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**FISHERIES RESEARCH BOARD
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MANUSCRIPT REPORT SERIES

No. 1094

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**Midwater Trawling for Sockeye Salmon
Underyearlings (*Oncorhynchus nerka*)
at Babine Lake, 1967**

by
J. G. McDonald and J. R. Scarsbrook

Biological Station, Nanaimo, B.C.

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INTRODUCTION

This report describes the method and results of midwater trawling for underyearling sockeye salmon (Oncorhynchus nerka) at Babine Lake, British Columbia, in 1967. The work was part of a joint Fisheries Research Board - Fisheries Service program to assess a large-scale sockeye development project (Canada Department of Fisheries, MS, 1965). One of the requirements of assessment was to measure changes in the density and distribution of young sockeye in the lake nursery area as the size of the population was increased. Estimates of density had been made for sockeye in Babine Lake by Johnson (1956, 1958) using catch per unit effort by surface townetting and later by McDonald (1969), using purse seines. However, the catch by both types of gear was extremely variable and the resulting estimates of density did not provide the desired precision. The limitation of these techniques appeared to stem mainly from rapid changes in the vertical distribution of the fish and, thus, their availability to the gear. Townets were effective only for a period of an hour or less at evening twilight. Seines caught sockeye throughout the night but not by day. Apparently at dawn the young sockeye descended somewhere below the depth of the seine (about 16 m).

Midwater trawls, together with purse seines and an echo sounder were used in 1967 in an attempt to determine the whereabouts and vertical movements of underyearling sockeye throughout the day and night. Such information would facilitate the development of methods to improve estimates of density as well as to add substantially to our knowledge of the sockeye's lacustrine ecology. The midwater trawl proved to be an effective means of capturing sockeye by day and at depths as great as 59 m. Results have been reported (McDonald, in press) but catches and the particulars of individual seine sets and trawl tows were not included. This detailed information is given in two reports. The first (Scarsbrook and McDonald, MS, 1970), deals with all seining operations at Babine Lake, 1966-1968, and includes sets made for the study of vertical distribution. This second report deals with the midwater trawling.

METHODS

Trawling was carried out at two locations in areas 2 and 3 of the lake's main basin (see X's in Fig. 1).

Two 6-ft Isaacs-Kidd trawls were used each with a different sized mesh. A 3/16-inch (0.48 cm) mesh (stretched measure) was used in July and part of August (tow no. 8-59, 74-80). In this period the average length of under-yearlings was 31.6 mm, SE 0.39 (July 1-7), and 51.0 mm, SE 0.64 (August 18-29). A larger 3/8-inch (0.96 cm) mesh was used in the last half of August through to October (tow no. 60-73, 81-184). Captured underyearlings averaged 62.9 mm, SE 0.82, September 24-29, and 67.0 mm, SE 2.63, on October 27.

The nets were constructed of 210/6 knotless nylon thread dyed dark green. Number 210 designates the type and weight of thread and No. 6 designates

