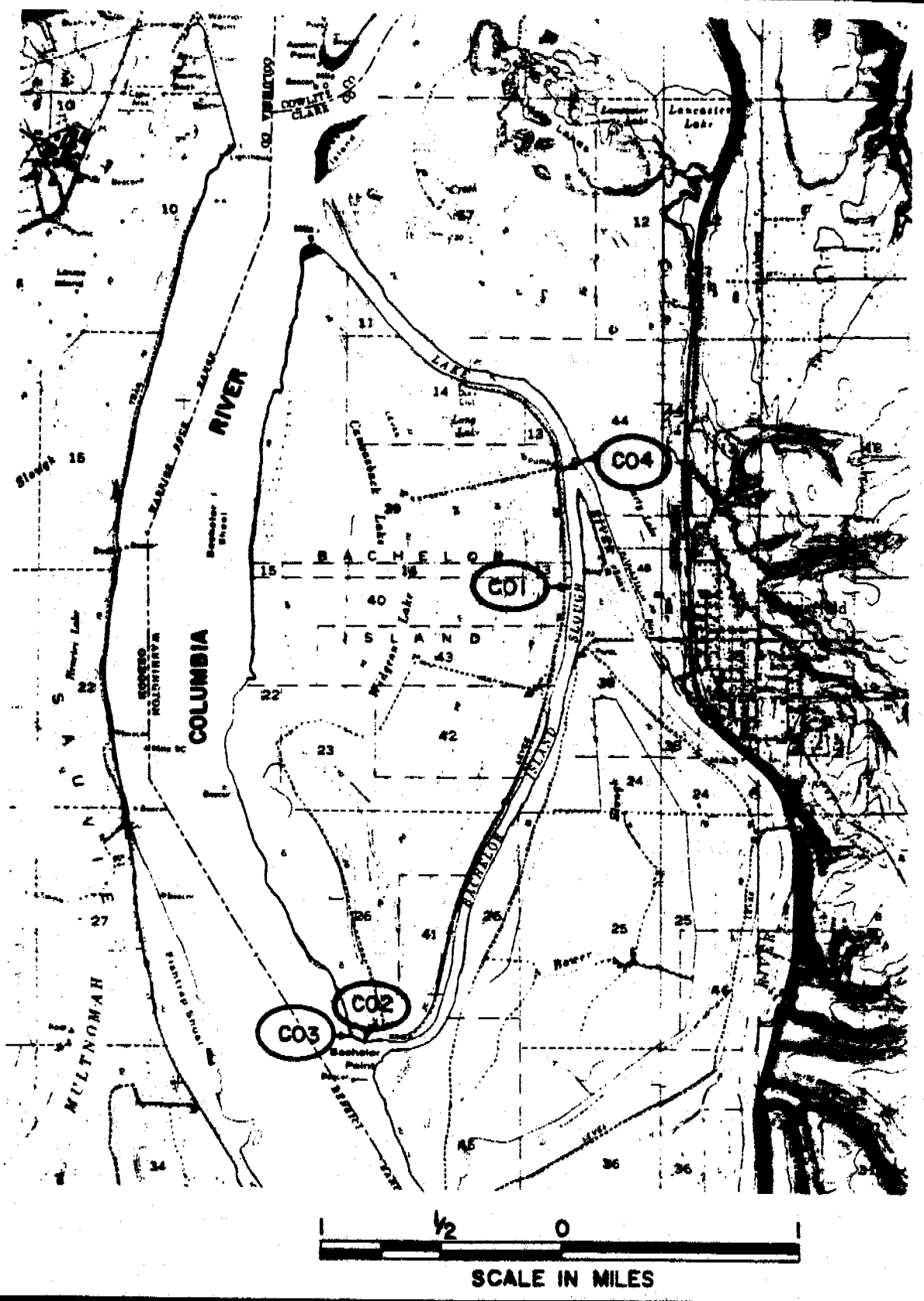


VANCOUVER LAKE
FISH SAMPLING LOCATIONS

FIGURE 1



COLUMBIA RIVER BACHELOR ISLAND SLOUGH
FISH SAMPLING LOCATIONS

FIGURE 2

TABLE 1
BEACH SEINE CATCHES IN VANCOUVER LAKE AND COLUMBIA RIVER
ON 7-8 JUNE 1983

SPECIES	SAMPLING LOCATION[a] V10	V02	V08	V03	V04	V11	V12	TOTAL	RELATIVE ABUNDANCE
Black Crappie	2	1		33		77	20	133	.369
White Crappie	9	4		43	4	34	27	121	.336
Yellow Perch		1		4	6		3	14	.039
Yellow Perch[b]				21	5	2		28	.078
Bluegill					12	1	4	17	.047
Largemouth Bass		1		3	3		2	9	.025
Largescale Sucker	1			1	3	1	1	7	.019
Pumpkinseed				3	3			6	.017
Carp		2		1			2	5	.014
Peamouth			1		1	2	1	5	.014
Prickly Sculpin				2	1	1		4	.011
Chinook Salmon[c]	1	1	1					3	.008
Threespine Stickleback				1		1		2	.006
American Shad		2						2	.006
Northern Squawfish						2		2	.006
Walleye	1							1	.003
Brown Bullhead				1				1	.003
TOTAL	14	12	2	113	38	121	60	360	1.001

SPECIES	SAMPLING LOCATION[a] C01[d]	C04	C02[d]	C03	TOTAL	RELATIVE ABUNDANCE
Chinook Salmon[c]	1	1	7.5		9.5	.345
Peamouth	1	2	2.5	1	6.5	.236
Black Crappie	2	3			5	.182
Threespine Stickleback		3			3	.109
Northern Squawfish			0.5	1	1.5	.055
White Crappie	0.5		0.5		1	.036
Mountain Whitefish			0.5		0.5	.018
Prickly Sculpin	0.5				0.5	.018
TOTAL	5	9	11.5	2	27.5	0.999

[a] Vancouver Lake sampling locations are denoted by V02 to V12, Columbia River locations by C01 to C04.
[b] Young of this year, others of same species are yearlings, juveniles or adults.
[c] Parr or smolts.
[d] Average of two seine hauls taken adjacent to each other.

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TABLE 2
