AN ESTIMATE OF THE MIGRATORY TIMING OF SOCKEYE SALMON INTO UPPER COOK INLET, ALASKA, IN 1990 USING A TEST FISHERY

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ABSTRACT

During the 1990 Upper Cook Inlet, Alaska commercial salmon fishing season a test fishery was used to estimate the timing of sockeye salmon (*Oncorhynchus nerka*) to the Inlet. The fishery operated from 1 July to 30 July and captured 2042 sockeye salmon (1357.6 CPUE points). Mean date of the return was 18 July and the test fishery encompassed approximately 91% of the run.

KEY WORDS: Salmon, *Oncorhynchus*, Upper Cook Inlet, Alaska, test fishery, migratory behavior

INTRODUCTION

In 1979, the Alaska Department of Fish and Game (ADF&G) began a test fishing project near the southern boundary of the Upper Cook Inlet (UCI) salmon management area (Figure 1). The objective of this project was to estimate the total return of sockeye salmon (*Oncorhynchus nerka*) to UCI during the fishing season before they reached commercial fishing areas. Such information would help ADF&G management biologists determine how best to set fishing time and area for commercial harvests of sockeye salmon surplus to spawning goals. Test fishing results have been reported annually since 1979 (Waltemyer 1983a, 1983b, 1986a, 1986b, Hilsinger and Waltemyer 1987, Hilsinger 1988, Tarbox and Waltemyer 1989, Tarbox, 1990). This report presents the results of the 1990 test fishing project.

METHODS

Test Fish Sampling

Sockeye salmon returning to Upper Cook Inlet were sampled by fishing geographically fixed stations between Anchor Point and Red River Delta (Figure 1). Stations were numbered consecutively from east to west. Station locations were determined from LORAN C coordinates. The test fishing vessel sampled stations 2, 4, 5, 6, 7 and 8 on one day. The following day, the vessel sampled stations 9, 7, 6, 5 and 3. This same routine was followed throughout the sampling period.

Sampling started on 1 July in 1990 and continued through 30 July. The chartered vessel, *F/V Corrina Kay*, used 200 fm (4 shackles at 50 fm each) of 2.1 cm (5 1/8 in) multifilament gill net during test fishing. Drift gill net web specifications were: filament size number 53/S6F, 45 meshes deep, double knot construction, and Super Crystal shade number 1.

All salmon captured were identified by species. All sockeye salmon were measured for length (mid-eye to fork of tail in mm). The number of each species caught at each station was expressed as a catch per unit of effort (CPUE) statistic:

$$CPUE_s = \frac{100 \text{ fm} \times 60 \text{ min} \times \text{number of fish}}{\text{fm of gear} \times \text{MFT}},$$

where: $CPUE_s$ = CPUE for station s, and
MFT = mean fishing time.

Mean fishing time was calculated as:

$$MFT = (C - B) + \frac{[B - A] + [D - C]}{2} ,$$

where: A = time net deployment started,
B = time net fully deployed,
C = time net retrieval started, and
D = time net fully retrieved.

Once deployed at a station, gill nets fished 30 min before retrieval started.

Daily CPUE ($CPUE_d$) was calculated as:

$$CPUE_d = \sum_{s=1}^{n} CPUE_s$$

If a station was not fished, the CPUE value for that station was estimated by a simple linear interpolation procedure (i.e., the mean value of the previous and following day's CPUE values).

The following physical and chemical measurements were taken at the start of each set: air and water temperature (at 1 m below the surface), wind velocity and direction, tide stage, water depth and clarity, and salinity. Air temperature, water temperature, and salinity were measured using a YSI salinity/temperature meter. Wind speed was measured in knots and direction was recorded as (0) no wind, (1) north, (2) northeast, (3) east, (4) southeast, (5) south, (6) southwest, (7) west, or (8) northwest. Tide stage was classed as flood, ebb or slack by observing the movement of the vessel while drifting with the gill net. Water depth was measured in fathoms (fm) using a Simrad echo sounder, and water clarity was measured in meters (m) using a 17.5 cm secchi disk.

Describing the Salmon Migration

Catchability, the fraction of the available population taken by a defined unit of fishing effort, was estimated as:

$$q_d = c_d/r_d ,$$

where: q_d = estimated catchability on day d,
r_d = adjusted cumulative total return on day d, and
c_d = cumulative CPUE on day d.

Passage rate, the expansion factor used to convert CPUE in estimated numbers of salmon passing the test fishing transect, was calculated as:

$$PR = 1/q_d = \text{passage rate}$$

Because the test fishery did not encompass the entire sockeye salmon run, the total CPUE for the test fishery was estimated after the season using the following relationship:

$$CPUE_t = CPUE_f \times \frac{H_t}{H_{(f+2)}} ,$$

where: $CPUE_t$ = total estimated CPUE for the season,
$CPUE_f$ = cumulative CPUE through final day, f, of test fishing,
H_t = total commercial harvest for the season
$H_{(f+2)}$ = total commercial catch through final day of test fishery (f+2), and
2 = number of days it takes salmon to travel from test fishery to commercial harvest areas.

Estimates of $CPUE_t$ and $CPUE_d$ values were used to estimate daily and cumulative proportions of $CPUE_t$, based on a non-linear model:

$$y_d = 1/(1 + e^{-(a+bd)})$$

where: Y_d = cumulative proportion of CPUE or return on day d,
a and b = coefficients of model, a = - 5.7913 b = 0.2259
d = day of observation.

To calculate mean date of return, the following formula was used:

$$M = a/b$$

where: M = mean date of return,

RESULTS

A total of 2042 sockeye salmon, 198 pink salmon (*O. gorbuscha*), 601 chum salmon (*O. keta*), 450 coho salmon (*O. kisutch*), and 5 chinook salmon (*O. tshawytscha*) were captured during the 1990 test fishery (Table 1, Appendix A-D). Daily sockeye salmon catches ranged from 5 to 280 fish (Table 1).

Sockeye salmon daily CPUE values ranged from 4.1 on 15 July to 166 on 21 July. Cumulative total CPUE for the duration of the project was 1357.6 (Table 1, Figure 2 and 3). Using post season commercial harvest and escapement figures, test fishing spanned approximately 96.7% of the total run. Therefore, total CPUE for the test fishery would have been 1404 if test fishing had continued throughout the duration of the run.

Sockeye salmon catches along the transect were similar to the distribution of CPUE values. Approximately 94% of the total sockeye salmon catch and 93% of the total CPUE occurred at stations 5, 6, 7 and 8 (Table 2 and 3).

Examination of daily and cumulative proportions (estimated post season) of the sockeye salmon run to UCI suggested that only 1.8% of the run had passed the transect prior to the start of test fishing on 1 July and that the return was 93% completed at the termination of the project (Appendix E; Figure 4). The mean date of the run was 18 July 1990 which was 4 d late relative to the historic average (Table 4).

The total sockeye salmon run to UCI in 1990 was estimated at 5.0 million fish of which 3,604,064 were harvested in the commercial fishery (Table 5). Estimate of passage rate for the season was 3,561 sockeye salmon per CPUE index point.

Water temperatures measured along the transect generally increased during the season from a low of 9.5°C early in July to a high of 13°C in mid-July (Appendix F). Air temperatures fluctuated between 10°C and 17°C during the project (Appendix F). Salinity measurements ranged from 16 ppt to 32 ppt with a noticeable decline in average salinities as the season progressed (Appendix F). Wind velocities were generally moderate. However, on 6 days winds of 20 knots or greater were recorded (Appendix F). Wind direction was typically from the southwest or northwest.

During the commercial salmon fishing season five estimates of the sockeye salmon total return were made (Table 6). The initial estimate on 10 July was 3.6 million fish which was 28% below the actual return. As the season progressed the estimate increased to 5.0 million fish on 13 July which was the actual total return. Estimates remained near 5.0 million fish for the remainder of the season (Table 6). Estimates of total CPUE from the test fishery ranged from 819 to 1357 (Table 7). The number of sockeye salmon per index point (passage rate) varied from 3,626 on 21 July to 4,669 on 16 July (Table 8).

DISCUSSION

The primary objective of the offshore test fish project is to make reliable and accurate estimates of the total sockeye salmon return to UCI during the commercial fishing season. In this context, results from the 1990 season were excellent. At approximately the 20% point of the return the estimate of total return was 5.0 million fish. This matched the actual return. Estimates made after this date stayed within 6% of this value.

Tarbox and Waltemyer (1989) discuss sources of error associated with offshore test fish data collection and analysis. No procedural changes were made in the

program in 1990. Therefore, as noted by Tarbox and Waltemyer (1989), late returns tend to have less error in selection of the proper run timing curve for comparison. This unquestionably contributed to the accuracy of the 1990 estimates.

In addition to timing, the estimate of passage rate is critical to proper data analysis. Consistent with previous years the passage rate increased to a high during the peak of the season and then declined. Obviously, offshore test fish catches are not proportional to abundance. Further research into adequate sampling power is critical to the over all success of this program.

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Table 1. Summary of sockeye salmon salmon fishing effort, daily and cumulative catch, and daily and cumulative CPUE, Upper Cook Inlet offshore test fish project, 1990.