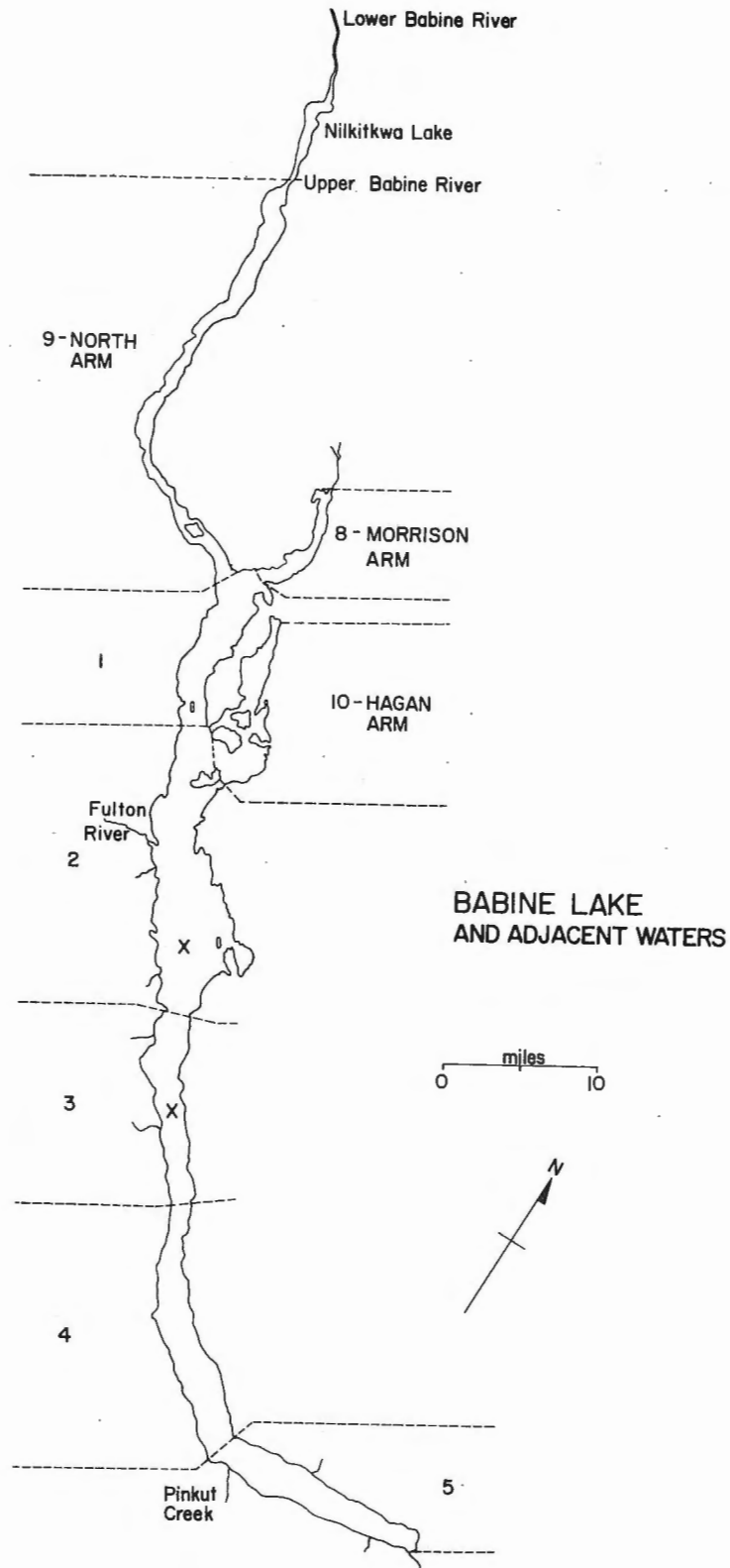


Fig. 1. Babine Lake showing lake areas and midwater trawling sites (X's).

the number of strands. The mouth of the trawl was 6 ft (1.83 m) wide, 8 ft (2.44 m) high, and 15 ft (4.58 m) long. The trawl was fitted with a depressor board on the bottom and a spreader bar on top to keep the mouth of the trawl open. The towline was a 1/4-inch (0.63 cm) diameter wire rope. All trawling was carried out from a 35-ft (10.7 m) drum seiner (Fig. 2) using the purse winch for setting and retrieving the net.

To determine the fishing depth of the trawl, a series of tows was made when both towline length and trawl depth were recorded. Depth was shown on a Furuno Pilotograph (200 kHz) echo sounder operated from a small boat which rode astern of the towing vessel and above the trawl. The centre of the net opening (as shown in the echo tracing in Fig. 3) was taken to be the depth of the net. The depths of subsequent tows were determined by adjusting the towing line length according to the length-depth relationship derived from the above series of tows (roughly 3 m of line for each metre of depth).

Towing speed, with both sizes of mesh, was maintained at 4 mph (6.4 km/hr).

The procedure for operating the trawl was as follows: the net was "shot" over the side of the vessel while underway at a speed of about 2 mph (3.2 km/hr). The towing line was let out the appropriate length and the vessel brought up to towing speed. Usually, a series of tows was made starting near the surface (4.6 m or 9.2 m) and then at depth intervals of 9.2 m to a maximum of 58.6 m. The net was retrieved (the vessel was slowed down to approximately 2 mph) and the catch removed and recorded after each tow which was usually 15 minutes long (i.e., from the time towing speed was reached until retrieval began). The time taken to set and retrieve the net varied with the depth of the tow. At 4.6 m, the shallowest towing depth, the average time taken to set and retrieve the net was 3 minutes, at 54.9 m it took about 11.5 minutes. A series of tows at 9.6 m intervals to a depth of 54.9 m usually took about 2.5 hours to complete. Information such as times, location, weather conditions, and other pertinent data were recorded for each tow. The catch was preserved in a 10% formalin solution for future examination.

Catches and other pertinent data are given in the accompanying table.