BEACH SEINE CATCHES IN VANCOUVER LAKE AND COLUMBIA RIVER
ON 20-22 JUNE 1983

SPECIES	SAMPLING LOCATION[a] V10	V02	V08	V03	V04	V11	V12	TOTAL	RELATIVE ABUNDANCE
Crappie Spp.[b]	27	12	14	13	13	10		89	.126
White Crappie	23	10	1	14	2	137	39	226	.321
Black Crappie	30	12	7	55	2	40	11	157	.223
Yellow Perch	12	2		2	15	2	4	37	.052
Yellow Perch[b]	17	4		3	34	2		60	.085
Carp	7	1		3	2	5	18	36	.051
Goldfish	27	1				1	6	35	.050
Brown Bullhead	2					20	4	26	.037
Peamouth	1			8	1			10	.014
Bluegill		2		1		2	3	8	.011
Largemouth Bass		4					1	5	.007
Pumpkinseed	1						4	5	.007
Prickly Sculpin	1			2		1	1	5	.007
Chinook Salmon[c]		2						2	.003
Northern Squawfish	2							2	.003
Threespine Stickleback		1						1	.001
Largescale Sucker						1		1	.001
TOTAL	150	51	22	101	69	221	91	705	0.999

SPECIES	SAMPLING LOCATION[a] C01[d]	C04	C02[d]	C03	TOTAL	RELATIVE ABUNDANCE
Chinook Salmon[c]	6	5	20	11	42	.472
Threespine Stickleback	4.5	19			23.5	.264
Black Crappie	1.5	8	0.5		10	.112
Yellow Perch	2	4			6	.067
Peamouth	1		1		2	.022
Sockeye Salmon[e]			1		1	.011
White Crappie	1				1	.011
Largemouth Bass		1			1	.011
Prickly Scuplin		1			1	.011
Mountain Whitefish			0.5		0.5	.006
Redside Shiner	0.5				0.5	.006
Pumpkinseed	0.5				0.5	.006
TOTAL	17	38	23	11	89	0.999

[a] Vancouver Lake sampling locations are denoted by V02 to V12, Columbia River locations by C01 to C04.
[b] Young of this year, others of same species are yearlings, juveniles or adults.
[c] Parr or smolts
[d] Average of two seine hauls taken adjacent to each other.
[e] Caught two adult sockeye in one seine haul.