Date	Number of Stations	Mean Fishing Time (min)	Catch		CPUE		Mean Length (mm)
			Daily	Cum	Daily	Cum	
01-Jul	6	236.5	21	21	16.9	16.9	542
02-Jul	5	197.0	6	27	4.4	21.3	542
03-Jul	6	225.0	21	48	15.8	37.1	552
04-Jul	5	181.5	7	55	5.6	42.7	576
05-Jul	6	228.5	55	110	41.7	84.4	565
06-Jul	5	177.0	9	119	7.3	91.7	510
07-Jul	6	226.0	16	135	12.3	104.0	567
08-Jul	5	193.0	25	160	18.5	122.5	543
09-Jul	4	149.0	11	171	9.1	131.6	543
10-Jul	5	189.0	26	197	19.3	150.9	559
11-Jul	6	239.5	130	327	77.1	228.0	
12-Jul	4	173.1	155	482	94.9	322.9	558
13-Jul	5	207.5	79	561	49.8	372.7	567
14-Jul	3	117.0	21	582	15.7	388.4	561
15-Jul	5	179.5	5	587	4.1	392.5	556
16-Jul	4	145.5	62	649	38.3	430.8	550
17-Jul	5	193.5	220	869	132.8	563.6	578
18-Jul	4	166.0	77	946	48.0	611.5	
19-Jul	5	210.0	239	1185	125.9	737.5	574
20-Jul	3	120.0	65	1250	41.1	778.6	587
21-Jul	5	228.5	280	1530	166.0	944.5	593
22-Jul	4	157.0	37	1567	28.0	972.6	587
23-Jul	4	172.0	48	1615	31.6	1004.1	577
24-Jul	5	192.0	67	1682	49.2	1053.3	587
25-Jul	5	192.5	83	1765	57.5	1110.8	578
26-Jul	4	164.0	81	1846	54.8	1165.7	578
27-Jul	3	114.5	29	1875	61.8	1227.5	
28-Jul	3	131.5	106	1981	58.9	1286.4	568
29-Jul	5	109.5	30	2011	48.3	1334.7	576
30-Jul	4	147.5	31	2042	22.9	1357.6	579

Table 2. Estimated sockeye salmon salmon catch by date and station, Upper Cook Inlet offshore test fish project, 1990.

	Station Number								
Date	2	3	4	5	6	7	8	9	Total
01-Jul	1		6	7	4	1	2		21
02-Jul		3		0	2	1		0	6
03-Jul	0		2	14	4	1	0		21
04-Jul		0		5	2	0		0	7
05-Jul	1		17	20	8	9	0		55
06-Jul		0		9	0	0		0	9
07-Jul	0		1	8	1	6	0		16
08-Jul		2		6	16	1		0	25
09-Jul	1		0	0	10	0		0	11
10-Jul		3		3	18	0	2		26
11-Jul	0		0	3	5	113	9		130
12-Jul		1		51	15	88			155
13-Jul			0	6	45	28	0		79
14-Jul				3	5	13			21
15-Jul			0	0	3	1	1		5
16-Jul		4		2	0	56			62
17-Jul			4	3	6	97	110		220
18-Jul			1	2	57	17			77
19-Jul			0	0	20	9	210		239
20-Jul		65			0	0			65
21-Jul			0	69	121	16	74		280
22-Jul		3		9	21	4			37
23-Jul			1	10	25	12			48
24-Jul		0		22	8	32	5		67
25-Jul			0	20	62	0	1		83
26-Jul		0		6	41	34			81
27-Jul			6	17	7	-1			29
28-Jul				3	2	101			106
29-Jul			1	3	1	8	17		30
30-Jul		0		9	22	0			31
Total	3	81	39	310	531	647	431	0	2042
%	0.1	4.0	1.9	15.2	26.0	31.7	21.1	0.0	100.0

Table 3. Estimated sockeye salmon salmon CPUE by date and station, Upper Cook Inlet offshore test fish project, 1990.

	Station Number								
Date	2	3	4	5	6	7	8	9	Total
01-Jul	1.3		4.7	5.3	3.2	0.8	1.6		16.9
02-Jul		2.4		0.0	1.3	0.8		0.0	4.4
03-Jul	0.0		1.6	10.2	3.1	0.8	0.0		15.8
04-Jul		0.0		4.0	1.6	0.0		0.0	5.6
05-Jul	0.8		12.9	14.1	6.2	7.6	0.0		41.7
06-Jul		0.0		7.3	0.0	0.0		0.0	7.3
07-Jul	0.0		0.8	6.0	0.8	4.7	0.0		12.3
08-Jul		1.6		4.7	11.4	0.8		0.0	18.5
09-Jul	0.8		0.0	0.0	7.9	0.4		0.0	9.1
10-Jul		2.4		2.5	12.9	0.0	1.6		19.3
11-Jul	0.0		0.0	2.5	3.9	63.9	6.8		77.1
12-Jul		0.9		36.0	11.2	46.8			94.9
13-Jul			0.0	4.6	27.9	17.3	0.0		49.8
14-Jul				2.5	3.7	9.4			15.7
15-Jul			0.0	0.0	2.4	0.8	0.8		4.1
16-Jul		3.4		1.6	0.0	33.3			38.3
17-Jul			3.3	3.0	8.2	58.8	59.5		132.8
18-Jul			0.8	1.6	33.2	12.3			48.0
19-Jul			0.0	0.0	16.4	7.0	102.5		125.9
20-Jul		41.1			0.0	0.0			41.1
21-Jul			0.0	44.0	62.6	11.2	48.2		166.0
22-Jul		2.4		6.9	15.7	2.9			28.0
23-Jul			0.8	8.1	15.3	7.3			31.6
24-Jul		0.0		16.5	6.3	22.3	4.1		49.2
25-Jul			0.0	16.6	40.0	0.0	0.9		57.5
26-Jul		0.0		4.6	28.3	22.0			54.8
27-Jul			5.1	12.9	5.3	38.5			61.8
28-Jul				2.2	1.6	55.0			58.9
29-Jul			4.1	18.9	6.2	6.0	13.1		48.3
30-Jul		0.0		7.4	15.5	0.0			22.9
Total	3.0	54.2	34.2	244.2	352.1	430.7	239.1	0.0	1357.6
%	0.2	4.0	2.5	18.0	25.9	31.7	17.6	0.0	100.0

Table 4. Mean date of the sockeye salmon return across Anchor Point transect by year, Upper Cook Inlet, Alaska offshore test fish project.

Year	Mean Date[a] (t)	Calendar Date
1979	18.4	July 11
1980	22.7	July 15
1981	13.2	July 06
1982	24.2	July 17
1983	22.6	July 15
1984	18.4	July 11
1985	22.7	July 15
1986	23.0	July 16
1987	25.7	July 18
1988	20.6	July 13
1989	21.6	July 14
1990	25.6	July 18
1979-1989	21.6	July 14

[a] Day (t) 1 = June 24.

Table 5. The 1990 Upper Cook Inlet, Alaska commercial salmon harvest[a].

Date	Number of Deliveries	CHINOOK Daily	CHINOOK Cumulative	SOCKEYE Daily	SOCKEYE Cumulative	COHO Daily	COHO Cumulative	PINK Daily	PINK Cumulative	CHUM Daily	CHUM Cumulative	TOTAL Daily	TOTAL Cumulative
5-25 Fri	7	19	19	65	65							84	84
5-28 Mon	7	46	65	136	201							182	266
6-01 Fri	9	341	406	457	658							798	1,064
6-04 Mon	119	3,018	3,424	1,060	1,718	2	2					4,080	5,144
6-08 Fri	3	16	3,440	577	2,295		2					593	5,737
6-11 Mon	132	3,387	6,827	3,289	5,584		2					6,676	12,413
6-15 Fri	10	21	6,848	1,211	6,795		2					1,232	13,645
6-18 Mon	163	2,283	9,131	2,104	8,899	16	18	3	3	3	3	4,409	18,054
6-22 Fri	27	51	9,182	779	9,678		18		3	2	5	832	18,886
6-25 Mon	491	1,058	10,240	8,383	18,061	12	30	6	9	1,681	1,686	11,140	30,026
6-29 Fri	604	578	10,818	19,987	38,048	101	131	20	29	4,506	6,192	25,192	55,218
7-02 Mon	826	501	11,319	41,025	79,073	347	478	100	129	6,276	12,468	48,249	103,467
7-06 Fri	999	390	11,709	108,305	187,378	1,668	2,146	54	183	20,596	33,064	131,013	234,480
7-09 Mon	912	342	12,051	177,045	364,423	5,497	7,643	428	611	34,084	67,148	217,396	451,876
7-13 Fri	109	103	12,154	3,806	368,229	798	8,441	282	893	932	68,080	5,921	457,797
7-16 Mon	997	411	12,565	731,403	1,099,632	29,643	38,084	7,504	8,397	65,366	133,446	834,327	1,292,124
7-18 Wed	953	458	13,023	109,537	1,209,169	1,603	39,687	1,951	10,348	4,075	137,521	117,624	1,409,748
7-20 Fri	1292	498	13,521	738,860	1,948,029	54,474	94,161	33,461	43,809	55,357	192,878	882,650	2,292,398
7-21 Sat	1010	441	13,962	166,155	2,114,184	1,667	95,828	3,940	47,749	1,599	194,477	173,802	2,466,200
7-22 Sun	221	45	14,007	31,271	2,145,455	379	96,207	1,144	48,893	671	195,148	33,510	2,499,710
7-23 Mon	1199	398	14,405	365,881	2,511,336	30,666	126,873	36,689	85,582	19,363	214,511	452,997	2,952,707
7-25 Wed	658	108	14,513	62,967	2,574,303	1,204	128,077	5,420	91,002	3,654	218,165	73,353	3,026,060
7-26 Thu	688	202	14,715	71,265	2,645,568	2,154	130,231	4,933	95,935	1,368	219,533	79,922	3,105,982
7-27 Fri	1306	301	15,016	391,486	3,037,054	53,930	184,161	45,251	141,186	31,717	251,250	522,685	3,628,667
7-28 Sat	24		15,016	5,229	3,042,283	1,251	185,412	168	141,354	1,586	252,836	8,234	3,636,901
7-29 Sun	748	87	15,103	127,286	3,169,569	15,022	200,434	17,596	158,950	9,499	262,335	169,490	3,806,391
7-30 Mon	1234	243	15,346	252,074	3,421,643	71,882	272,316	50,602	209,552	27,440	289,775	402,241	4,208,632
7-31 Tue	935	204	15,550	61,479	3,483,122	11,983	284,299	15,473	225,025	4,017	293,792	93,156	4,301,788
8-01 Wed	19		15,550	2,144	3,485,266	1,784	286,083	651	225,676	144	293,936	4,723	4,306,511
8-03 Fri	1005	181	15,731	41,960	3,527,226	51,150	337,233	47,577	273,253	16,595	310,531	157,463	4,463,974
8-06 Mon	821	137	15,868	34,694	3,561,920	28,396	365,629	60,002	333,255	16,535	327,066	139,764	4,603,738
8-08 Wed	92	2	15,870	2,498	3,564,418	6,871	372,500	1,238	334,493	761	327,827	11,370	4,615,108
8-10 Fri	641	105	15,975	16,732	3,581,150	28,012	400,512	133,624	468,117	8,762	336,589	187,235	4,802,343
8-13 Mon	542	75	16,050	10,601	3,591,751	29,035	429,547	98,300	566,417	6,680	343,269	144,691	4,947,034
8-15 Wed	359	42	16,092	4,589	3,596,340	17,135	446,682	29,142	595,559	1,681	344,950	52,589	4,999,623
8-17 Fri	159	3	16,095	1,978	3,598,318	11,070	457,752	2,444	598,003	2,552	347,502	18,047	5,017,670
8-20 Mon	91	4	16,099	1,546	3,599,864	7,467	465,219	477	598,480	1,567	349,069	11,061	5,028,731
8-22 Wed	94	2	16,101	1,446	3,601,310	9,146	474,365	933	599,413	326	349,395	11,853	5,040,584
8-24 Fri	127	2	16,103	1,258	3,602,568	8,279	482,644	3,986	603,399	1,027	350,422	14,552	5,055,136
8-27 Mon	60		16,103	566	3,603,134	6,049	488,693	130	603,529	403	350,825	7,148	5,062,284
8-29 Wed	51	2	16,105	389	3,603,523	5,146	493,839	58	603,587	107	350,932	5,702	5,067,986
8-31 Fri	48		16,105	212	3,603,735	3,263	497,102	18	603,605	174	351,106	3,667	5,071,653
9-03 Mon	34		16,105	197	3,603,932	1,260	498,362	8	603,613	63	351,169	1,528	5,073,181
9-05 Wed	14		16,105	14	3,603,946	422	498,784		603,613	3	351,172	439	5,073,620
9-07 Fri	22		16,105	91	3,604,037	888	499,672	12	603,625	16	351,188	1,007	5,074,627
9-10 Mon	13		16,105	27	3,604,064	347	500,019	5	603,630	9	351,197	388	5,075,015
9-14 Fri	1		16,105		3,604,064	7	500,026		603,630		351,197	7	5,075,022