References

- Department of Fisheries of Canada. 1965. Proposed sockeye salmon development program for Babine Lake. Dept. Fish. Canada, Vancouver, B.C. 53 p.
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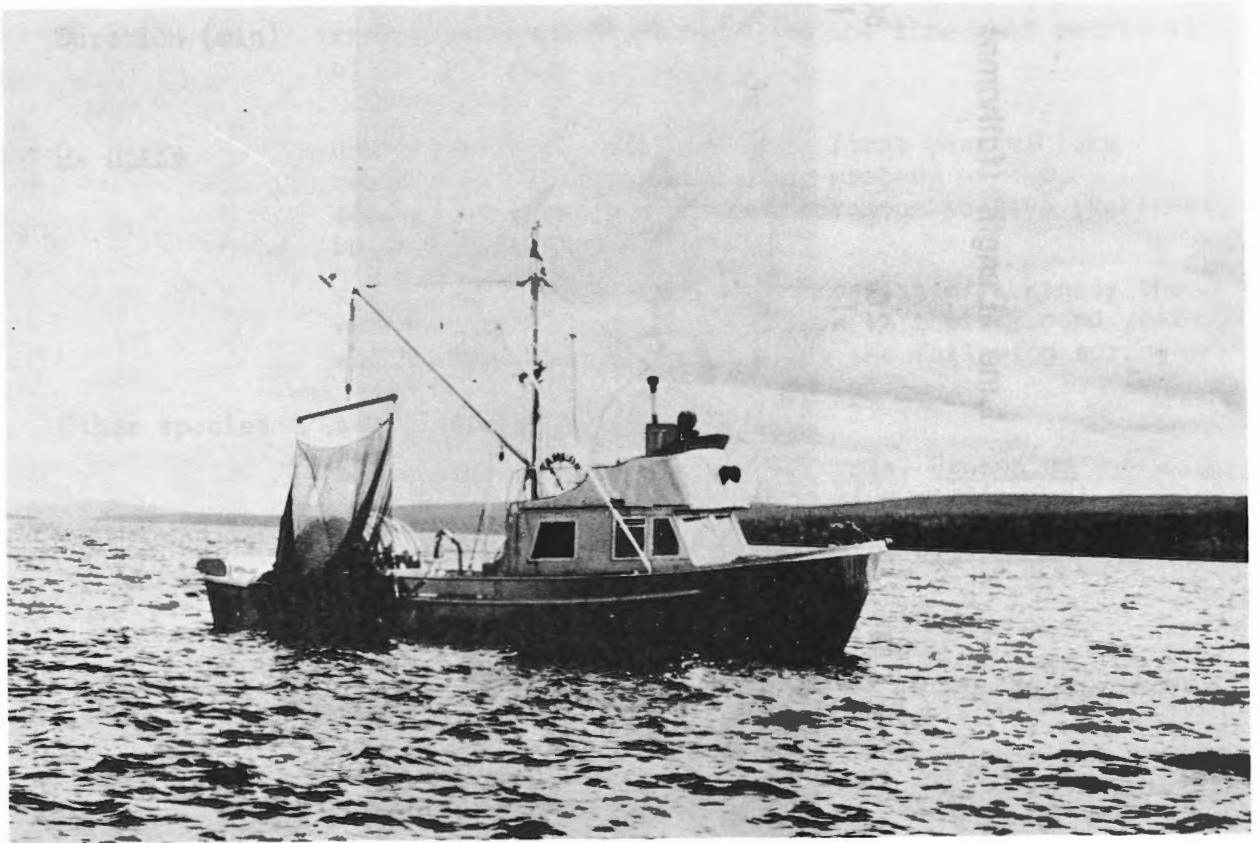


Fig. 2. M.V. Tahlok on Babine Lake.

