

Canadian Data Report of
Fisheries and Aquatic Sciences No. 858

December 1991

1991 Rivers Inlet Echo Sounding Program

Summary Report

by

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Cat. No. Fs 97-13/0858E ISSN 0706-6465

Correct citation for this publication:

Winther, I. 1991. 1991 Rivers Inlet echo sounding program:
summary report. Can. Data Rep. Fish. Aquat. Sci. 858: iii + 21 p.

ABSTRACT

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Sockeye salmon escapement past the Rivers Inlet (Department of Fisheries and Oceans, Statistical Area 9) commercial fishery is monitored by an echo sounding program conducted at the head of the inlet. This report summarizes the field data collected during the 1991 Rivers Inlet echo sounding program.

RESUME

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La pêche commerciale du saumon sockeye qui remonte le bras de mer Rivers (ministère des Pêches et des Océans, secteur statistique no 9) est contrôlée au moyen d'un système d'écho-sondage mis en place à l'extrémité du bras de mer. Ce rapport récapitule les données fournies par le programme d'écho-sondage du bras de mer Rivers durant 1991.

INTRODUCTION

Rivers Inlet is located in the Central Coast area of British Columbia within Statistical Area 9 as described by the Department of Fisheries and Oceans, Canada (Fig. 1). Rivers Inlet sockeye represent the largest stock of sockeye returning to the Central Coast. The Wannock River and the tributaries of Owikeno Lake are the spawning grounds for the majority of Rivers Inlet sockeye. Owikeno Lake provides additional spawning capacity and is the main rearing area for sockeye fry. The Wannock River drains Owikeno Lake into Rivers Inlet.

After passing through the Rivers Inlet fishing area (management subareas 9-2,3,4 & 11) adult sockeye tend to hold at the head of the inlet before continuing up the Wannock River. Wood and Mason (1971) determined that the Rivers Inlet sockeye stock size could be estimated using hydroacoustic techniques.

Goruk and Thomson (1988) and Wood and Mason (1971) discussed characteristics of the Rivers Inlet sockeye salmon stock used in determining the hydroacoustic sampling procedure. Dense daytime schools of sockeye ascend and disperse at night allowing individual salmon targets to be distinguished on an echogram. Most of the targets (95 to 99%) are found in the top 10 fathoms. Adult salmon tend to avoid the freshwater layer that exists at the surface of the inlet thus minimizing vessel avoidance to some extent.

The Rivers Inlet Echo Sounding Program has been operated since 1967. Data collected during the program is used in season to provide information for management of the commercial sockeye fishery.

METHODS

The Rivers Inlet Echo sounding program was conducted from July 9 to July 24, 1991. The Walker Rock, a 12 m seine vessel belonging to the Department of Fisheries and Oceans, was used for the program. The Walker Rock was equipped with a Simrad EY-M dry paper recorder and a Simrad 74AA/AP (70 kHz) transducer with a beam angle of 30 degrees. The Simrad EY-M recorder was operated at settings of Gain = 9 and Time-varied Gain (TVG) = 40 log R. A Furuno color echo sounder was used when navigating to and from the grid site. The echo sounders were used individually because of interference created when both units were operated. No quantitative data was collected with the Furuno color echo sounder.

It was possible to use a Wesmar HD series sonar simultaneously with the Simrad EY-M without interference. The echogram produced by the Wesmar in sounding mode was almost identical to that of the Simrad. The only exception was a very slight difference in the presence and absence of targets near the surface probably due to the different positions of the sonar dome and the sounder transducer. After calibrating the Wesmar in sounding mode it was possible to use the sonar mode to find and track fish. No quantitative data was collected with the Wesmar sonar.

Eleven transects were sounded nightly. In Figure 2 the Miss Robyn grid is represented by transects 1 to 6 and the R.D. 102 grid is represented by transects A to E. Sounding began after dusk at the head of the inlet and continued seaward to the last transect off McAllister Point. Soundings were completed before dawn. Soundings were initiated and terminated one cable (180 m) from the beach. The echogram was marked at the start and end of each transect. The duration of each transect was timed with a stopwatch. The engine speed of the Walker Rock was kept at 800 R.P.M. during transects.

Targets on the echogram were counted in five depth divisions between 1 and 10 m. The depth divisions were 1-2 m, 2-3 m, 3-5 m, 5-7 m, and 7-10 m.

Calculations for estimating sockeye abundance from echosounding counts are described by Goruk and Thomson (1988). A micro computer was used to perform the calculations.

RESULTS & DISCUSSION

Sockeye populations in the grid area as estimated by the echo sounding program are presented in Table 1 and Figure 3. Very few targets were observed during the first six nights of echo sounding July 9/10 to 14/15. The first group of fish estimated at approximately 20,000 were observed on the R.D. 102 grid on July 15/16. The following night the majority of the targets were observed on the Miss Robyn grid without an appreciable change in abundance (23,250 estimate for both grids). Subsequent declines were observed in both grids to a low total of 14,270 on the night of July 18/19. A body of fish began moving onto the grids about July 20. The maximum estimate of 209,765 for both grids was reached on the last night of the program, July 23/24.

Weather and transect time data appear in the field notes. The paucity of information on fish observations (ie. jumpers and targets on the color sounder) this year was not a result of changes in methods or recording, there were simply very few fish observed.

There were five commercial gillnet fisheries directed at Rivers Inlet sockeye in 1991. Three 48 hour openings were held beginning at 1800 hours of June 30, July 7 and July 14 followed by two 24 hour openings beginning at 1800 hours of July 21 and 28. Management subareas 9-2,3,4 and 11 were opened to fishing gillnets with a maximum mesh restriction of 150 mm. A 24 hour gillnet fishery directed at chum salmon stocks began at 1800 hours August 11. The fishery was held in subareas 9-2,3 and 4 with gillnets restricted to a minimum mesh size of 149 mm. Total sockeye catch in Area 9 in 1991 was 152,241. Catches are presented in Table 2.