TABLE 3
BEACH SEINE CATCHES IN VANCOUVER LAKE AND COLUMBIA RIVER
ON 5-6 JULY 1983

SPECIES	SAMPLING LOCATION[a] V10	V02	V08	V03	V04	V11	V12	TOTAL	RELATIVE ABUNDANCE
Crappie Spp.[b]	7	19		113	155	1		295	.445
Black Crappie	23	1		2	15	1		42	.063
White Crappie	5	1	1	7	12			26	.039
Brown Bullhead				9	15	89	13	126	.190
Carp	1	1		3	4	38	49	96	.145
Yellow Perch	5	1		2	2	2		12	.018
Yellow Perch[b]	10		1	2	4	1		18	.027
Largemouth Bass	1	5			2		4	12	.018
Largemouth Bass[b]				2			2	4	.006
Peamouth				5	3	1		9	.014
Bluegill	4		1		2	1		8	.012
Pumpkinseed						5		5	.008
Goldfish	1		1		1			3	.005
Chinook Salmon[c]			2					2	.003
American Shad					2			2	.003
Prickly Sculpin						1		1	.002
Largescale Sucker						1		1	.002
Channel Catfish							1	1	.002
TOTAL	57	28	6	145	217	141	69	663	1.002

SPECIES	SAMPLING LOCATION[a] C01[d]	C04	C02[d]	C03	TOTAL	RELATIVE ABUNDANCE
Chinook Salmon[c]	10	6	60.5	5	81.5	.780
Threespine Stickleback	1.5		5	2	8.5	.081
Peamouth	1.5	1	1	1	4.5	.043
Starry Flounder		3			3	.029
Mountain Whitefish			2		2	.019
Yellow Perch	1	1			2	.019
Northern Squawfish	0.5	1			1.5	.014
Carp		1			1	.010
Prickly Scuplin	0.5				0.5	.005
TOTAL	15	13	68.5	8	104.5	1.000

[a] Vancouver Lake sampling locations are denoted by V02 to V12, Columbia River locations by C01 to C04.
[b] Young of this year, others of same species are yearlings, juveniles or adults.
[c] Parr or smolts
[d] Average of two seine hauls taken adjacent to each other.

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TABLE 4
BEACH SEINE CATCHES IN VANCOUVER LAKE AND COLUMBIA RIVER
ON 19-20 JULY 1983

SPECIES	SAMPLING LOCATION[a] V10	V02	V08	V03	V04	V11	V12	TOTAL	RELATIVE ABUNDANCE
Peamouth	65	53	18	6	4	92	86	324	.561
Crappie Spp.[b]	6	5		52	40	6	1	110	.190
Black Crappie	2				3	2	2	9	.016
White Crappie						7		7	.012
Carp	2			2	2	1	27	34	.059
Pumpkinseed	9			2		3	10	24	.042
Yellow Perch					1	4	8	13	.022
Yellow Perch[b]	3			1		4		8	.014
Largemouth Bass	8	2	1					11	.019
Largemouth Bass[b]				3				3	.005
Brown Bullhead				5	1	5	2	13	.022
Northern Squawfish	5					1	3	9	.016
Goldfish	3					3		6	.010
Bluegill	2					1	1	4	.007
Chinook Salmon[c]			1					1	.002
Warmouth							1	1	.002
Prickly Sculpin							1	1	.002
TOTAL	105	60	20	71	51	129	142	578	1.001

SPECIES	SAMPLING LOCATION[a] C01[d]	C04	C02[d]	C03	TOTAL	RELATIVE ABUNDANCE
Chinook Salmon[c]	0.5		10	2	12.5	.373
Yellow Perch	1.5	9		1	11.5	.343
Peamouth	1.5	2		1	4.5	.134
Largescale Sucker	1.5	1			2.5	.075
Carp		1			1	.030
Northern Squawfish	0.5				0.5	.015
Largemouth Bass	0.5				0.5	.015
Threespine Stickleback	0.5				0.5	.015
TOTAL	6.5	13	10	4	33.5	1.000

[a] Vancouver Lake sampling locations are denoted by V02 to V12, Columbia River locations by C01 to C04.
[b] Young of this year, others of same species are yearlings, juveniles or adults.
[c] Parr or smolts
[d] Average of two seine hauls taken adjacent to each other.