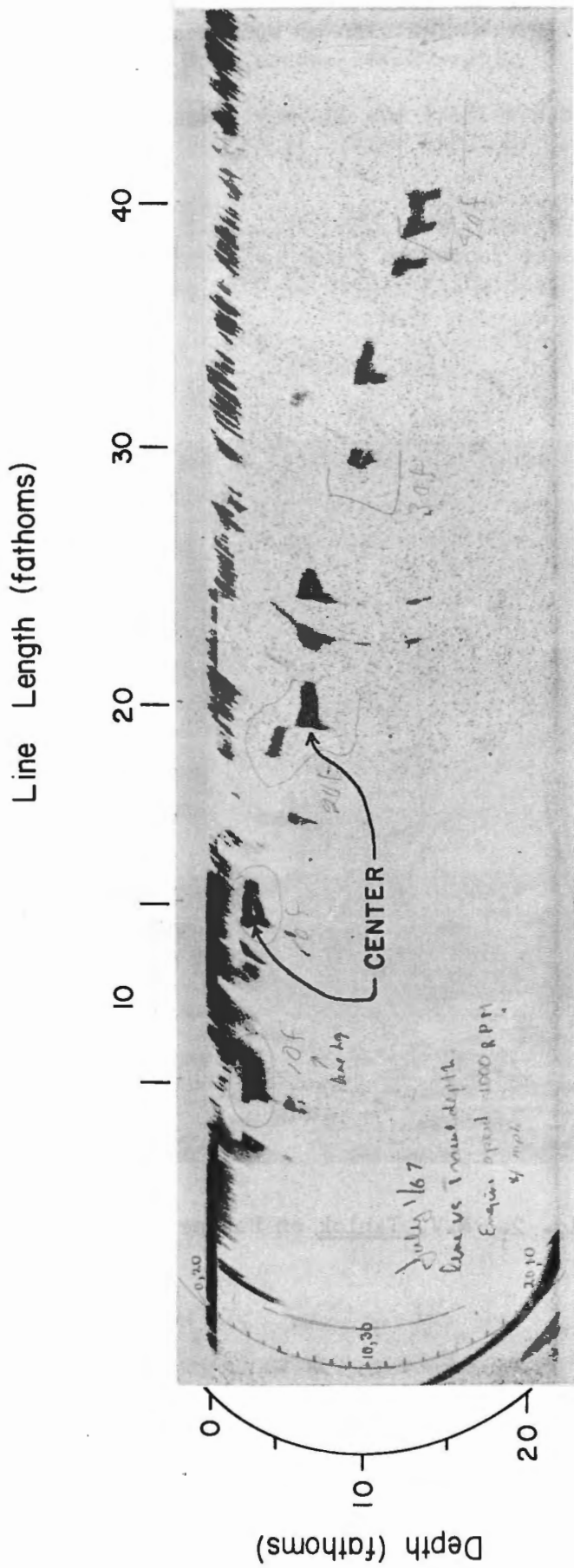


Fig. 3. Echo-sounder tracings of the midwater trawl.

DEFINITION OF TERMS USED IN THE TABLE

Tow number:	identification number for each tow
Lake area (see map):	Babine Lake was divided into 8 areas. All trawling was done in areas 2 and 3 (exact locations are shown on the map by X's)
Time: Start	the time recorded when the towline was out to length and the vessel was brought up to towing speed. All times are Pacific Daylight Saving Time
Duration (min)	the period between "start" and the time that retrieval of the net began
Catch: <u>O. nerka</u>	underyearlings - fish in their first year of lake residence. These would be the progeny of the anadromous sockeye and non-anadromous sockeye (kokanee), but mainly of the former age 1 and older - these would consist of kokanee, the non-anadromous form, and sockeye in their second year which would emigrate to the sea the following spring
Other species	sculpins, <u>Cottus asper</u> whitefishes, <u>Coregonus clupeaformis</u> , <u>Prosopium coulteri</u> , or <u>Prosopium williamsoni</u> suckers, <u>Catostomus macrocheilus</u> or <u>Catostomus commersoni</u>

Table giving catches of O. nerka and other fishes by midwater trawling, 1967.

Date	Tow No.	Lake Area	Depth (m)	Time		Catch		Other Species
						O. nerka		
				Start (hr)	Duration (min)	Under-yearlings	Age 1 and older	
July 1	8	2	9.2	1345	15	-	-	-
	9	2	18.3	1410	15	3	-	-
	10	2	23.8	1443	15	31	-	-
	11	2	28.8	1512	15	6	1	-
	12	2	36.6	1540	16	21	-	-
	13	2	47.6	1613	15	-	-	-
	14	2	58.6	1648	15	3	-	-
July 2	15	2	9.2	1435	15	-	-	-
	16	2	18.3	1502	13	-	-	-
	17	2	22.9	1527	15	19	-	-
	18	2	27.5	1554	15	13	-	-
	19	2	36.6	1625	15	10	1	2 ^a
	20	2	45.8	1700	15	2	-	-
	21	2	54.9	1735	16	-	-	-
July 4	22	3	9.2	1032	15	-	-	-
	23	3	18.3	1054	15	1	-	-
	24	3	27.5	1119	15	27	-	-
	25	3	22.9	1149	15	61	-	-
	26	3	36.6	1218	15	11	-	-
	27	3	45.8	1249	15	3	-	-
	28	3	54.9	1321	16	1	-	-
	29	3	9.2	1354	15	-	-	-
	30	3	18.3	1417	15	8	-	-
	31	3	22.9	1444	15	30	-	1 ^a
	32	3	27.5	1513	15	33	-	-
	33	3	36.6	1545	15	7	-	-
	34	3	45.8	1616	15	1	-	-
	35	3	54.9	1647	16	2	-	1 ^b
July 6	36	3	12.6	2146	18	52	-	-
	37	3	4.6	2217	15	10	-	-
	38	3	9.2	2241	15	1	-	-
	39	3	18.3	2306	15	3	-	-
	40	3	22.9	2333	15	1	-	-
July 7	41	3	27.5	0002	15	1	-	-
	42	3	36.6	0035	15	3	-	-
	43	3	4.6	0107	15	18	-	-
	44	3	9.2	0132	15	29	-	-
	45	3	9.2	0159	15	10	-	-
	46	3	13.5	0223	15	16	-	-
	47	3	18.3	0250	15	4	-	-
	48	3	22.9	0317	15	-	-	-
	49	3	27.5	0344	15	1	-	-