[a] Source of data: Upper Cook Inlet Fish Ticket System (Ruesch, Alaska Department of Fish and Game, personal communication).

Table 6. Total offshore test fish CPUE and the total sockeye salmon return estimates made during the 1990 Upper Cook Inlet, Alaska salmon fishing season.

Date	Accum. CPUE[a]	Best Fit Year	MSSDEV[b]	Passage Rate	Total CPUE	Return to Date (X 10^6)	Total Return Estimate (X 10^6)
10-Jul	150.9	1987	0.000301	4,382	819	0.661	3.6
11-Jul	228.0	1987	0.000511	4,382	898	-	3.9
13-Jul	372.7	1987	0.001345	4,382	1,139	-	5.0
16-Jul	430.8	1987	0.001153	4,669	1,149	2.012	5.3
21-Jul	944.5	1987	0.002194	3,626	1,357	3.424	4.9

[a] Accumulated CPUE recorded from start of test fishery to day of estimate of total CPUE.
[b] Mean sum of squared deviation.

Table 7. Estimates of relative error associated with the total CPUE and total sockeye salmon return predictions made by the Upper Cook Inlet, Alaska offshore test fish project, 1990.

	CPUE[a]			Total Return[b]		
Date	Percent of Migration	Estimate of Total	Relative Error (%)	Percent of Migration	Estimate of Total	Relative Error (%)
10-Jul	12.4	819	-41.7	13.2	3.6	-28.0
11-Jul	15.1	898	-36.0	-	-	-
13-Jul	21.9	1,139	-18.9	-	-	-
16-Jul	35.5	1,149	-18.2	40.2	5.3	6.2
21-Jul	63.0	1,357	- 3.3	68.5	4.9	-2.0

[a] Total CPUE for season was 1,404. Percent migration based on curve fit of daily index points.
[b] Total sockeye salmon return was 5.0 million fish. Percent of migration based on adjusted total return.

Table 8. Estimates of sockeye salmon catchability, passage rate, and the relative error of those estimates, Upper Cook Inlet, Alaska offshore test fish project, 1990.

	Catchability[a]		Passage Rate[b]	
Date	q	Relative Error (%)	$\frac{1}{q}$	Relative Error (%)
10-Jul	0.000228	58.3	4,382	23.1
16-Jul	0.000214	48.6	4,669	31.1
21-Jul	0.000276	91.7	3,626	18.3

[a] Catchabilty (q) for 1990 was 0.000144.
[b] Passage rate for 1990 was 3,561 fish. Passage rate was calculated using a total sockeye return pass the transect of 5.0 million fish.

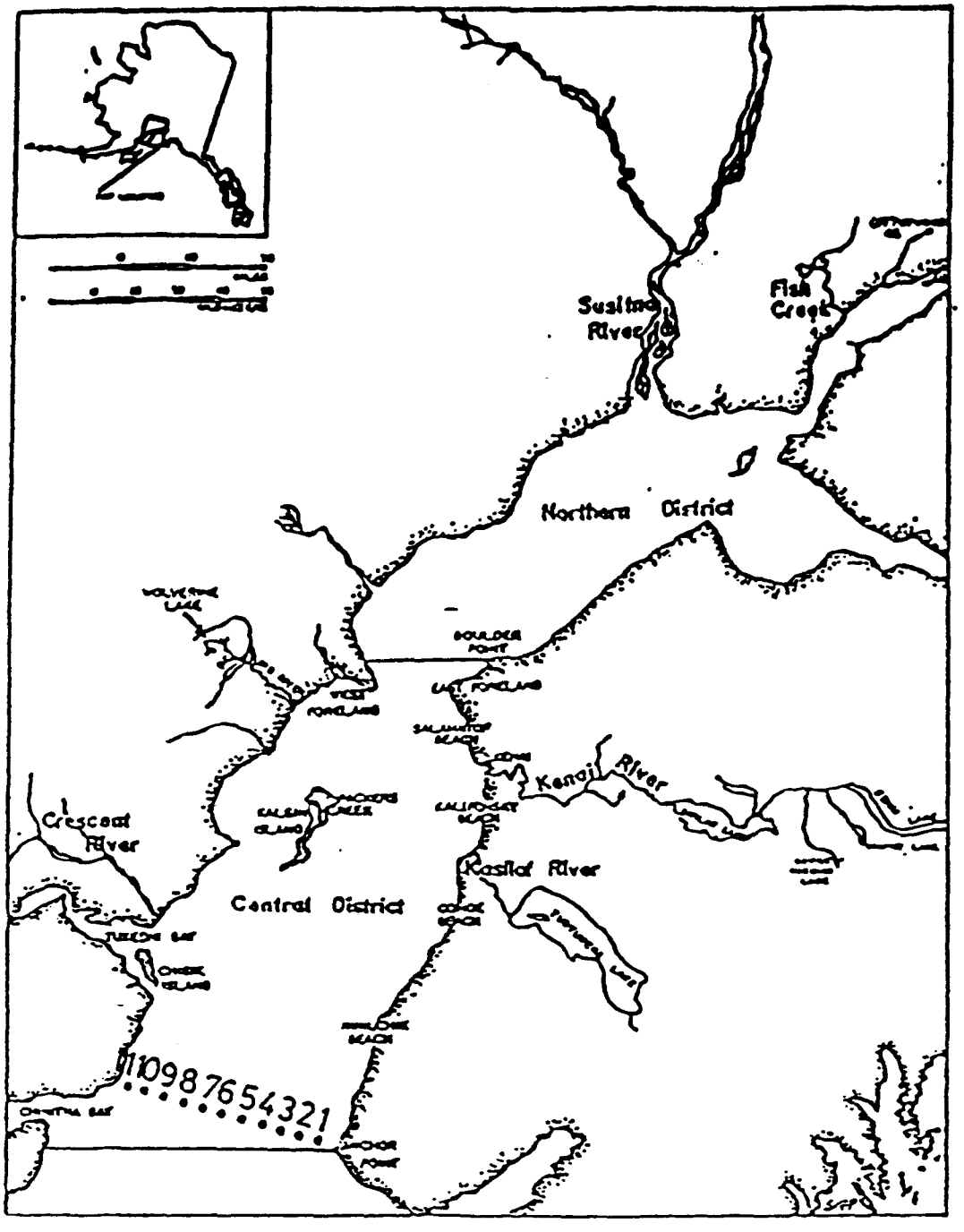

Figure 1. Map of Upper Cook Inlet, Alaska, showing location of Offshore Test Fish transect.