The Owekeno Band harvested food fish from the Wannock River and the head of Rivers Inlet by gillnet. Total catch to September 14, 1991 was 1020 sockeye, 1 coho and 1 steelhead.

Table 3 presents age data from sockeye scale samples collected from the commercial gillnet catch. Age 5₂ sockeye make up 70.9 % of the population and age 4₂ sockeye make up 24.3 %.

A tide table for Wadhams, Rivers Inlet is presented in Appendix 1 for the period July 1 to August 15, 1991. Tidal extremes are graphed in Figure 4.

Appendix 2 compares 1991 soundings to historic echo sounding work in Rivers Inlet (Goruk & Thomson, 1988; Winther, 1989; Winther, 1990).

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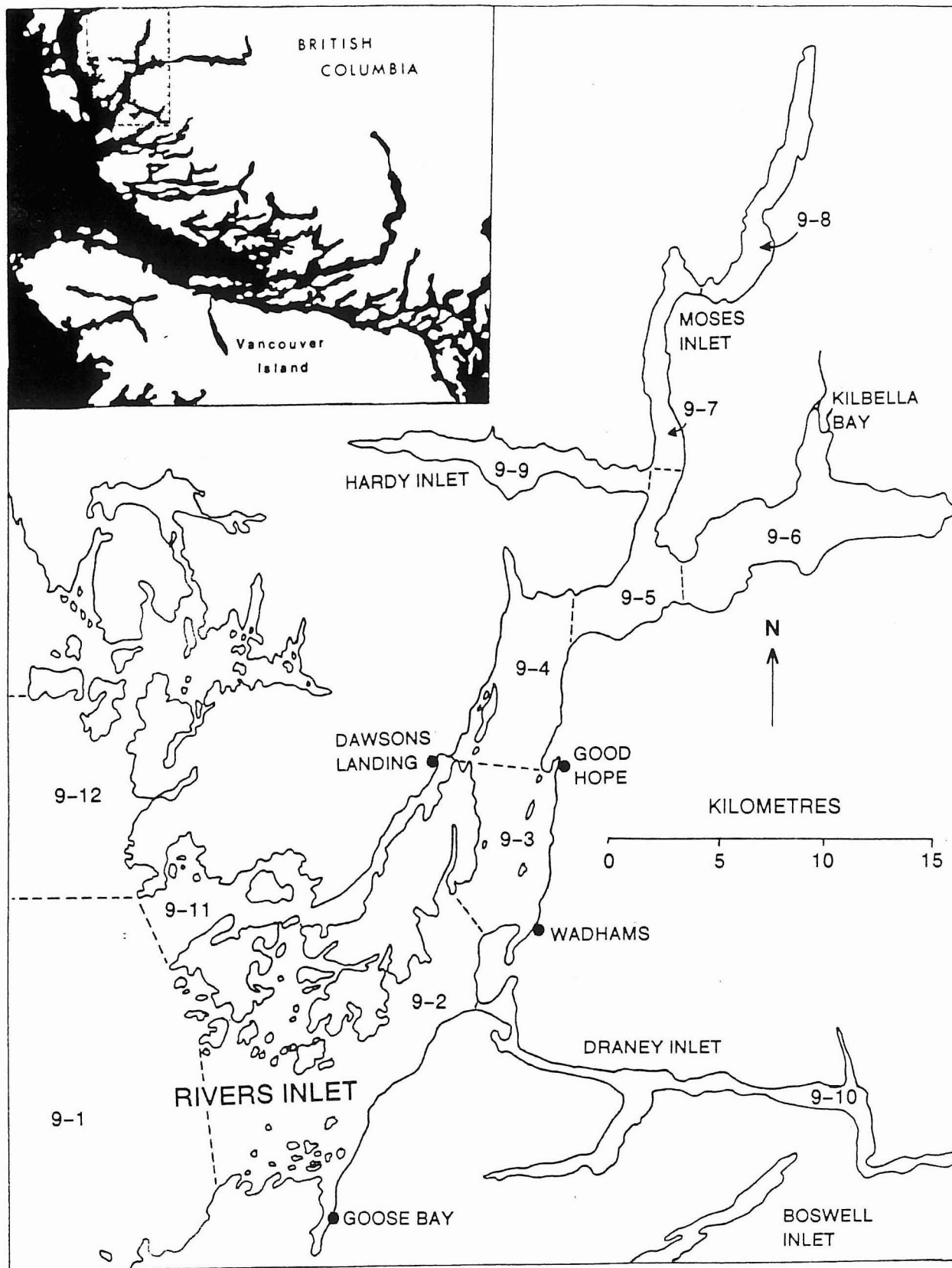


FIGURE 1. Rivers Inlet (Statistical Area 9), British Columbia.