Date	Tow No.	Lake Area	Depth (m)	Time		Catch		Other Species
				Start (hr)	Duration (min)	O. nerka		
						Under-yearlings	Age 1 and older	
Aug. 18	50	3	4.6	0952	15	-	-	-
	51	3	9.2	1013	15	-	-	-
	52	3	18.3	1035	15	-	-	-
	53	3	27.5	1059	15	1	-	-
	54	3	36.6	1126	15	-	-	-
	56	3	45.8	1242	15	50	-	-
	57	3	54.9	1309	15	5	-	-
	58	3	10.8	1339	15	-	-	-
	59	3	32.5	1400	15	1	-	-
	60	3	4.6	1431	15	-	-	-
	61	3	9.2	1453	15	-	-	-
	62	3	18.3	1513	15	8	-	-
	63	3	27.5	1541	15	-	-	-
	64	3	36.6	1601	15	51	-	-
Aug. 19	65	3	45.8	1633	15	6	-	-
	66	3	54.9	1703	15	8	-	-
	67	3	4.6	1018	15	-	-	-
	68	3	9.2	1040	15	-	-	-
	69	3	18.3	1103	15	1	-	-
	70	3	27.5	1127	15	2	-	-
	71	3	36.6	1153	15	17	-	-
	72	3	45.8	1220	15	14	-	-
	73	3	54.9	1252	15	5	-	-
	74	3	4.6	1328	15	-	-	-
	75	3	9.2	1348	14	-	-	-
	76	3	18.3	1410	15	-	-	-
	77	3	27.5	1433	15	-	-	-
	78	3	36.6	1502	15	7	-	-
79	3	45.8	1531	15	9	-	-	
80	3	54.9	1605	15	5	-	1 ^b	
Aug. 22	81	3	4.6	1958	15	-	-	-
	82	3	9.2	2019	15	4	-	-
	83	3	13.5	2041	14	2	-	-
	84	3	18.3	2103	15	1	-	-
	85	3	27.5	2127	15	-	-	-
	86	3	36.6	2152	15	1	-	-
	87	3	45.8	2220	15	1	-	-
Aug. 23	88	3	16.2	1957	15	6	-	-
	89	3	14.4	2021	15	7	-	-
	90	3	4.6	2044	15	3	-	-
	91	3	9.2	2106	15	-	-	-
	92	3	13.5	2129	15	-	-	-