TABLE 5
NIGHT BEACH SEINE CATCHES IN VANCOUVER LAKE
ON 7 JUNE AND 5 JULY 1983

SPECIES	JUNE 7 SAMPLING LOCATION V03	V11	V12	TOTAL	RELATIVE ABUNDANCE
White Crappie	42	52	16	110	.539
Black Crappie	29	24	7	60	.294
Yellow Perch	2	8		10	.049
Yellow Perch[a/]		2		2	.010
Bluegill		2	3	5	.025
Pumpkinseed	1	2	2	5	.025
Largescale Sucker	1	1	3	5	.025
Brown Bullhead	1		3	4	.020
Carp			1	1	.005
Largemouth Bass			1	1	.005
Goldfish			1	1	.005
TOTAL	76	91	37	204	1.002

SPECIES	JULY 5 SAMPLING LOCATION V02	V03	V11	TOTAL	RELATIVE ABUNDANCE
Crappie Spp.[a/]	3		3	6	.025
White Crappie	35	55	4	94	.400
White Crappie[a/]			1	1	.004
Black Crappie	20		49	69	.291
Pumpkinseed		5	11	16	.068
Yellow Perch	1	3	8	12	.051
Yellow Perch[a/]	1		2	3	.013
Bluegill			11	11	.046
Brown Bullhead		5	2	7	.030
Carp		1	5	6	.025
Largemouth Bass	2	1	2	5	.021
Peamouth	2		2	4	.017
Goldfish		1		1	.004
Northern Squawfish	1			1	.004
Largescale Sucker			1	1	.004
TOTAL	65	71	101	237	1.003

[a/] Young of this year, others of same species are yearlings, juveniles or adults.

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TABLE 6
GILLNET CATCHES IN VANCOUVER LAKE
ON 20 JUNE AND 20 JULY 1983

SPECIES	JUNE 20 SAMPLING LOCATION V10	V02	V03	V11	TOTAL	RELATIVE ABUNDANCE
Largescale Sucker	10	8	2		20	.227
White Crappie		11	1	5	17	.193
White Sturgeon	3	12		2	17	.193
Carp	6	1	1	5	13	.148
Black Crappie		5	2	1	8	.091
Peamouth	2			4	6	.068
Chinook Salmon[a/]		3			3	.034
Goldfish	2				2	.023
American Shad[b/]		1			1	.011
Northern Squawfish		1			1	.011
TOTAL	23	42	6	17	88	0.999

SPECIES	JULY 20 SAMPLING LOCATION V10	V02	V03	V11	TOTAL	RELATIVE ABUNDANCE
Black Crappie	3	20		2	25	.352
White Crappie		14	1	4	19	.268
Carp		1	5	1	7	.100
Peamouth	1		1	3	5	.070
White Sturgeon	1	2	1		4	.056
American Shad[b/]		4			4	.056
Goldfish	2				2	.028
Brown Bullhead			2		2	.028
Yellow Perch	1				1	.014
Largescale Sucker				1	1	.014
Northern Squawfish			1		1	.014
TOTAL	8	41	11	11	71	1.000

[a/] Parr or smolts.
[b/] Juveniles.

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TABLE 7

WEIR CATCH IN LAKE RIVER FOR
THE PERIODS 1400 JUNE 6 to 1615 JUNE 8 AND 1400 JUNE 20
TO 1430 JUNE 22, 1983

Species	JUNE 6-8		JUNE 20-22	
	Number	Relative Abundance	Number	Relative Abundance
White Crappie	336	.538	374	.626
Black Crappie	232	.371	199	.333
Bluegill	13	.021	13	.022
Largescale Sucker	18	.029	6	.010
Carp	8	.013	1	.002
Largemouth Bass	6	.010	2	.003
Brown Bullhead	5	.008	2	.003
Goldfish	4	.006		
White Sturgeon[a/]	2	.003		
Pumpkinseed	1	.002		
TOTAL	625	1.001	597	0.999

a/ During 6-8 June and 20-22 June, 3 and 2 white sturgeon were found in the wings when weir pulled, respectively.