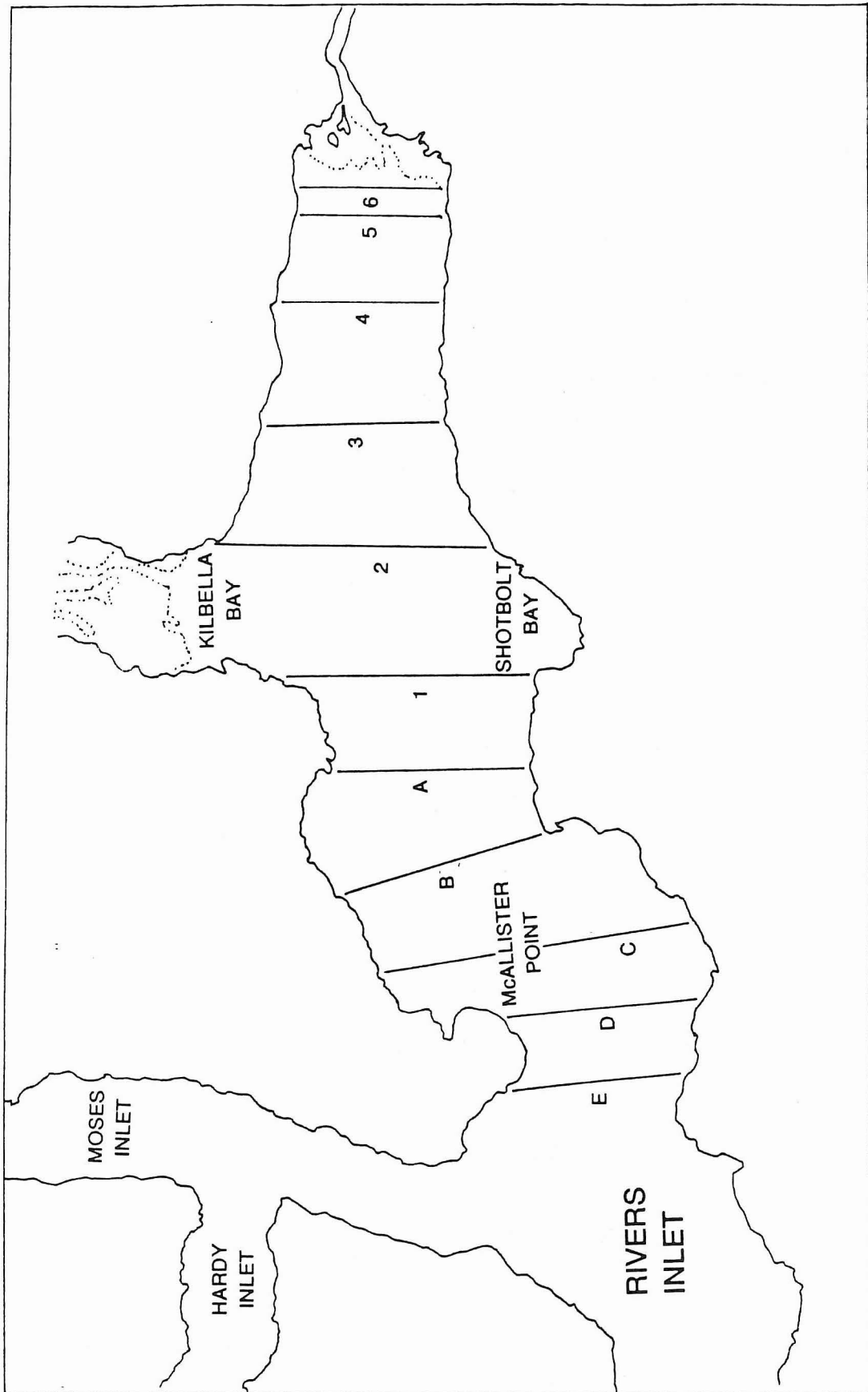


FIGURE 2. Miss Robyn Grid and R.D. 102 Grid, Rivers Inlet.