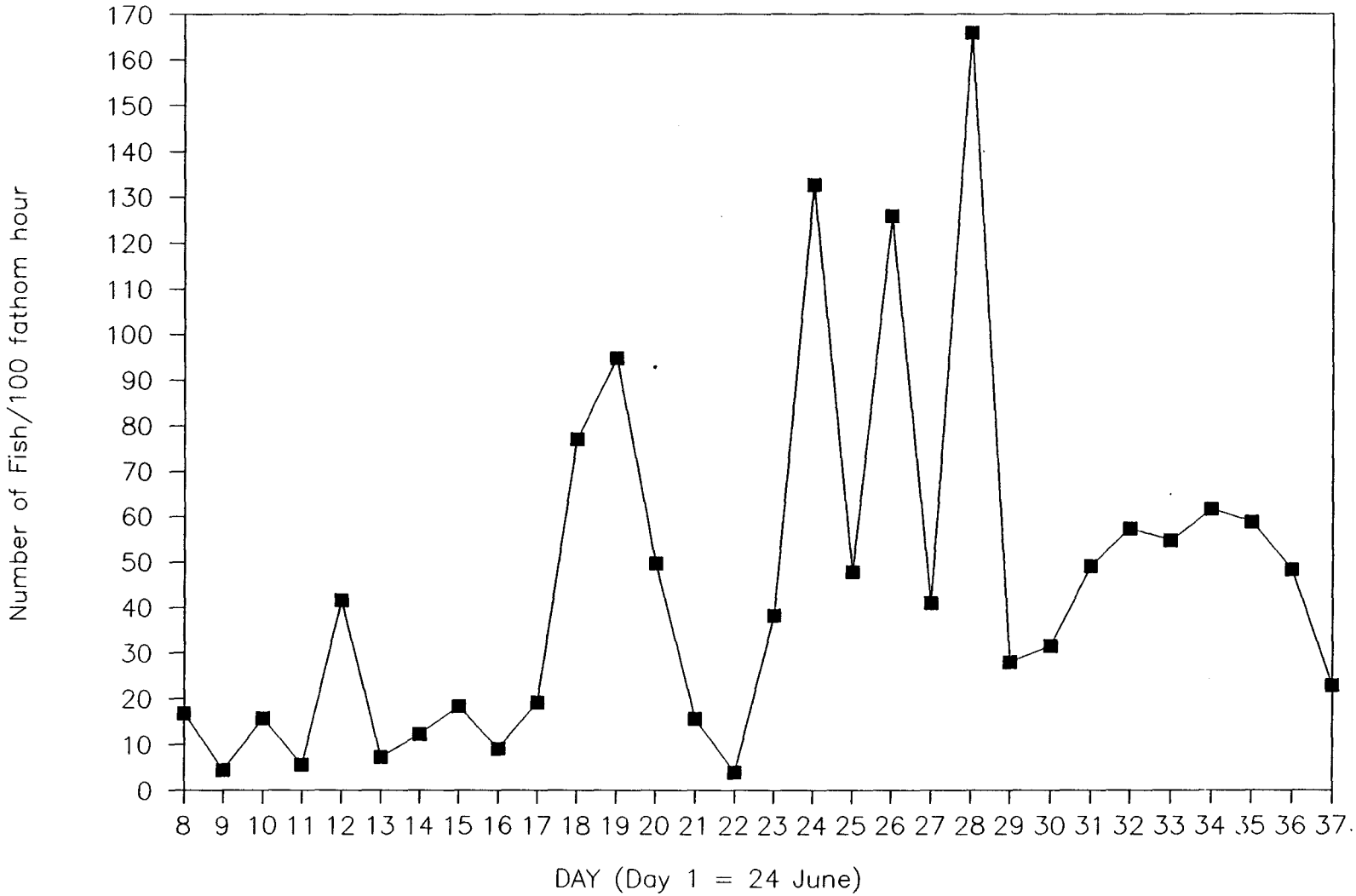

Figure 2. Daily CPUE for sockeye salmon recorded during the 1990 Offshore Test Fish project, Upper Cook Inlet, Alaska.

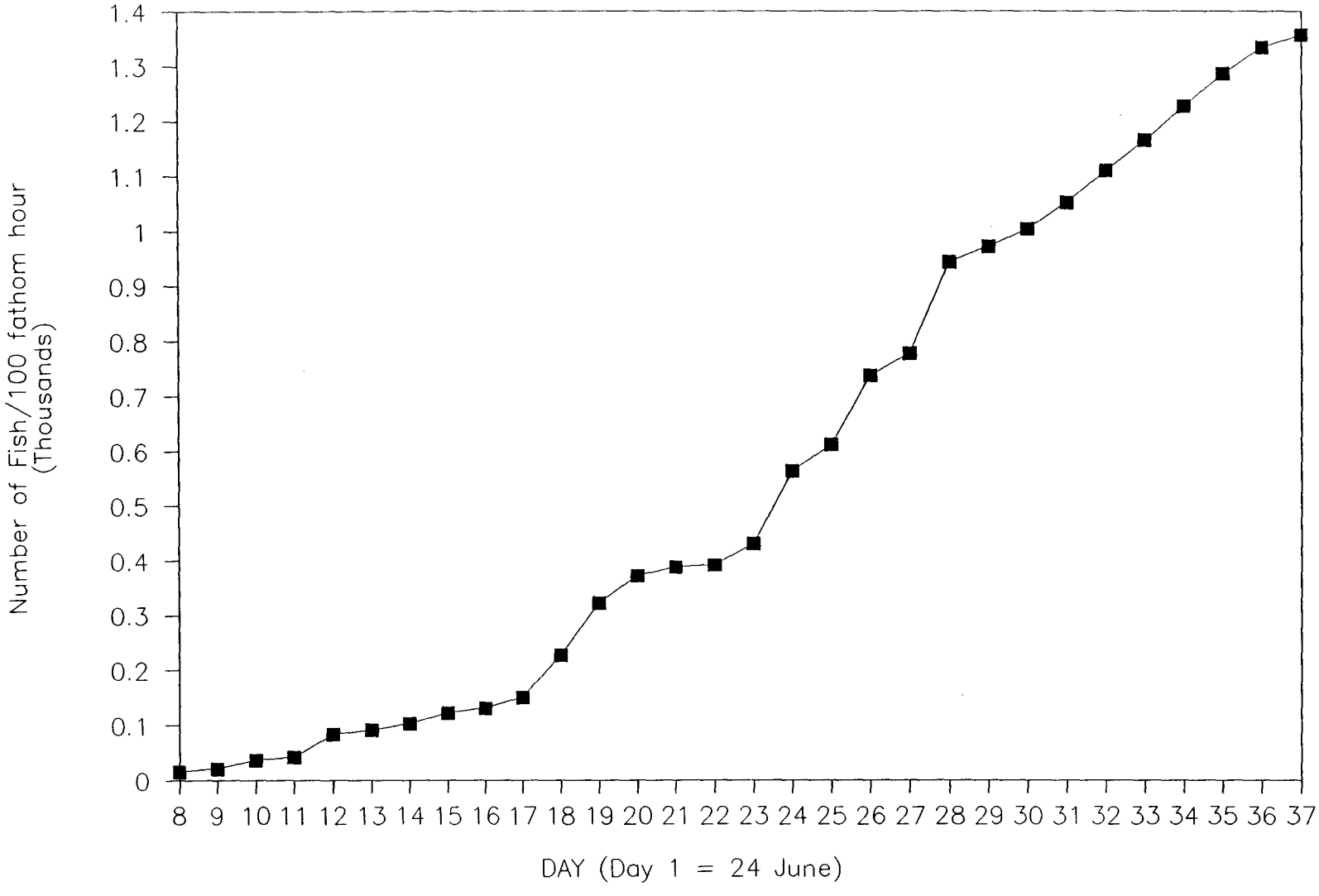

Figure 3. Cumulative CPUE for sockeye salmon recorded during the 1990 Offshore Test Fish project, Upper Cook Inlet, Alaska.