TABLE 8

WEIR CATCH IN LAKE RIVER FOR
THE PERIODS 1320 JULY 5 TO 1400 JULY 7 AND 1300 JULY 19
TO 1550 JULY 21, 1983

Species	JULY 5-7[a] Number	JULY 5-7[a] Relative Abundance	JULY 19-21[b] Number	JULY 19-21[b] Relative Abundance
Black Crappie	116	.475	214	.652
White Crappie	84	.344	89	.271
Bluegill	30	.123	18	.055
Carp	5	.020	3	.009
Brown Bullhead	5	.020		
Largescale Sucker	2	.008	2	.006
Warmouth	1	.004		
Largemouth Bass	1	.004		
Yellow Perch			1	.003
Goldfish			1	.003
TOTAL	244	0.998	328	0.999

[a] One white sturgeon found gilled in wing when weir pulled on 7 July.
[b] One cutthroat found gilled in wing when weir pulled on 21 July.

TABLE 9

VANCOUVER LAKE FLUSHING CHANNEL FYKE NET CATCH FOR THE PERIODS 1700 JUNE 13 TO 2125 JUNE 15 AND 1130 JULY 11 TO 1315 JULY 13, 1983

Species	JUNE[a] Number	JUNE[a] Relative Abundance	JULY[b] Number	JULY[b] Relative Abundance
Black Crappie	1590	.919	242	.786
Chinook Salmon	50	.029	18	.058
Threespine Stickleback	30	.017	18	.058
White Crappie	36	.021	10	.032
Yellow Perch	12	.007	8	.026
Peamouth	5	.003	6	.019
American Shad	3	.002	1	.003
Northern Squawfish	2	.001	1	.003
Prickly Sculpin			2	.006
Bluegill	1	.001	1	.003
Largescale Sucker			2	.006
Goldfish	1	.001		
TOTAL	1730	1.001	308	.997

[a] June Net Efficiency for Chinook Salmon - 6/41 = 14.6%; and for Crappie - 51/170 = 30.0%

[b] July Net Efficiency for Chinook Salmon - 2/8 = 25.0%; and for Crappie - 81/265 = 30.6%

TABLE 10
BEACH SEINE CATCHES OF JUVENILE CHINOOK SALMON IN THE FLUSHING CHANNEL IN NEARBY OPEN AND PROTECTED AREAS IN THE COLUMBIA RIVER AND TOTAL FYKE NET CATCH IN VANCOUVER LAKE IN JUNE AND JULY 1983

Location	Total
Fyke Net Catch	
June 13-16	50
July 11-14	18

	Seine Haul Location[a/]						
	Inner		Middle		Outer		
Location	N	S	N	S	N	S	Mean
Flushing Channel							
June 13-16	23	34	7	15	6	8	15.5
July 11-14	3	9	1	1	3	1	3.0

	Seine Haul Number			
Location	1	2	3	Mean
Davis Bar (open water)				
June 13-16	5	10	10	8.3
July 11-14	7	10	21	12.7
Frenchman's Bar (open water)				
June 13-16	10	18	14	14.0
July 11-14	11	2	9	7.3
Protected Backwaters				
June 13-16	34	46	114	64.7
July 11-14	16	15	16	15.7

a/ Inner = Closest locations to the lake
Outer = Closest locations to the river
N = North bank on channel
S = South bank on channel

4033A

WATER QUALITY CODE DEFINITIONS

PROGRAM

Code	Definition
BSR	Beach seining, daytime
BSN	Beach seining, night
GNR	Gill netting, bottom
GNS	Gill netting, surface
WL	Weir, Lake River

STATION (LOCATION)

Code	Definition
C__	Columbia River or Bachelor Island Slough location
V__	Vancouver Lake location
L__	Lake River weir location