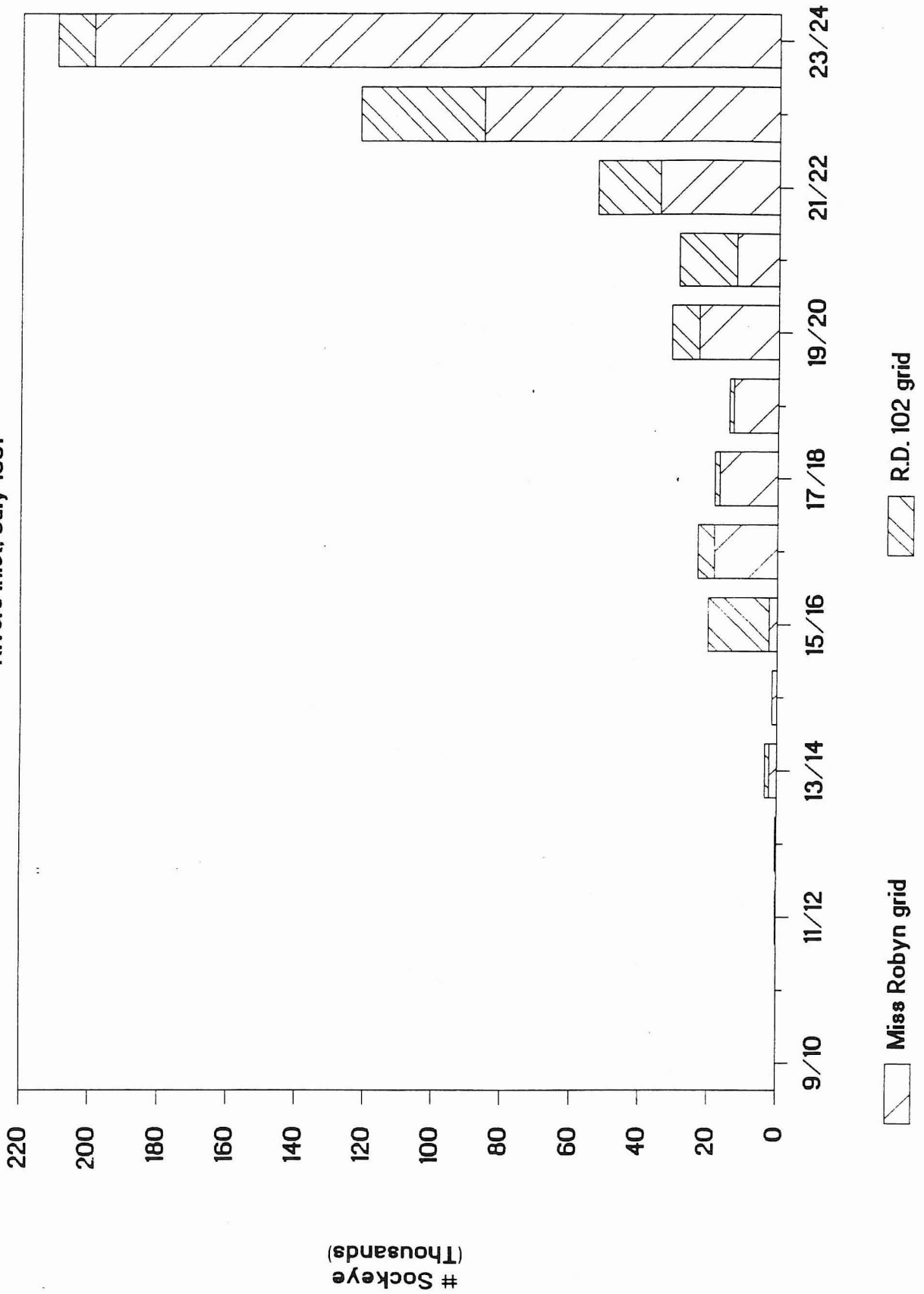
Table 1: 1991 ECHO SOUNDING RESULTS

DATE	MISS ROBYN GRID						TOTAL MISS ROBYN	RD 102 GRID						TOTAL RD 102 GRID	TOTAL ALL GRIDS
	6	5	4	3	2	1		A	B	C	D	E			
JULY 9/10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JULY 10/11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JULY 11/12	0	0	0	0	0	0	0	0	0	434	0	0	0	0	434
JULY 12/13	0	139	0	0	0	0	139	0	0	0	414	0	0	0	414
JULY 13/14	0	0	0	0	2298	0	2298	0	0	723	0	0	427	0	1149
JULY 14/15	185	334	893	0	0	0	1412	0	0	0	0	0	0	0	1412
JULY 15/16	286	0	0	0	0	0	2559	3887	6655	1699	3401	2104	0	17745	20304
JULY 16/17	990	754	2457	5719	5143	3438	18501	539	815	2566	829	0	0	4749	23250
JULY 17/18	864	3986	5114	7082	0	0	17047	0	0	732	0	568	0	1291	18338
JULY 18/19	131	517	4467	5488	2011	437	13052	857	0	362	0	0	0	1218	14270
JULY 19/20	876	2398	6078	5984	4596	3205	23137	2853	1738	1301	950	1236	0	8078	31215
JULY 20/21	0	3123	6571	1017	1150	437	12297	2112	4863	4284	2970	2558	0	16787	29084
JULY 21/22	1001	3427	6796	14345	6181	3177	34746	1551	1331	5675	3316	6098	0	17970	52716
JULY 22/23	1281	17874	33361	11238	17385	4518	85657	7417	2527	6027	12231	7820	0	36066	121723
JULY 23/24	619	906	23616	158832	12787	2538	199298	3821	1279	3254	1900	213	0	10467	209765

#'S MAY DIFFER SLIGHTLY FROM FIELD SHEET TOTALS DUE TO ROUNDING ERRORS

Figure 3: Echosounding Estimates

Rivers Inlet, July 1991



1991 Rivers Inlet Echo Sounding Program Field Notes:

The following notes record the times each transect was run, weather conditions and sightings of fish. Transect run times have been collected for correlation with tidal information. Times of the start and end of each transect are presented to the nearest minute (local time, 24 hour clock). The exact duration of each transect was recorded with a stop watch for use in calculations of fish density and are presented in two formats; minutes and seconds and total seconds.

Central Coast Biologist, Ivan Winther conducted the echo sounding. Captain Robert E. Davis operated the Department of Fisheries and Oceans vessel Walker Rock which acted as the sounding platform. The main engine was run at 800 RPM during each transect. The Simrad EY-M paper sounder was operated at a gain of 9 and a time varied gain (TVG) of 40 log R.

There were very few observations of fish (either jumpers, finners or targets on the color sounder) early in the program.

JULY 9/10 Depart Dawsons 2100, return 0345. Weather 10% cloud, wind W 10-15 kn. Several large targets around 20 fm near McPhee Bay.

	START (hr:min)	END (hr:min)	DURATION (min:sec)	DURATION (sec)
Miss Robyn 6	22:54	23:02	08:25	505
5	23:03	23:15	12:21	741
4	23:24	23:37	12:23	743
3	23:42	23:57	14:21	861
2	00:02	00:22	19:24	1164
1	00:30	00:51	21:16	1276
R.D. 102 A	00:59	01:13	14:06	846
B	01:19	01:32	13:11	791
C	01:37	01:58	20:55	1255
D	02:03	02:18	15:50	950
E	02:24	02:36	12:08	728

JULY 10/11 Depart Dawsons 2050, return 0330. Weather 90% overcast, calm. Large targets deep (20 fm) on the R.D 102 transects.

Miss Robyn 6	22:41	22:50	08:38	518
5	22:51	23:01	09:54	594
4	23:06	23:19	12:15	735
3	23:24	23:38	13:26	806
2	23:44	00:05	21:20	1280
1	00:11	00:30	18:52	1132
R.D. 102 A	00:39	00:53	13:50	830
B	00:57	01:10	13:11	791
C	01:15	01:37	22:12	1332
D	01:42	01:56	14:03	843
E	02:02	02:14	11:00	660

JULY 11/12 Depart Dawsons 2050, return 0330. Weather overcast, hard rain in the morning, rain squalls after 2400, wind SW 0-5 kn. First five jumpers observed between Dawsons and Stone Point. Several deep targets on the R.D. 102 grid.

Miss Robyn	6	22:37	22:45	08:01	481
	5	22:46	22:55	09:12	552
	4	23:00	23:12	11:18	678
	3	23:17	23:31	13:10	790
	2	23:37	23:57	20:14	1214
	1	00:02	00:22	19:54	1194
R.D. 102	A	00:30	00:44	14:22	862
	B	00:48	01:01	12:59	779
	C	01:06	01:27	20:34	1234
	D	01:32	01:45	13:02	782
	E	01:53	02:04	10:57	657

JULY 12/13 Depart Dawsons 2045, return 0320. Weather overcast, foggy at the head of the inlet, rain, wind SW 0-5 kn. Very poor visibility due to fog and rain. Lots of logs and debris in the inlet. Deep targets on the 2 outside transects.