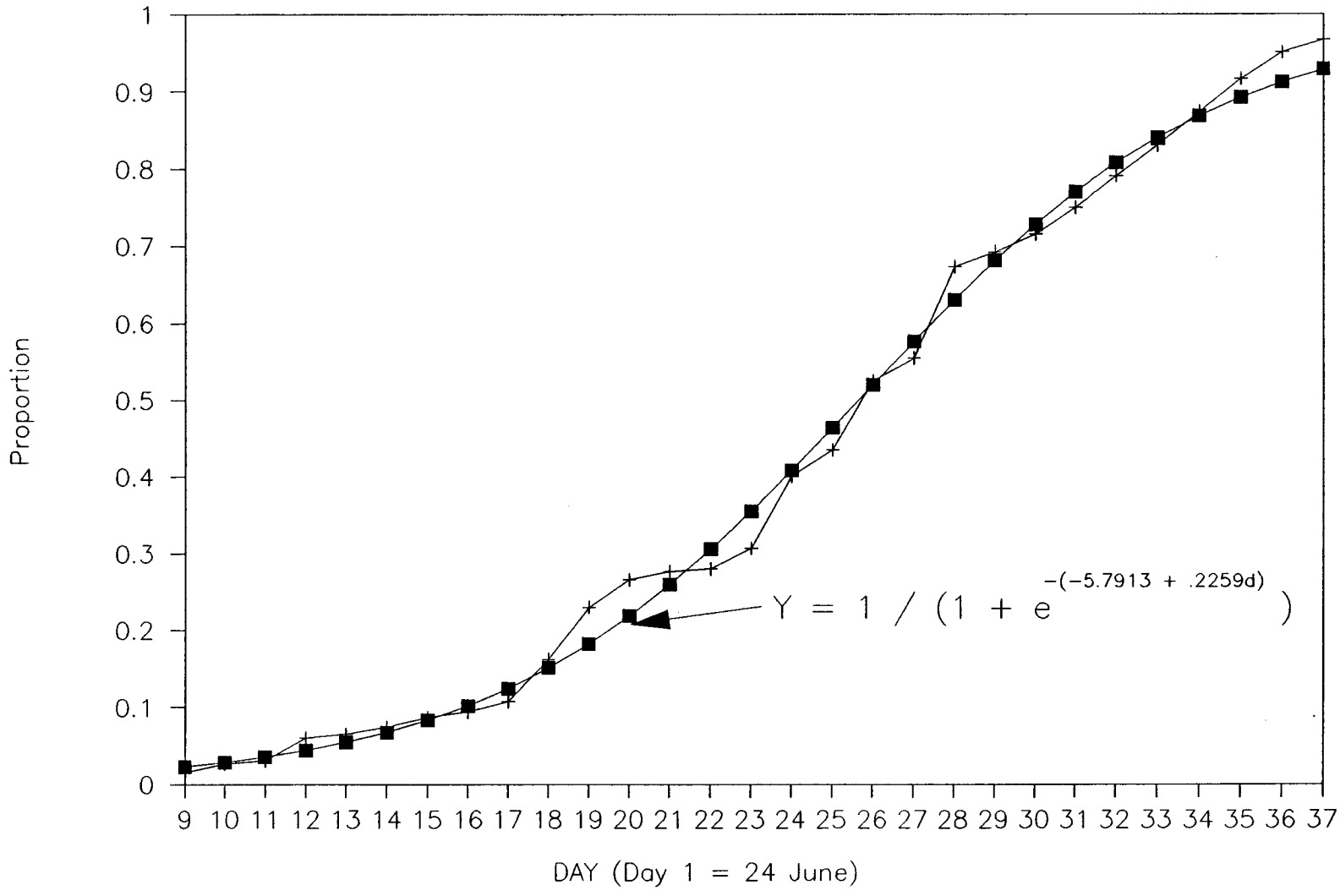

Figure 4. Cumulative proportions estimated for the sockeye salmon return to Upper Cook Inlet, Alaska, in 1990.

Appendix A.1. Summary of pink salmon salmon fishing effort, daily and cumulative catch, and daily and cumulative CPUE, Upper Cook Inlet offshore test fish project, 1990.

Date	Number of Stations	Mean Fishing Time (min)	Catch		CPUE	
			Daily	Cumul.	Daily	Cumul.
01-Jul	6	236.5	0	0	0.0	0.0
02-Jul	5	197.0	0	0	0.0	0.0
03-Jul	6	225.0	0	0	0.0	0.0
04-Jul	5	181.5	0	0	0.0	0.0
05-Jul	6	228.5	0	0	0.0	0.0
06-Jul	5	177.0	0	0	0.0	0.0
07-Jul	6	226.0	0	0	0.0	0.0
08-Jul	5	193.0	0	0	0.0	0.0
09-Jul	4	149.0	0	0	0.0	0.0
10-Jul	5	189.0	0	0	0.0	0.0
11-Jul	6	239.5	2	2	1.3	1.3
12-Jul	4	173.1	5	7	3.2	4.6
13-Jul	5	207.5	0	7	0.0	4.6
14-Jul	3	117.0	4	11	3.0	7.6
15-Jul	5	179.5	2	13	1.6	9.2
16-Jul	4	145.5	3	16	1.8	11.0
17-Jul	5	193.5	4	20	2.3	13.3
18-Jul	4	166.0	3	23	1.9	15.2
19-Jul	5	210.0	10	33	5.6	20.8
20-Jul	3	120.0	1	34	0.6	21.4
21-Jul	5	228.5	33	67	20.9	42.3
22-Jul	4	157.0	11	78	8.3	50.6
23-Jul	4	172.0	21	99	14.6	65.2
24-Jul	5	192.0	19	118	13.9	79.2
25-Jul	5	192.5	9	127	5.8	85.0
26-Jul	4	164.0	19	146	13.2	98.1
27-Jul	3	114.5	14	160	10.7	108.8
28-Jul	3	131.5	17	177	9.5	118.3
29-Jul	5	109.5	11	188	17.3	135.6
30-Jul	4	147.5	10	198	7.2	142.8

Appendix A.2. Estimated pink salmon salmon catch by date and station, Upper Cook Inlet offshore test fish project, 1990.

	Station Number								
Date	2	3	4	5	6	7	8	9	Total
01-Jul	0		0	0	0	0	0		0
02-Jul		0		0	0	0		0	0
03-Jul	0		0	0	0	0	0		0
04-Jul		0		0	0	0		0	0
05-Jul	0		0	0	0	0	0		0
06-Jul		0		0	0	0		0	0
07-Jul	0		0	0	0	0	0		0
08-Jul		0		0	0	0		0	0
09-Jul	0		0	0	0	0		0	0
10-Jul		0		0	0	0	0		0
11-Jul	0		0	0	1	1	0		2
12-Jul		0		2	1	2			5
13-Jul			0	0	0	0	0		0
14-Jul				1	1	2			4
15-Jul			0	0	2	0	0		2
16-Jul		0		0	0	3			3
17-Jul			0	0	0	2	2		4
18-Jul			0	0	2	1			3
19-Jul			0	1	1	0	8		10
20-Jul		1			0	0			1
21-Jul			0	6	7	9	11		33
22-Jul		0		5	3	3			11
23-Jul			6	3	4	8			21
24-Jul		0		9	1	8	1		19
25-Jul			0	0	9	0	0		9
26-Jul		0		7	2	10			19
27-Jul			1	6	7	0			14
28-Jul				1	0	16			17
29-Jul			1	1	0	2	7		11
30-Jul		0		1	9	0			10
Total	0	1	8	43	50	67	29	0	198
%	0.0	0.5	4.0	21.7	25.3	33.8	14.6	0.0	100.0

Appendix A.3. Estimated pink salmon salmon CPUE by date and station, Upper Cook Inlet offshore test fish project, 1990.

	Station Number								
Date	2	3	4	5	6	7	8	9	Total
01-Jul	0.0		0.0	0.0	0.0	0.0	0.0		0.0
02-Jul		0.0		0.0	0.0	0.0		0.0	0.0
03-Jul	0.0		0.0	0.0	0.0	0.0	0.0		0.0
04-Jul		0.0		0.0	0.0	0.0		0.0	0.0
05-Jul	0.0		0.0	0.0	0.0	0.0	0.0		0.0
06-Jul		0.0		0.0	0.0	0.0		0.0	0.0
07-Jul	0.0		0.0	0.0	0.0	0.0	0.0		0.0
08-Jul		0.0		0.0	0.0	0.0		0.0	0.0
09-Jul	0.0		0.0	0.0	0.0	0.0		0.0	0.0
10-Jul		0.0		0.0	0.0	0.0	0.0		0.0
11-Jul	0.0		0.0	0.0	0.8	0.6	0.0		1.3
12-Jul		0.0		1.4	0.7	1.1			3.2
13-Jul			0.0	0.0	0.0	0.0	0.0		0.0
14-Jul				0.8	0.7	1.4			3.0
15-Jul			0.0	0.0	1.6	0.0	0.0		1.6
16-Jul		0.0		0.0	0.0	1.8			1.8
17-Jul			0.0	0.0	0.0	1.2	1.1		2.3
18-Jul			0.0	0.0	1.2	0.7			1.9
19-Jul			0.0	0.8	0.8	0.0	3.9		5.6
20-Jul		0.6			0.0	0.0			0.6
21-Jul			0.0	3.8	3.6	6.3	7.2		20.9
22-Jul		0.0		3.8	2.2	2.2			8.3
23-Jul			4.9	2.4	2.4	4.9			14.6
24-Jul		0.0		6.7	0.8	5.6	0.8		13.9
25-Jul			0.0	0.0	5.8	0.0	0.0		5.8
26-Jul		0.0		5.3	1.4	6.5			13.2
27-Jul			0.8	4.6	5.3	0.0			10.7
28-Jul				0.7	0.0	8.7			9.5
29-Jul			4.1	6.3	0.0	1.5	5.4		17.3
30-Jul		0.0		0.8	6.4	0.0			7.2
Total	0.0	0.6	9.8	37.7	33.8	42.4	18.4	0.0	142.8
%	0.0	0.4	6.9	26.4	23.7	29.7	12.8	0.0	100.0

Appendix B.1. Summary of chum salmon salmon fishing effort, daily and cumulative catch, and daily and cumulative CPUE, Upper Cook Inlet offshore test fish project, 1990.