Date	Tow No.	Lake Area	Depth (m)	Time		Catch		Other Species
				Start (hr)	Duration (min)	O. nerka		
						Under-yearlings	Age 1 and older	
Aug. 23	93	3	18.3	2155	15	1	-	-
cont'd	94	3	10.8	2218	17	15	1	-
	95	3	27.5	2242	15	1	-	-
	96	3	11.7	2307	15	61	-	-
	97	3	36.6	2332	15	-	-	-
	98	3	10.8	2358	15	28	1	-
Aug. 24	99	3	45.8	0022	15	-	-	-
	100	3	10.8	0053	15	24	2	1 ^c
	101	3	4.6	0117	15	7	-	-
	102	3	10.8	0140	16	10	-	-
	103	3	18.3	0203	15	-	-	-
	104	3	10.8	0228	15	16	1	-
	105	3	27.5	0254	15	-	-	-
	106	3	10.8	0317	15	18	1	-
	107	3	36.6	0342	15	-	-	-
	108	3	10.8	0407	15	13	-	-
	109	3	4.6	0451	15	45	-	-
	110	3	9.2	0515	17	3	1	-
	111	3	18.3	0543	15	1	-	-
	112	3	8.1	0608	15	5	-	-
	113	3	27.5	0631	15	3	-	-
	114	3	19.8	0656	15	31	-	-
	115	3	36.6	0721	15	9	-	-
	116	3	45.8	0748	15	26	-	-
	117	3	54.9	0817	15	3	-	-
Aug. 25	118	2	40.6	1058	15	8	-	-
	119	2	4.6	1124	15	1	-	-
	120	2	9.2	1146	15	-	-	-
	121	2	18.3	1208	15	-	-	-
	122	2	27.5	1232	15	1	-	-
	123	2	36.6	1257	15	17	-	-
	124	2	45.8	1327	15	10	-	-
	125	2	54.9	1357	15	1	-	-
Aug. 29	126	3	4.6	0727	15	-	-	-
	127	3	9.2	0751	15	-	-	-
	128	3	4.6	0815	15	1	-	-
	129	3	27.5	0841	15	-	-	-
	130	3	36.6	0907	15	37	-	-
	131	3	45.8	0938	15	7	-	-
	132	3	54.9	1011	15	-	-	-
	133	3	4.6	1646	15	-	-	-
	134	3	9.2	1707	15	-	-	-

Date	Tow No.	Lake Area	Depth (m)	Time		Catch		
				Start (hr)	Duration (min)	O. nerka		Other Species
						Under-yearlings	Age 1 and older	
Aug. 29	135	3	18.3	1729	15	2	-	-
cont'd	136	3	27.5	1754	15	2	-	-
	137	3	36.6	1821	15	30	-	-
	138	3	45.8	1850	15	1	-	-
	139	3	54.9	1919	15	1	-	-
	Sept. 24	140	2	4.6	2005	15	69	-
	141	2	9.2	2031	15	71	1	-
	142	2	18.3	2056	15	2	-	-
	143	2	27.5	2124	15	-	-	-
	144	2	36.6	2149	15	-	-	-
	145	2	45.8	2223	15	-	-	-
	146	2	54.9	2252	15	-	-	-
	147	2	13.5	2321	15	43	-	-
Sept. 25	148	2	22.9	1517	15	1	-	-
	149	2	36.6	1541	15	1	-	-
Sept. 26	150	2	4.6	0901	15	-	-	-
	151	2	9.2	0922	15	-	-	-
	152	2	18.3	0943	15	13	-	-
	153	2	27.5	1006	15	-	-	-
	154	2	36.6	1029	15	2	-	-
	155	2	45.8	1055	15	-	-	-
	156	2	54.9	1122	15	-	-	-
	157	2	4.6	1340	10	-	-	-
	158	2	9.2	1355	15	-	-	-
	159	2	18.3	1416	15	7	-	-
	160	2	27.5	1438	15	-	-	-
	161	2	36.6	1502	15	2	-	-
	162	2	45.8	1528	15	-	-	-
	163	2	54.9	1553	15	-	-	-
Oct. 1	164	2	4.6	0952	15	-	-	-
	165	2	9.2	1011	15	-	-	-
	166	2	18.3	1032	15	-	-	-
	167	2	27.5	1054	15	4	-	-
	168	2	36.6	1119	15	-	-	-
	169	2	45.8	1145	15	-	-	-
	170	2	54.9	1212	15	-	-	-
	171	2	24.3	1241	15	-	-	1 ^b
	172	2	4.6	1359	15	-	-	-
	173	2	9.2	1420	15	-	-	-
	174	2	18.3	1441	15	1	-	-
	175	2	27.5	1502	15	-	-	1 ^b

Date	Tow No.	Lake Area	Depth (m)	Time		Catch		Other Species
				Start (hr)	Duration (min)	O. nerka		
						Under-yearlings	Age 1 and older	
Oct. 1	176	2	36.6	1530	15	-	-	-
cont'd	177	2	45.8	1554	15	-	-	-
	178	2	54.9	1623	15	1	-	-
Oct. 27	179	2	4.6	1521	15	-	-	-
	180	2	9.2	1544	16	-	-	-
	181	2	18.3	1607	15	13	-	-
	182	2	23.8	1632	15	2	-	-
	183	2	27.5	1656	15	3	-	-
	184	2	36.6	1721	15	1	-	-

^aSculpin

^bWhitefish

^cSucker

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