Miss Robyn	6	22:30	22:38	07:58	478
	5	22:39	22:48	08:39	519
	4	22:52	23:04	11:29	689
	3	23:09	23:22	13:18	798
	2	23:33	23:54	21:06	1266
	1	23:59	00:20	20:25	1225
R.D. 102	A	00:29	00:42	13:17	797
	B	00:46	00:58	12:48	768
	C	01:04	01:25	21:13	1273
	D	01:31	01:44	13:48	828
	E	01:49	01:59	09:33	573

JULY 13/14 Depart Dawsons 2040, return 0320. Weather overcast, showers, wind SE 0-5 kn. Four targets between transects 5 and 6 on the south shore.

Miss Robyn	6	22:34	22:42	07:55	475
	5	22:43	22:51	08:19	499
	4	22:57	23:08	11:08	668
	3	23:12	23:25	12:47	767
	2	23:32	23:53	20:22	1222
	1	23:58	00:15	17:16	1036
R.D. 102	A	00:23	00:37	13:26	806
	B	00:41	00:54	13:14	794
	C	00:59	01:21	21:03	1263
	D	01:26	01:41	14:24	864
	E	01:45	01:56	10:49	649

JULY 14/15 Depart Dawsons 1845, return 0400. Weather low overcast, rain, wind NE 5-15 kn. Areas 9-2,3,4 & 11 open to commercial fishing by gillnet and troll at 1800. Departed early to get by the nets. Several deep targets between transects 4 and 5.

Miss Robyn	6	22:30	22:37	08:01	481
	5	22:38	22:48	09:14	554
	4	22:54	23:04	10:40	640
	3	23:09	23:21	12:41	761
	2	23:28	23:49	21:16	1276
	1	23:55	00:14	18:50	1130
R.D. 102	A	00:22	00:35	13:02	782
	B	00:38	00:51	13:00	780
	C	00:56	01:17	20:59	1259
	D	01:22	01:38	15:12	912
	E	01:42	01:53	11:06	666

JULY 15/16 Depart Dawsons 2015, return 0430. Weather low overcast, rain, wind NE 0-5 kn. Commercial fishery still open. Six targets at 3 to 5 fm in Shotbolt Bay. Most targets concentrated on the south side of the inlet.

Miss Robyn	6	22:45	22:53	08:11	491
	5	22:54	23:03	09:39	579
	4	23:09	23:20	11:15	675
	3	23:25	23:38	13:01	781
	2	23:44	00:05	20:49	1249
	1	00:10	00:29	19:12	1152
R.D. 102	A	00:36	00:51	13:48	828
	B	00:53	01:06	12:42	762
	C	01:11	01:34	23:00	1380
	D	01:40	01:55	14:49	889
	E	02:01	02:13	11:12	672

JULY 16/17 Depart Dawsons 2045, return 0330. Weather 90% cloud, rain during the day, wind W 0-5 kn. Commercial fishery closed at 1800. Observed 2 schools on the color sounder off of Stone point at 2130.

Miss Robyn	6	22:34	22:43	08:36	516
	5	22:44	22:54	09:54	594
	4	22:59	23:11	11:27	687
	3	23:15	23:30	14:12	852
	2	23:36	23:57	20:19	1219
	1	00:03	00:20	17:39	1059
R.D. 102	A	00:28	00:42	14:38	878
	B	00:45	01:00	13:55	835
	C	01:05	01:27	21:52	1312
	D	01:31	01:46	14:26	866
	E	01:51	02:02	10:43	643

JULY 17/18 Depart Dawsons 2100, return 0330. Weather 50% cloud, wind W 0-5 kn. Eleven targets between transects 4 and 5.

Miss Robyn	6	22:53	23:02	09:24	564
	5	23:03	23:14	10:52	652
	4	23:20	23:31	11:35	695
	3	23:36	23:49	12:54	774
	2	23:55	00:17	21:20	1280
	1	00:22	00:41	18:20	1100
R.D. 102	A	00:48	01:03	14:39	879
	B	01:06	01:19	12:59	779
	C	01:23	01:46	23:13	1393
	D	01:51	02:05	14:26	866
	E	02:09	02:20	10:12	612

JULY 18/19 Depart Dawsons 2045, return 0300. Weather low overcast, showers, wind W 0-5 kn.

Miss Robyn	6	22:40	22:48	08:10	490
	5	22:49	22:59	10:02	602
	4	23:05	23:17	11:43	703
	3	23:22	23:34	12:39	759
	2	23:40	00:01	20:52	1252
	1	00:07	00:25	18:03	1083
R.D. 102	A	00:33	00:47	13:52	832
	B	00:50	01:04	13:38	818
	C	01:08	01:28	19:42	1182
	D	01:33	01:48	14:56	896
	E	01:53	02:03	10:26	626

JULY 19/20 Depart Dawsons 2045, return 0300. Weather overcast, wind W 0-10 kn. The first sockeye were reported in the Wannock River seine tests this morning. Observed several targets between transects 4 and 5 and 2 jumpers off of Stone Point.

Miss Robyn	6	22:41	22:49	08:23	503
	5	22:50	23:00	09:32	572
	4	23:05	23:17	11:56	716
	3	23:22	23:35	13:30	810
	2	23:42	00:02	20:04	1204
	1	00:08	00:26	17:53	1073
R.D. 102	A	00:32	00:46	13:42	822
	B	00:49	01:03	14:13	853
	C	01:07	01:27	19:56	1196
	D	01:32	01:47	15:01	901
	E	01:51	02:00	09:33	573

JULY 20/21 Depart Dawsons 2045, return 0315. Weather overcast, rain showers, calm. Saw a few finners and 2 jumpers in Darby channel, 40 jumpers from Darby channel to Browns Bay. Perfect viewing conditions.