Date	Number of Stations	Mean Fishing Time (min)	Catch		CPUE	
			Daily	Cumul.	Daily	Cumul.
01-Jul	6	236.5	1	1	0.8	0.8
02-Jul	5	197.0	0	1	0.0	0.8
03-Jul	6	225.0	5	6	3.7	4.5
04-Jul	5	181.5	6	12	4.9	9.4
05-Jul	6	228.5	15	27	10.7	20.1
06-Jul	5	177.0	1	28	0.8	21.0
07-Jul	6	226.0	7	35	5.5	26.5
08-Jul	5	193.0	2	37	1.5	28.0
09-Jul	4	149.0	0	37	0.0	28.0
10-Jul	5	189.0	3	40	2.3	30.3
11-Jul	6	239.5	17	57	11.5	41.8
12-Jul	4	173.1	82	139	44.5	86.3
13-Jul	5	207.5	23	162	14.7	101.0
14-Jul	3	117.0	22	184	16.6	117.5
15-Jul	5	179.5	2	186	1.6	119.1
16-Jul	4	145.5	26	212	20.0	139.1
17-Jul	5	193.5	118	330	67.6	206.7
18-Jul	4	166.0	12	342	7.7	214.4
19-Jul	5	210.0	83	425	48.3	262.7
20-Jul	3	120.0	2	427	1.3	264.0
21-Jul	5	228.5	57	484	33.8	297.9
22-Jul	4	157.0	6	490	4.4	302.3
23-Jul	4	172.0	21	511	13.2	315.5
24-Jul	5	192.0	9	520	6.7	322.3
25-Jul	5	192.5	22	542	14.6	336.9
26-Jul	4	164.0	33	575	22.6	359.4
27-Jul	3	114.5	0	575	0.0	359.4
28-Jul	3	131.5	19	594	10.6	370.1
29-Jul	5	109.5	6	600	4.5	374.6
30-Jul	4	147.5	1	601	0.7	375.3

Appendix B.2. Estimated chum salmon salmon catch by date and station, Upper Cook Inlet offshore test fish project, 1990.

	Station Number								
Date	2	3	4	5	6	7	8	9	Total
01-Jul	0		0	1	0	0	0		1
02-Jul		0		0	0	0		0	0
03-Jul	0		1	4	0	0	0		5
04-Jul		1		5	0	0		0	6
05-Jul	0		3	12	0	0	0		15
06-Jul		0		0	1	0		0	1
07-Jul	2		0	2	2	1	0		7
08-Jul		0		0	1	1		0	2
09-Jul	0		0	0	0	0		0	0
10-Jul		1		0	1	0	1		3
11-Jul	0		0	1	3	8	5		17
12-Jul		0		3	2	77			82
13-Jul			0	3	18	2	0		23
14-Jul				4	1	17			22
15-Jul			0	0	1	1	0		2
16-Jul		1		0	6	19			26
17-Jul			1	0	2	28	87		118
18-Jul			0	0	7	5			12
19-Jul			0	0	20	4	59		83
20-Jul		2			0	0			2
21-Jul			0	3	26	5	23		57
22-Jul		0		0	2	4			6
23-Jul			0	2	7	12			21
24-Jul		0		2	4	3	0		9
25-Jul			0	3	19	0	0		22
26-Jul		0		5	15	13			33
27-Jul			0	0	0	0			0
28-Jul				0	1	18			19
29-Jul			0	0	0	5	1		6
30-Jul		0		0	1	0			1
Total	2	5	5	50	140	223	176	0	601
%	0.3	0.8	0.8	8.3	23.3	37.1	29.3	0.0	100.0

Appendix B.3. Estimated chum salmon salmon CPUE by date and station, Upper Cook Inlet offshore test fish project, 1990.

	Station Number								
Date	2	3	4	5	6	7	8	9	Total
01-Jul	0.0		0.0	0.8	0.0	0.0	0.0		0.8
02-Jul		0.0		0.0	0.0	0.0		0.0	0.0
03-Jul	0.0		0.8	2.9	0.0	0.0	0.0		3.7
04-Jul		0.9		4.0	0.0	0.0		0.0	4.9
05-Jul	0.0		2.3	8.5	0.0	0.0	0.0		10.7
06-Jul		0.0		0.0	0.8	0.0		0.0	0.8
07-Jul	1.6		0.0	1.5	1.6	0.8	0.0		5.5
08-Jul		0.0		0.0	0.7	0.8		0.0	1.5
09-Jul	0.0		0.0	0.0	0.0	0.0		0.0	0.0
10-Jul		0.8		0.0	0.7	0.0	0.8		2.3
11-Jul	0.0		0.0	0.8	2.3	4.5	3.8		11.5
12-Jul		0.0		2.1	1.5	40.9			44.5
13-Jul			0.0	2.3	11.1	1.2	0.0		14.7
14-Jul				3.4	0.7	12.4			16.6
15-Jul			0.0	0.0	0.8	0.8	0.0		1.6
16-Jul		0.9		0.0	7.8	11.3			20.0
17-Jul			0.8	0.0	2.7	17.0	47.1		67.6
18-Jul			0.0	0.0	4.1	3.6			7.7
19-Jul			0.0	0.0	16.4	3.1	28.8		48.3
20-Jul		1.3			0.0	0.0			1.3
21-Jul			0.0	1.9	13.4	3.5	15.0		33.8
22-Jul		0.0		0.0	1.5	2.9			4.4
23-Jul			0.0	1.6	4.3	7.3			13.2
24-Jul		0.0		1.5	3.2	2.1	0.0		6.7
25-Jul			0.0	2.3	12.3	0.0	0.0		14.6
26-Jul		0.0		3.8	10.3	8.4			22.6
27-Jul			0.0	0.0	0.0	0.0			0.0
28-Jul				0.0	0.8	9.8			10.6
29-Jul			0.0	0.0	0.0	3.7	0.8		4.5
30-Jul		0.0		0.0	0.7	0.0			0.7
Total	1.6	3.8	3.9	37.5	98.0	134.2	96.2	0.0	375.3
%	0.4	1.0	1.0	10.0	26.1	35.8	25.6	0.0	100.0

Appendix C.1. Summary of coho salmon salmon fishing effort, daily and cumulative catch, and daily and cumulative CPUE, Upper Cook Inlet offshore test fish project, 1990.

Date	Number of Stations	Mean Fishing Time (min)	Catch		CPUE	
			Daily	Cumul.	Daily	Cumul.
01-Jul	6	236.5	0	0	0.0	0.0
02-Jul	5	197.0	0	0	0.0	0.0
03-Jul	6	225.0	0	0	0.0	0.0
04-Jul	5	181.5	0	0	0.0	0.0
05-Jul	6	228.5	5	5	3.6	3.6
06-Jul	5	177.0	0	5	0.0	3.6
07-Jul	6	226.0	0	5	0.0	3.6
08-Jul	5	193.0	6	11	4.5	8.0
09-Jul	4	149.0	0	11	0.0	8.0
10-Jul	5	189.0	5	16	3.8	11.8
11-Jul	6	239.5	4	20	2.7	14.5
12-Jul	4	173.1	28	48	14.9	29.4
13-Jul	5	207.5	6	54	4.0	33.4
14-Jul	3	117.0	2	56	1.4	34.8
15-Jul	5	179.5	4	60	3.2	38.1
16-Jul	4	145.5	16	76	9.5	47.6
17-Jul	5	193.5	34	110	23.9	71.5
18-Jul	4	166.0	9	119	5.8	77.3
19-Jul	5	210.0	21	140	14.9	92.2
20-Jul	3	120.0	9	149	6.1	98.3
21-Jul	5	228.5	57	206	36.5	134.8
22-Jul	4	157.0	5	211	3.7	138.5
23-Jul	4	172.0	130	341	79.6	218.1
24-Jul	5	192.0	18	359	13.6	231.7
25-Jul	5	192.5	29	388	18.8	250.5
26-Jul	4	164.0	26	414	17.5	268.1
27-Jul	3	114.5	8	422	6.1	274.1
28-Jul	3	131.5	16	438	9.8	284.0
29-Jul	5	109.5	6	444	10.1	294.1
30-Jul	4	147.5	6	450	4.4	298.5

Appendix C.2. Estimated coho salmon salmon catch by date and station, Upper Cook Inlet offshore test fish project, 1990.

	Station Number								
Date	2	3	4	5	6	7	8	9	Total
01-Jul	0		0	0	0	0	0		0
02-Jul		0		0	0	0		0	0
03-Jul	0		0	0	0	0	0		0
04-Jul		0		0	0	0		0	0
05-Jul	0		1	4	0	0	0		5
06-Jul		0		0	0	0		0	0
07-Jul	0		0	0	0	0	0		0
08-Jul		0		0	2	4		0	6
09-Jul	0		0	0	0	0		0	0
10-Jul		1		0	3	1	0		5
11-Jul	0		0	0	1	2	1		4
12-Jul		0		0	0	28			28
13-Jul			0	2	4	0	0		6
14-Jul				0	0	2			2
15-Jul			0	0	3	1	0		4
16-Jul		0		0	0	16			16
17-Jul			1	0	5	17	11		34
18-Jul			0	2	6	1			9
19-Jul			0	0	6	9	6		21
20-Jul		7			0	2			9
21-Jul			0	7	9	15	26		57
22-Jul		0		2	0	3			5
23-Jul			0	0	85	45			130
24-Jul		0		0	4	8	6		18
25-Jul			0	1	28	0	0		29
26-Jul		0		1	14	11			26
27-Jul			0	4	4	0			8
28-Jul				0	4	12			16
29-Jul			0	1	0	3	2		6
30-Jul		1		0	5	0			6
Total	0	9	2	24	183	180	52	0	450
%	0.0	2.0	0.4	5.3	40.7	40.0	11.6	0.0	100.0

Appendix C.3. Estimated coho salmon salmon CPUE by date and station, Upper Cook Inlet offshore test fish project, 1990.