CORRESPONDING TIME AND REPLICATE

Code	Definition
END	Water quality data collected at end of sampling
BEGIN	Water quality data collected at start of sampling
LATER	Water quality data collected significantly later than the end of fish sampling

TABLE 11

WATER QUALITY DATA FROM VANCOUVER LAKE, THE COLUMBIA RIVER AND BACHELOR ISLAND SLOUGH FOR EARLY JUNE, 1983

DATE	PROGRAM	STATION	COLLECTION TIME	CORRESPONDING TIME	REPLICATE	SECCHI DEPTH (cm)	WATER TEMPERATURE (°C)	DISSOLVED OXYGEN (mg/l)	DEPTH OF SAMPLE (m)
6/8/83	BSR	C01	1335	END	1	75	17.5	11.9	0.2
6/8/83	BSR	C02	1220	END	1	75	16.6	11.8	0.2
6/8/83	BSR	C03	1245	END	1	75	17.0	11.8	0.2
6/8/83	BSR	C04	1422	END	1	70	17.9	12.1	0.2
6/8/83	BSR	V02	0940	END	1	35	21.0	9.9	0.2
6/7/83	BSR	V03	1535	END	1	32	24.0	11.0	0.2
6/8/83	BSR	V04	1014	END	1	37	21.7	10.1	0.2
6/8/83	BSR	V08	0912	END	1	33	20.0	10.1	0.2
6/7/83	BSR	V10	1454	END	1	35	22.5	10.7	0.2
6/7/83	BSR	V11	1340	END	1	25	22.0	9.9	0.2
6/7/83	BSR	V12	1223	END	1	17	22.8	9.8	0.2
6/6/83	BSN	V03	2141	END	1	-	19.8	9.7	0.2
6/6/83	BSN	V11	2304	END	1	-	19.7	9.2	0.2
6/7/83	BSN	V12	0035	END	1	-	19.5	9.6	0.2
6/6/83	WL	L01	1400	END	1	35	19.5	-	0.2
6/7/83	WL	L01	1015	END	1	31	18.3	-	0.2
6/7/83	WL	L01	1645	END	1	35	20.6	-	0.2
6/8/83	WL	L01	0800	END	1	31	19.2	-	0.2
6/8/83	WL	L01	1615	END	1	28	20.1	-	0.2

TABLE 12

WATER QUALITY DATA FROM VANCOUVER LAKE, THE COLUMBIA RIVER AND BACHELOR ISLAND SLOUGH FOR LATE JUNE, 1983

DATE	PROGRAM	STATION	COLLECTION TIME	CORRESPONDING TIME	REPLICATE	SECCHI DEPTH (cm)	WATER TEMPERATURE (°C)	DISSOLVED OXYGEN (mg/l)	DEPTH OF SAMPLE (m)
6/22/83	BSR	C01	1212	END	1	100	17.4	10.8	0.2
6/22/83	BSR	C02	1046	END	1	110	17.1	10.5	0.2
6/22/83	BSR	C03	1121	END	1	110	17.1	10.5	0.2
6/22/83	BSR	C04	1242	END	1	100	17.0	10.6	0.2
6/21/83	BSR	V02	1200	END	1	30	21.5	9.6	0.2
6/20/83	BSR	V03	1542	END	1	17	20.4	9.4	0.2
6/22/83	BSR	V04	0858	END	1	25	18.1	9.0	0.2
6/20/83	BSR	V08	1455	END	1	36	21.2	9.6	0.2
6/21/83	BSR	V10	1245	END	1	30	24.6	9.6	0.2
6/21/83	BSR	V11	1510	END	1	30	26.6	11.3	0.2
6/21/83	BSR	V12	1410	END	1	30	25.4	10.0	0.2
6/20/83	GNR	V02	2213	END	1	-	19.0	9.4	0.2
6/20/83	GNR	V03	2200	END	1	-	18.5	9.7	0.2
6/20/83	GNR	V11	2224	END	1	-	20.0	9.5	0.2
6/20/83	GNR	V10	2145	END	1	-	19.8	10.2	0.2
6/20/83	WL	L01	1700	END	1	30	19.2	-	0.2
6/21/83	WL	L01	1100	END	1	35	18.1	-	0.2
6/21/83	WL	L01	1635	END	1	30	22.5	-	0.2
6/22/83	WL	L01	0830	END	1	32	19.0	-	0.2
6/22/83	WL	L01	1430	END	1	33	18.1	-	0.2