Miss Robyn	6	22:37	22:44	07:40	460
	5	22:45	22:55	09:29	569
	4	23:00	23:12	11:49	709
	3	23:17	23:31	13:15	795
	2	23:38	23:59	21:09	1269
	1	00:04	00:22	18:00	1080
R.D. 102	A	00:28	00:42	13:27	807
	B	00:44	00:58	13:58	838
	C	01:03	01:24	19:54	1194
	D	01:28	01:42	14:01	841
	E	01:46	01:57	11:31	691

JULY 21/22 Depart Dawsons 1900, return 0400. Weather overcast in the morning, clear after noon, wind W 0-5 kn. Bright 3/4 moon after 2200. Commercial fishery open at 1800. 147 gillnetters in area 9-4, 357 gillnetters in all of area 9. Approximately 40 jumpers inside of Stone Point. A couple of schools on the colored sounder.

Miss Robyn	6	22:30	22:38	08:00	480
	5	22:39	22:48	09:27	567
	4	22:54	23:06	11:54	714
	3	23:11	23:25	14:00	840
	2	23:32	23:52	19:50	1190
	1	23:58	00:16	18:32	1112
R.D. 102	A	00:23	00:37	13:38	818
	B	00:40	00:53	13:08	788
	C	00:57	01:20	22:48	1368
	D	01:25	01:40	14:36	876
	E	01:44	01:55	11:25	685

JULY 22/23 Depart Dawsons 1900, return 0330. Weather clear, wind W 5-10 kn., calm after 2300, NE outflow 5-15 kn. after 2400. Bright 3/4 moon. Commercial fishery closed at 1800. Approximately 50 jumpers between Stone Point and the R.D. 102 grid. Very few jumpers on the grid. Heavy concentration of targets between transects 4 and 5 on the north side of the inlet. Targets were clumped and difficult to count on transects 4 and 5.

Miss Robyn	6	22:38	22:47	08:24	504
	5	22:48	22:57	09:31	571
	4	23:03	23:14	11:35	695
	3	23:19	23:32	12:52	772
	2	23:40	23:59	18:56	1136
	1	00:05	00:23	18:09	1089
R.D. 102	A	00:29	00:44	14:32	872
	B	00:47	00:59	11:53	713
	C	01:02	01:22	19:26	1166
	D	01:27	01:42	15:16	916
	E	01:46	01:57	10:45	645

JULY 23/24 Depart Dawsons 2100, return 0345. Weather 20% cloud, clear most of the day, wind W 0-5 kn. Heavy concentration of targets near Rivers Inlet Resort. 20 to 30 jumpers on the grid.

Miss Robyn	6	22:51	22:59	08:03	483
	5	23:00	23:09	09:37	577
	4	23:16	23:28	12:07	727
	3	23:33	23:46	12:22	742
	2	23:52	00:12	19:24	1164
	1	00:18	00:35	16:36	996
R.D. 102	A	00:41	00:56	14:19	859
	B	01:59	01:12	12:57	777
	C	01:17	01:37	20:27	1227
	D	02:42	01:57	14:20	860
	E	00:01	02:13	12:33	753

Table 2: AREA 9 GILLNET FIELD CATCH FIGURES - 1991

Date	Opr.	Sockeye	Coho	Pink	Chum	Chin.	Jack	Sthd.
01-Jul	249	1420	491	0	253	279	242	4
02-Jul	212	1982	736	6	600	228	47	0
TFW	461	3402	1227	6	853	507	289	4
TTD	461	3402	1227	6	853	507	289	4
08-Jul	145	4407	216	10	151	169	39	1
09-Jul	145	5925	216	13	233	160	63	2
TFW	290	10332	432	23	384	329	102	3
TTD	751	13734	1659	29	1237	836	391	7
15-Jul	261	53773	151	14	282	67	11	1
16-Jul	199	11810	123	23	318	43	22	1
TFW	460	65583	274	37	600	110	33	2
TTD	1211	79317	1933	66	1837	946	424	9
22-Jul	357	47674	169	199	593	139	42	0
TFW	357	47674	169	199	593	139	42	0
TTD	1568	126991	2102	265	2430	1085	466	9
29-Jul	328	25230	565	2014	2036	226	32	0
TFW	328	25230	565	2014	2036	226	32	0
TTD	1896	152221	2667	2279	4466	1311	498	9
12-Aug	3	20	33	25	184	3	1	0
TFW	3	20	33	25	184	3	1	0
TTD	1899	152241	2700	2304	4650	1314	499	9

Table 3: 1991 RIVERS INLET SOCKEYE SCALE SAMPLES

DATE	TOTAL	AGE						
		3(1)	4(1)	4(2)	4(3)	5(2)	6(2)	6(3)
01-Jul-91	5			4		1		
02-Jul-91	64	1	3	16	1	40		3
08-Jul-91	106		1	13		84	1	7
15-Jul-91	286	2		38		118		
22-Jul-91		1	1	22		46		
29-Jul-91			1	19		38		
TOTAL	461	4	6	112	1	327	1	10
%	100.0%	0.9%	1.3%	24.3%	0.2%	70.9%	0.2%	2.2%