	Station Number								
Date	2	3	4	5	6	7	8	9	Total
01-Jul	0.0		0.0	0.0	0.0	0.0	0.0		0.0
02-Jul		0.0		0.0	0.0	0.0		0.0	0.0
03-Jul	0.0		0.0	0.0	0.0	0.0	0.0		0.0
04-Jul		0.0		0.0	0.0	0.0		0.0	0.0
05-Jul	0.0		0.8	2.8	0.0	0.0	0.0		3.6
06-Jul		0.0		0.0	0.0	0.0		0.0	0.0
07-Jul	0.0		0.0	0.0	0.0	0.0	0.0		0.0
08-Jul		0.0		0.0	1.4	3.0		0.0	4.5
09-Jul	0.0		0.0	0.0	0.0	0.0		0.0	0.0
10-Jul		0.8		0.0	2.1	0.8	0.0		3.8
11-Jul	0.0		0.0	0.0	0.8	1.1	0.8		2.7
12-Jul		0.0		0.0	0.0	14.9			14.9
13-Jul			0.0	1.5	2.5	0.0	0.0		4.0
14-Jul				0.0	0.0	1.4			1.4
15-Jul			0.0	0.0	2.4	0.8	0.0		3.2
16-Jul		0.0		0.0	0.0	9.5			9.5
17-Jul			0.8	0.0	6.8	10.3	6.0		23.9
18-Jul			0.0	1.6	3.5	0.7			5.8
19-Jul			0.0	0.0	4.9	7.0	2.9		14.9
20-Jul		4.4			0.0	1.6			6.1
21-Jul			0.0	4.5	4.7	10.5	17.0		36.5
22-Jul		0.0		1.5	0.0	2.2			3.7
23-Jul			0.0	0.0	52.0	27.5			79.6
24-Jul		0.0		0.0	3.2	5.6	4.9		13.6
25-Jul			0.0	0.8	18.1	0.0	0.0		18.8
26-Jul		0.0		0.8	9.7	7.1			17.5
27-Jul			0.0	3.0	3.0	0.0			6.1
28-Jul				0.0	3.3	6.5			9.8
29-Jul			0.0	6.3	0.0	2.2	1.5		10.1
30-Jul		0.9		0.0	3.5	0.0			4.4
Total	0.0	6.1	1.6	22.9	121.9	113.0	33.0	0.0	298.5
%	0.0	2.1	0.5	7.7	40.8	37.9	11.1	0.0	100.0

Appendix D.1. Summary of chinook salmon salmon fishing effort, daily and cumulative catch, and daily and cumulative CPUE, Upper Cook Inlet offshore test fish project, 1990.

Date	Number of Stations	Mean Fishing Time (min)	Catch		CPUE	
			Daily	Cumul.	Daily	Cumul.
01-Jul	6	236.5	0	0	0.0	0.0
02-Jul	5	197.0	0	0	0.0	0.0
03-Jul	6	225.0	0	0	0.0	0.0
04-Jul	5	181.5	0	0	0.0	0.0
05-Jul	6	228.5	2	2	1.5	1.5
06-Jul	5	177.0	0	2	0.0	1.5
07-Jul	6	226.0	0	2	0.0	1.5
08-Jul	5	193.0	0	2	0.0	1.5
09-Jul	4	149.0	0	2	0.0	1.5
10-Jul	5	189.0	0	2	0.0	1.5
11-Jul	6	239.5	0	2	0.0	1.5
12-Jul	4	173.1	0	2	0.0	1.5
13-Jul	5	207.5	0	2	0.0	1.5
14-Jul	3	117.0	0	2	0.0	1.5
15-Jul	5	179.5	0	2	0.0	1.5
16-Jul	4	145.5	0	2	0.0	1.5
17-Jul	5	193.5	0	2	0.0	1.5
18-Jul	4	166.0	0	2	0.0	1.5
19-Jul	5	210.0	3	5	1.5	2.9
20-Jul	3	120.0	0	5	0.0	2.9
21-Jul	5	228.5	0	5	0.0	2.9
22-Jul	4	157.0	0	5	0.0	2.9
23-Jul	4	172.0	0	5	0.0	2.9
24-Jul	5	192.0	0	5	0.0	2.9
25-Jul	5	192.5	0	5	0.0	2.9
26-Jul	4	164.0	0	5	0.0	2.9
27-Jul	3	114.5	0	5	0.0	2.9
28-Jul	3	131.5	0	5	0.0	2.9
29-Jul	5	109.5	0	5	0.0	2.9
30-Jul	4	147.5	0	5	0.0	2.9

Appendix D.2. Estimated chinook salmon salmon catch by date and station, Upper Cook Inlet offshore test fish project, 1990.

	Station Number								
Date	2	3	4	5	6	7	8	9	Total
01-Jul	0		0	0	0	0	0		0
02-Jul		0		0	0	0		0	0
03-Jul	0		0	0	0	0	0		0
04-Jul		0		0	0	0		0	0
05-Jul	0		0	1	1	0	0		2
06-Jul		0		0	0	0		0	0
07-Jul	0		0	0	0	0	0		0
08-Jul		0		0	0	0		0	0
09-Jul	0		0	0	0	0		0	0
10-Jul		0		0	0	0	0		0
11-Jul	0		0	0	0	0	0		0
12-Jul		0		0	0	0			0
13-Jul			0	0	0	0	0		0
14-Jul				0	0	0			0
15-Jul			0	0	0	0	0		0
16-Jul		0		0	0	0			0
17-Jul			0	0	0	0	0		0
18-Jul			0	0	0	0			0
19-Jul			0	0	0	0	3		3
20-Jul		0			0	0			0
21-Jul			0	0	0	0	0		0
22-Jul		0		0	0	0			0
23-Jul			0	0	0	0			0
24-Jul		0		0	0	0	0		0
25-Jul			0	0	0	0	0		0
26-Jul		0		0	0	0			0
27-Jul			0	0	0	0			0
28-Jul				0	0	0			0
29-Jul			0	0	0	0	0		0
30-Jul		0		0	0	0			0
Total	0	0	0	1	1	0	3	0	5
%	0.0	0.0	0.0	20.0	20.0	0.0	60.0	0.0	100.0

Appendix D.3. Estimated chinook salmon salmon CPUE by date and station, Upper Cook Inlet offshore test fish project, 1990.

	Station Number								
Date	2	3	4	5	6	7	8	9	Total
01-Jul	0.0		0.0	0.0	0.0	0.0	0.0		0.0
02-Jul		0.0		0.0	0.0	0.0		0.0	0.0
03-Jul	0.0		0.0	0.0	0.0	0.0	0.0		0.0
04-Jul		0.0		0.0	0.0	0.0		0.0	0.0
05-Jul	0.0		0.0	0.7	0.8	0.0	0.0		1.5
06-Jul		0.0		0.0	0.0	0.0		0.0	0.0
07-Jul	0.0		0.0	0.0	0.0	0.0	0.0		0.0
08-Jul		0.0		0.0	0.0	0.0		0.0	0.0
09-Jul	0.0		0.0	0.0	0.0	0.0		0.0	0.0
10-Jul		0.0		0.0	0.0	0.0	0.0		0.0
11-Jul	0.0		0.0	0.0	0.0	0.0	0.0		0.0
12-Jul		0.0		0.0	0.0	0.0			0.0
13-Jul			0.0	0.0	0.0	0.0	0.0		0.0
14-Jul				0.0	0.0	0.0			0.0
15-Jul			0.0	0.0	0.0	0.0	0.0		0.0
16-Jul		0.0		0.0	0.0	0.0			0.0
17-Jul			0.0	0.0	0.0	0.0	0.0		0.0
18-Jul			0.0	0.0	0.0	0.0			0.0
19-Jul			0.0	0.0	0.0	0.0	1.5		1.5
20-Jul		0.0			0.0	0.0			0.0
21-Jul			0.0	0.0	0.0	0.0	0.0		0.0
22-Jul		0.0		0.0	0.0	0.0			0.0
23-Jul			0.0	0.0	0.0	0.0			0.0
24-Jul		0.0		0.0	0.0	0.0	0.0		0.0
25-Jul			0.0	0.0	0.0	0.0	0.0		0.0
26-Jul		0.0		0.0	0.0	0.0			0.0
27-Jul			0.0	0.0	0.0	0.0			0.0
28-Jul				0.0	0.0	0.0			0.0
29-Jul			0.0	0.0	0.0	0.0	0.0		0.0
30-Jul		0.0		0.0	0.0	0.0			0.0
Total	0.0	0.0	0.0	0.7	0.8	0.0	1.5	0.0	2.9
%	0.0	0.0	0.0	23.9	26.4	0.0	49.6	0.0	100.0

Appendix E.1. Entry pattern of sockeye salmon into Upper Cook Inlet, Alaska in 1990 as estimated from daily CPUE measured at the latitude of Anchor Point.

Day	Date	Input Y	Estimated Y	Residual	Change in Y	Change in estimated Y
9	702	0.0152	0.0228	-0.0076	0.0032	0.0045
10	703	0.0264	0.0284	-0.0020	0.0112	0.0056
11	704	0.0304	0.0353	-0.0049	0.0040	0.0069
12	705	0.0601	0.0439	0.0162	0.0297	0.0086
13	706	0.0653	0.0544	0.0109	0.0052	0.0105
14	707	0.0741	0.0673	0.0068	0.0087	0.0129
15	708	0.0872	0.0829	0.0043	0.0132	0.0156
16	709	0.0937	0.1018	-0.0081	0.0065	0.0189
17	710	0.1075	0.1244	-0.0169	0.0138	0.0226
18	711	0.1624	0.1512	0.0112	0.0549	0.0268
19	712	0.2300	0.1825	0.0475	0.0676	0.0313
20	713	0.2655	0.2186	0.0468	0.0355	0.0361
21	714	0.2766	0.2597	0.0170	0.0112	0.0410
22	715	0.2795	0.3054	-0.0258	0.0029	0.0457
23	716	0.3068	0.3553	-0.0484	0.0273	0.0499
24	717	0.4014	0.4085	-0.0071	0.0946	0.0533
25	718	0.4356	0.4640	-0.0285	0.0342	0.0555
26	719	0.5253	0.5204	0.0048	0.0897	0.0564
27	720	0.5545	0.5763	-0.0218	0.0293	0.0559
28	721	0.6728	0.6303	0.0424	0.1182	0.0540
29	722	0.6927	0.6812	0.0115	0.0200	0.0509
30	723	0.7152	0.7282	-0.0130	0.0225	0.0469
31	724	0.7502	0.7705	-0.0203	0.0350	0.0424
32	725	0.7912	0.8080	-0.0168	0.0409	0.0375
33	726	0.8302	0.8406	-0.0104	0.0391	0.0326
34	727	0.8743	0.8686	0.0056	0.0440	0.0280
35	728	0.9162	0.8923	0.0239	0.0420	0.0237
36	729	0.9506	0.9122	0.0385	0.0344	0.0199
37	730	0.9670	0.9287	0.0383	0.0163	0.0165

Appendix F.1. Chemical and physical observations made in Upper Cook Inlet, Alaska during the conduct of the 1990 offshore test fish project.