TABLE 13

WATER QUALITY DATA FROM VANCOUVER LAKE, THE COLUMBIA RIVER AND BACHELOR ISLAND SLOUGH FOR EARLY JULY, 1983

DATE	PROGRAM	STATION	COLLECTION TIME	CORRESPONDING TIME	REPLICATE	SECCHI DEPTH (cm)	WATER TEMPERATURE (°C)	DISSOLVED OXYGEN (mg/l)	DEPTH OF SAMPLE (m)
7/7/83	BSR	C01	1322	END	1	120	18.1	10.3	0.2
7/7/83	BSR	C02	0945	END	1	140	18.0	10.2	0.2
7/7/83	BSR	C03	1023	END	1	140	18.0	10.4	0.2
7/7/83	BSR	C04	1222	END	1	110	18.0	10.2	0.2
7/6/83	BSR	V02	1305	END	1	40	20.0	9.2	0.2
7/5/83	BSR	V03	1524	END	1	36	22.5	9.8	0.2
7/6/83	BSR	V04	1548	END	1	35	22.1	9.2	0.2
7/5/83	BSR	V08	1446	END	1	35	22.5	9.8	0.2
7/6/83	BSR	V10	1156	END	1	40	20.2	9.1	0.2
7/6/83	BSR	V11	1440	END	1	20	23.0	9.9	0.2
7/6/83	BSR	V12	1350	END	1	40	22.5	9.2	0.2
7/5/83	BSN	V02	2308	END	1	-	22.5	9.6	0.2
7/5/83	BSN	V03	2205	END	1	-	22.0	9.9	0.2
7/6/83	BSN	V11	0039	END	1	-	22.5	9.5	0.2
7/5/83	WL	L01	1320	END	1	41	19.5	-	0.2
7/5/83	WL	L01	1630	END	1	35	20.9	-	0.2
7/6/83	WL	L01	1010	END	1	40	18.5	-	0.2
7/6/83	WL	L01	1700	END	1	40	22.1	-	0.2
7/7/83	WL	L01	0800	END	1	40	19.0	-	0.2
7/7/83	WL	L01	1400	END	1	55	19.5	-	0.2

TABLE 14

WATER QUALITY DATA FROM VANCOUVER LAKE, THE COLUMBIA RIVER AND BACHELOR ISLAND SLOUGH FOR LATE JULY, 1983

DATE	PROGRAM	STATION	COLLECTION TIME	CORRESPONDING TIME	REPLICATE	SECCHI DEPTH (cm)	WATER TEMPERATURE (°C)	DISSOLVED OXYGEN (mg/l)	DEPTH OF SAMPLE (m)
7/21/83	BSR	C01	1335	END	1	120	20.2	-	0.2
7/21/83	BSR	C02	1225	END	1	130	19.7	-	0.2
7/21/83	BSR	C03	1256	END	1	100	19.6	-	0.2
7/21/83	BSR	C04	1405	END	1	100	21.0	-	0.2
7/19/83	BSR	V02	1540	END	1	60	21.6	-	0.2
7/20/83	BSR	V03	1040	END	1	40	21.0	-	0.2
7/19/83	BSR	V04	1655	END	1	50	21.5	-	0.2
7/19/83	BSR	V08	1620	END	1	60	21.0	-	0.2
7/20/83	BSR	V10	1130	END	1	40	21.9	-	0.2
7/20/83	BSR	V11	1335	END	1	50	23.0	-	0.2
7/20/83	BSR	V12	1245	END	1	40	23.7	-	0.2
7/19/83	WL	L01	1300	END	1	50	20.1	-	0.2
7/21/83	WL	L01	1010	END	1	42	20.5	-	0.2
7/21/83	WL	L01	1550	END	1	45	21.0	-	0.2