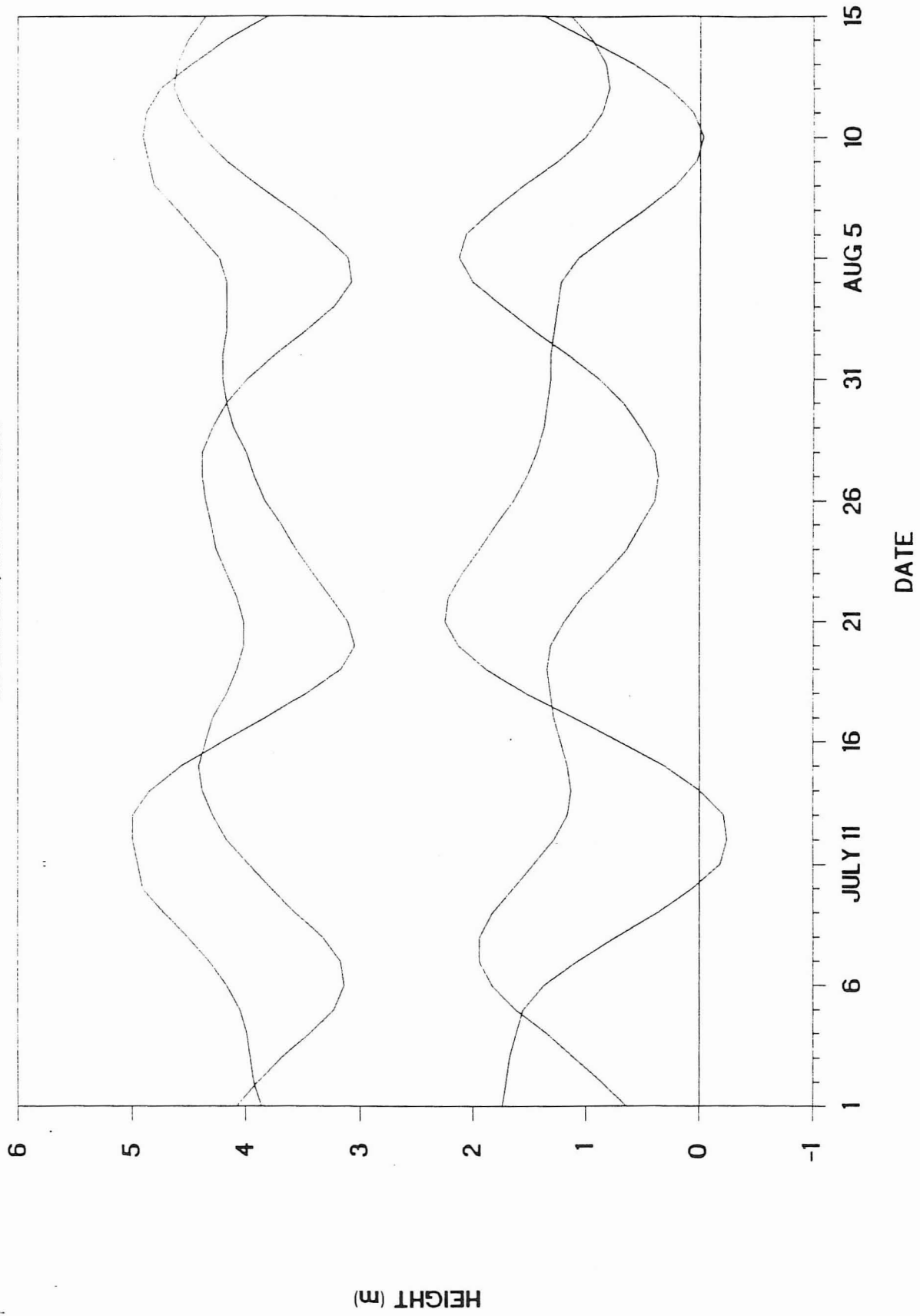
Note: Data collected from commercial gillnet fisheries.

Appendix 1: 1991 TIDE HEIGHTS AT WADHAMS, RIVERS INLET.