Date	Station	Air Temp. (c)	Water Temp. (c)	Wind Vel. (knots)	Wind Dir^	Tide Stage~	Salinity (ppt)	Water Depth (f)	Secchi (m)
01-Jul	2	12	11	12	5	4	25	27	6
	4	11	10	10	6	4	26	26	6
	5	11	10	8	6	4	25	49	5.5
	6	11	9.5	4	6	1	25	48	3.5
	7	12	10	4	6	3	26	46	4.5
	8	12	10	8	6	3	25	30	4
02-Jul	9	11	10	22	6	4	24	20	2
	7	14	10	20	6	4	24	45	2
	6	16	11	18	6	4	24	46	2.5
	5	14	9	18	6	4	25	36	2.8
	3	14	11	13	6	4	25	20	8.5
03-Jul	2	13	10	10	1	4	24	26	5
	4	14	11.5	7	1	4	24.8	27	2.5
	5	14	12	6	8	4	26	43	3
	6	15	11	4	8	4	24	49	3
	7	15	12.5	3	8	4	28	45	3
	8	16	12	3	8	1	32	30	4
04-Jul	9	10	10	12	5	3	23	19	2
	7	13	11.5	18	5	4	21	45	2.5
	6	11	11	12	5	4	22.5	44	2
	5	12	12	12	5	4	22	39	2
	3	13	10	8	6	4	25	20	5.5
05-Jul	2	11	11.5	15	6	2	23	28	4
	4	12	11.5	11	6	4	30	24	3
	5	11	11.5	7	6	4	21.5	37	2
	6	11	12	11	6	4	21.5	50	3.5
	7	12	12.5	12	6	4	21	43	4
	8	15	12.5	17	6	4	21	32	4
06-Jul	9	12	11.5	12	6	3	21.5	22	3.5
	7	12	12	10	6	3	22	42	3.5
	6	15	11	9	6	3	22.5	47	4.5
	5	12	12.5	8	6	3	20	32	3.5
	3	14	11	4	6	3	23.5	23	5
07-Jul	2	12	12.5	0	0	3	22	26	4.3
	4	12	13	5	8	3	20.5	23	3.5
	5	13	12.5	12	8	4	20.5	36	3.5
	6	12	12.5	18	8	4	20.5	47	3.5
	7	12	12.5	18	8	4	21.5	46	3.5
	8	14	12	16	8	4	21	28	3

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Appendix F.1. (p 2 of 4)

Date	Station	Air Temp. (c)	Water Temp. (c)	Wind Vel. (knots)	Wind Dir^	Tide Stage~	Salinity (ppt)	Water Depth (f)	Secchi (m)
08-Jul	9	12	11.5	0	0	3	21	22	3.5
	7	11	11	6	2	3	21	42	3
	6	12	11	0	0	3	22	45	3
	5	12	11	11	2	3	22	40	5
	3	11	11	10	4	3	23	21	5.5
09-Jul	2	10	11	12	8	3	23	23	5
	4	11	12	17	8	3	22	22	5
	5	11	10	23	8	3	23	36	5
	6	11	10	26	8	4	23	47	5
	7	-1	-1	-1	-1	-1	-1	-1	-1
	9	-1	-1	-1	-1	-1	-1	-1	-1
10-Jul	8	11	12	10	8	1	20	32	3
	7	11	11.5	0	0	3	21	42	3.5
	6	12	11	0	0	3	21	45	3
	5	13	10	0	0	3	23	40	5.3
	3	14	11	13	6	4	22.5	23	5.5
11-Jul	2	11	10.5	0	0	3	20.5	20	7.5
	4	12	10.5	0	0	3	23	25	5
	5	11	10	0	0	3	22.5	40	4
	6	11	11	4	6	3	23	47	4.5
	7	14	12	0	0	4	22	39	3.5
	8	14	12	6	6	4	20	28	2.5
12-Jul	7	10	10	6	6	4	22	43	3.5
	6	11	10	8	6	3	23	49	7
	5	17	11	6	6	3	22	32	3
	3	12	11	0	0	3	22	22	6.5
13-Jul	4	17	11	2	2	3	22	25	8
	5	15	11.5	6	1	3	21	34	4
	6	13	11	6	8	2	22	49	3
	7	13	11	4	8	4	21	27	3
	8	14	12	0	0	4	21	26	3
14-Jul	7	11	11	22	8	4	21	47	2.5
	6	10	10	23	8	4	23	49	4
	5	11	10	22	8	3	23	36	5
15-Jul	4	12	11	0	0	4	21	25	9
	5	11	11	0	0	4	22	37	9
	6	12	12	0	0	3	21	49	5
	7	13	12	7	4	3	21	42	4
	8	14	13	10	4	3	20	33	4
16-Jul	7	11	13	12	4	4	18	43	2.5
	6	15	11	9	4	4	22	48	10

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Appendix F.1. (p 3 of 4)

Date	Station	Air Temp. (c)	Water Temp. (c)	Wind Vel. (knots)	Wind Dir^	Tide Stage~	Salinity (ppt)	Water Depth (f)	Secchi (m)
16-Jul	5	11	10	10	4	4	21	35	11
	3	12	11	13	4	4	22	20	10
17-Jul	4	13	12	15	4	3	19.5	24	8
	5	13	10	12	4	4	22	43	7
	6	13	12	12	4	4	19	48	3
	7	14	13	14	4	4	19	46	3
	8	14	13	12	4	4	19	31	4
18-Jul	7	12	12.5	12	4	3	18.5	43	3
	6	14	13	0	0	2	19	43	2.5
	5	13	11	0	0	4	21	37	11.5
	4	14	11	0	0	4	21	21	10.5
19-Jul	4	13	11	0	0	2	20	24.5	5
	5	15	11	0	0	4	21	43	6
	6	11	11	6	6	4	21	49	7
	7	12	13	12	4	4	21	43	2.5
	8	14	13	13	4	4	19	37	2.5
20-Jul	7	10	13	20	6	3	18	44	2
	6	11	13	20	6	3	19	43	2.5
	3	15	9	0	0	3	23	22	8
21-Jul	4	13	11	0	0	3	20	24	5
	5	14	11.5	0	0	3	20.5	35	7
	6	16	13	0	0	4	21	47	4.5
	7	14	12	0	0	4	20	41	3.3
	8	13	12	0	0	4	19.5	38	3.5
22-Jul	7	10	11.5	8	6	1	19	47	3.3
	6	11	12	6	6	3	20	47	3.5
	5	13	12	7	6	3	19	35	3
	3	15	11	0	0	3	21	18	7
23-Jul	4	11	11	7	6	1	20	24	6
	5	11	11	5	6	3	21	31.8	5
	6	13	12.5	8	6	3	19.5	46.5	3
	7	12	12	11	6	3	20	39	2
24-Jul	8	10	11.5	14	2	3	19	32	3
	7	11	12	14	2	3	20	45	3
	6	11	12	12	2	3	20	48	3
	5	11	12	14	8	3	20	35	5
	3	11	12	0	0	3	20	20	5.5
25-Jul	4	16	11	0	0	3	18	23	8
	5	14	12	2	5	3	19	36	3
	6	14	11	3	5	3	20	48	3
	7	13	12.5	0	0	4	19	44	2.8

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Appendix F.1. (p 4 of 4)

Date	Station	Air Temp. (c)	Water Temp. (c)	Wind Vel. (knots)	Wind Dir^	Tide Stage~	Salinity (ppt)	Water Depth (f)	Secchi (m)
25-Jul	8	12	13	0	0	4	19	32	3
26-Jul	7	10	11.5	10	1	4	24	49	4
	6	10	11.5	12	8	1	19.5	51	7
	5	10	12	10	8	3	19	37	7.5
	3	10	13	14	8	3	18	18	8
27-Jul	4	10	11	16	8	3	19	24	8
	5	11	12	19	8	3	18.5	37	7
	6	11	11	21	8	3	20	45	3
	7	-1	-1	-1	-1	-1	-1	-1	-1
28-Jul	7	11	11	24	8	4	19.5	46	2.5
	6	12	11	17	2	4	19	47	4
	5	11	10	20	2	1	21	43	4
29-Jul	4	10	10	12	2	4	16	28	7
	5	10	10	9	2	3	20	50	5
	6	10	11	4	2	3	17	49	4
	7	11	11	4	2	3	18	43	3
	8	12	12	4	2	3	18	31	3
30-Jul	7	10	11	0	0	4	18	38	3
	6	11	13	0	0	4	18	49	3
	5	12	11	0	0	4	18.5	37	11
	3	14	11	0	0	4	19	21	9

^ Wind direction code 1=north,2=northeast,3=east,4=southeast,
5=south,6=southwest,7=west,8=northwest
~ Tide stage code 1=high,2=low,3=ebb,4=flood