Date	Time (PST)	Height (ft)	(m)	Date	Time (PST)	Height (ft)	(m)	Date	Time (PST)	Height (ft)	(m)
JULY 1	02:42	13.4	4.1	JULY 16	03:37	13.8	4.2	AUG 1	03:42	12.3	3.7
	09:23	2.1	0.6		10:03	2.3	0.7		09:53	3.8	1.2
	15:42	12.7	3.9		16:22	14.3	4.4		16:07	13.8	4.2
	21:38	5.7	1.7		22:43	4.0	1.2		22:43	4.3	1.3
JULY 2	03:22	12.8	3.9	JULY 17	04:32	12.6	3.8	AUG 2	04:32	11.4	3.5
	09:53	2.8	0.9		10:43	3.6	1.1		10:28	4.8	1.5
	16:17	12.9	3.9		17:07	14.1	4.3		16:52	13.7	4.2
JULY 3	22:23	5.6	1.7	JULY 18	23:48	4.2	1.3	AUG 3	23:43	4.2	1.3
	04:07	12.1	3.7		05:32	11.4	3.5		05:37	10.6	3.2
	10:28	3.6	1.1		11:28	5.0	1.5		11:13	5.7	1.7
JULY 4	16:57	13.0	4.0	JULY 19	17:57	13.7	4.2	AUG 4	17:42	13.7	4.2
	23:18	5.5	1.7		00:53	4.4	1.3		00:53	4.0	1.2
	04:57	11.3	3.4		06:42	10.4	3.2		06:57	10.1	3.1
JULY 5	11:08	4.4	1.3	JULY 20	12:23	6.2	1.9	AUG 5	12:18	6.6	2.0
	17:37	13.1	4.0		18:52	13.4	4.1		18:47	13.7	4.2
	00:18	5.1	1.6		02:08	4.3	1.3		02:13	3.5	1.1
JULY 6	06:02	10.6	3.2	JULY 21	08:12	10.0	3.0	AUG 6	08:37	10.2	3.1
	11:58	5.3	1.6		13:28	7.0	2.1		13:38	7.0	2.1
	18:27	13.3	4.1		19:52	13.2	4.0		20:02	13.9	4.2
JULY 7	01:28	4.5	1.4	JULY 22	03:13	3.9	1.2	AUG 7	03:28	2.6	0.8
	07:22	10.3	3.1		09:37	10.2	3.1		09:52	10.9	3.3
	12:58	6.0	1.8		14:43	7.4	2.3		15:08	6.8	2.1
JULY 8	19:27	13.7	4.2	JULY 23	20:52	13.2	4.0	AUG 8	21:12	14.5	4.4
	02:38	3.5	1.1		04:13	3.4	1.0		04:28	1.6	0.5
	08:52	10.4	3.2		10:42	10.7	3.3		10:52	11.8	3.6
JULY 9	14:08	6.4	2.0	JULY 24	15:53	7.3	2.2	AUG 9	16:18	6.0	1.8
	20:27	14.2	4.3		21:47	13.4	4.1		22:17	15.1	4.6
	03:43	2.4	0.7		05:03	2.7	0.8		05:23	0.7	0.2
JULY 10	10:02	10.9	3.3	JULY 25	11:27	11.2	3.4	AUG 10	11:42	12.8	3.9
	15:18	6.4	2.0		16:48	6.9	2.1		17:18	5.1	1.6
	21:27	14.8	4.5		22:37	13.7	4.2		23:12	15.8	4.8
JULY 11	04:43	1.2	0.4	JULY 26	05:43	2.1	0.6	AUG 11	06:08	0.1	0.0
	11:02	11.7	3.6		12:02	11.7	3.6		12:22	13.7	4.2
	16:23	6.0	1.8		17:33	6.4	2.0		18:08	4.1	1.2
JULY 12	22:27	15.5	4.7	JULY 27	23:22	14.0	4.3	AUG 12	00:07	16.1	4.9
	05:33	0.2	0.1		06:18	1.7	0.5		06:53	-0.1	0.0
	11:57	12.4	3.8		12:37	12.1	3.7		13:02	14.4	4.4
JULY 13	17:23	5.4	1.6	JULY 28	18:08	5.9	1.8	AUG 13	18:58	3.3	1.0
	23:22	16.1	4.9		00:02	14.3	4.4		00:57	16.0	4.9
	06:23	-0.6	-0.2		06:53	1.3	0.4		07:33	0.2	0.1
JULY 14	12:42	12.1	3.7	JULY 29	13:07	12.6	3.8	AUG 14	13:42	14.9	4.5
	18:18	4.8	1.5		18:48	5.4	1.6		19:48	2.8	0.9
	00:12	16.4	5.0		00:37	14.4	4.4		01:42	15.6	4.8
JULY 15	07:08	-0.8	-0.2	JULY 30	07:23	1.2	0.4	AUG 15	08:13	0.9	0.3
	13:27	13.7	4.2		13:37	12.9	3.9		14:22	15.2	4.6
	19:08	4.2	1.3		19:23	5.0	1.5		20:33	2.6	0.8
JULY 16	01:07	16.4	5.0	JULY 31	01:12	14.4	4.4	AUG 16	02:32	14.7	4.5
	07:53	-0.7	-0.2		07:53	1.3	0.4		08:48	1.9	0.6
	14:07	14.1	4.3		14:02	13.2	4.0		14:57	15.1	4.6
JULY 17	19:58	3.8	1.2	JULY 32	19:58	4.7	1.4	AUG 17	21:23	2.7	0.8
	01:57	15.9	4.8		01:47	14.1	4.3		03:17	13.7	4.2
	08:38	0.0	0.0		08:23	1.7	0.5		09:28	3.2	1.0
JULY 18	14:52	14.4	4.4	JULY 33	14:32	13.5	4.1	AUG 18	15:37	14.8	4.5
	20:53	3.7	1.1		20:33	4.5	1.4		22:13	3.1	0.9
	02:47	15.0	4.6		02:22	13.7	4.2		04:07	12.5	3.8
JULY 19	09:18	1.0	0.3	JULY 34	08:48	2.2	0.7	AUG 19	10:03	4.5	1.4
	15:37	14.5	4.4		15:02	13.7	4.2		16:17	14.3	4.4
	21:48	3.8	1.2		21:13	4.4	1.3		23:08	3.7	1.1
JULY 20				JULY 35	03:02	13.1	4.0	AUG 20			
					09:18	2.9	0.9				
					15:32	13.8	4.2				
				21:53	4.3	1.3					

Figure 4: 1991 TIDE HEIGHTS (m)

WADHAMS, RIVERS INLET



APPENDIX 2. Estimated daily sockeye abundance by year.

VESSEL SOUNDER FREQUENCY	DATE	1967*			1968			1969			1970			1971		
		MISS ROBYN	R.D. 102	TOTAL	MISS ROBYN	R.D. 102	TOTAL	MISS ROBYN	R.D. 102	TOTAL	MISS ROBYN	R.D. 102	TOTAL	MISS ROBYN	R.D. 102	TOTAL
	JUNE 28/29															
	29/30															
	30/1															
	JULY 1/2															
	2/3															
	3/4															
	4/5															
	5/6															
	6/7															
	7/8															
	8/9															
	9/10															
	10/11															
	11/12															
	12/13															
	13/14															
	14/15															
	15/16															
	16/17															
	17/18															
	18/19															
	19/20															
	20/21															
	21/22															
	22/23															
	23/24															
	24/25															
	25/26															
	26/27															
	27/28															
	28/29															
	29/30															
	30/31															
	31/1															
	AUG 1/2															
	2/3															
	3/4															
	4/5															
	5/6															
	6/7															
ESCAPEMENT																
CATCH																
TOTAL STOCK																

* 1967 sounding conducted during daylight hours

APPENDIX 2 (cont.). Estimated daily sockeye abundance by year.

VESSEL SOUNDER FREQUENCY	DATE	1987			1988			1989			1990			1991			
		Walker Rock Simrad EY-M 70 kHz	MISS ROBYN	R.D. 102	TOTAL	Walker Rock Simrad EY-M 70 kHz	MISS ROBYN	R.D. 102	TOTAL	Walker Rock Simrad EY-M 70 kHz	MISS ROBYN	R.D. 102	TOTAL	Walker Rock Simrad EY-M 70 kHz	MISS ROBYN	R.D. 102	TOTAL
	JUNE 28/29																
	29/30																
	30/1																
	JULY 1/2																
	2/3																
	3/4																
	4/5																
	5/6																
	6/7																
	7/8																
	8/9																
	9/10																
	10/11																
	11/12																
	12/13																
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	23/24																
	24/25																
	25/26																
	26/27																
	27/28																
	28/29																
	29/30																
	30/31																
	AUG 31/1																
	1/2																
	2/3																
	3/4																
	4/5																
	5/6																
	6/7																
ESCAPEMENT																	
CATCH																	
TOTAL STOCK																	

* Miss Robyn grid not completely sounded