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STATE OF ALASKA
Jay S. Hammond, Governor

1981 BRISTOL BAY SALMON TEST FISHING PROJECTS

Edited by:
Henry J. Yuen

April 1982

ALASKA DEPARTMENT OF FISH AND GAME
P.O. Box 3-2000, Juneau, Alaska 99802

Ronald O. Skoog
Commissioner

ADF&G TECHNICAL DATA REPORTS

This series of reports is designed to facilitate prompt reporting of data from studies conducted by the Alaska Department of Fish and Game, especially studies which may be of direct and immediate interest to scientists of other agencies.

The primary purpose of these reports is presentation of data. Description of programs and data collection methods is included only to the extent required for interpretation of the data. Analysis is generally limited to that necessary for clarification of data collection methods and interpretation of the basic data. No attempt is made in these reports to present analysis of the data relative to its ultimate or intended use.

Data presented in these reports is intended to be final, however, some revisions may occasionally be necessary. Minor revision will be made via errata sheets. Major revisions will be made in the form of revised reports.

1981 BRISTOL BAY SALMON TEST FISHING PROJECTS

A summary of data collected from salmon *(Oncorhynchus* sp.*)* test fishing projects in Bristol Bay, including Nushagak, Kvichak, Egegik, Ugashik, and Igushik escapement, Port Moller, and Nushagak offshore test fishing

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ABSTRACT

Test fishing was conducted in Bristol Bay to estimate salmon *(Oncorhynchus* sp.*)* run timing and run size into Bristol Bay and into Nushagak Bay; to estimate escapements in four selected rivers; and to monitor the magnitude and pattern of entry of salmon prior to and immediately after they have reached the individual fishing districts but prior to the time these fish are exposed to the fishing fleet. Summary and data tables are presented.

FOREWORD

The common objective in test fishing for Bristol Bay salmon *(Oncorhynchus* sp.*)* is to estimate numbers of fish before actual counts become available. There are references in these reports to management decisions. These decisions, whether or not to open or close a fishery, depend on the best estimate of the numbers of fish entering and leaving the fishery. The Bristol Bay salmon fisheries are managed by river systems. Fishing is limited to the mouths of the rivers. Each river has, at least for sockeye salmon *(O. nerka)*, an escapement goal. Management of the fishery is then directed to achieving escapement goals, while at the same time to maximize catch of the available surplus. Although fishery closures are frequently necessary to achieve escapement goals, short fishing periods are used early and throughout the season to spread the catch over the duration of the run. Actual counts of escapement are not available until the fish swim upriver in clear water where they can be counted. In the same manner, estimates of run size and therefore potential catch and escapement are not available until after the fact, when catch and escapement reports can be added together. Thus test fishing in Bristol Bay is designed to estimate, before the actual numbers are available, the abundance of: (1) total inshore run size as from the Port Moller Offshore Test Fishing project; (2) district inshore run size as from the Nushagak Offshore Test Fishing project; and (3) escapement past the commercial fishery in the various escapement test fishing projects. In the past, escapement test fisheries have been referred to as inside test fishing. Likewise, district test fishing has been referred to as outside test fishing. While most of these estimates are based on historical catch per unit of effort, there are some estimates based primarily on mean weights, mean lengths, and lag times. There are also references in these reports to both catchability and passage rate. Catchability refers to estimating the return or escapement per index point from the size of the fish. Passage rate is another term for return or escapement per index point. Daily passage is the passage rate multiplied by the daily index. The standard test fish index (catch per 100 fm hours) referred to in the texts is calculated as follows:

$$I = \frac{6000\ (C)}{(F)\ (T)}$$

Where C = Catch.
F = Fathoms of net.
T = Total time fished in minutes with F fathoms of net.
6000 = Constant to convert indices into catch per 100 fathoms - hours from 60 minutes x 100 fathoms.

Other methods as well as objectives specific to a particular project will be discussed in the individual reports. This report is the third in a series of Technical Data reports in which all Bristol Bay test fishing reports are combined into a single report.

1981 PORT MOLLER OFFSHORE TEST FISHING

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INTRODUCTION

The Bristol Bay offshore test fishing program has been conducted at Port Moller continuously since 1967. The location, timing, and gear specifications were standardized in 1968, but the primary goal of the project was always to preview the sockeye *(Oncorhynchus nerka)* and chum salmon *(O. keta)* runs to Bristol Bay roughly 1 week prior to their arrival inshore (Mundy and Mathisen 1977). Specific objectives of the 1981 Port Moller project were as follows:

1) Forecast the cumulative daily abundance of sockeye and chum salmon entering Bristol Bay;

2) Forecast the timing and entry pattern of the sockeye salmon run to the inshore area of Bristol Bay;

3) Forecast total sockeye abundance using entry pattern analysis and relationships between average fish size and total run size;

4) Obtain age data to monitor the performance of the pre-season sockeye forecast; and

5) Obtain age, length, and weight data to maintain the historical data base for future scale pattern analysis.

A large, unexplained variance was characteristic of the inshore fish per index values generated prior to 1979. This variance has since been largely explained by a size-based catchability relationship (Meacham 1979). In 1981, catchability-adjusted estimates of passage provided the earliest in-season abundance estimates. Later in the 1981 season actual inshore run data were used to calibrate the index values.

Total sockeye salmon abundance estimates were generated from each of seven independent methods in 1981. The earliest five values were produced from density-dependent growth models developed for each of the four major age classes and for all age groups combined (Huttunen 1979). Additionally, a completely different abundance estimate was made based upon the historic entry pattern of sockeye salmon into Bristol Bay (Mundy and Mathisen 1978). Finally, the most reliable but least timely estimate of total run size was generated by summing all of the actual return per index-adjusted daily passages throughout the season.

METHODS AND MATERIALS

Figure 1 shows the location of the offshore test fishing in 1981, which has remained essentially the same as for the last 13 years (Randall 1977), except that three new stations were added to the nearshore end of the transect to coincide with the apparent spatial distribution of the run. The fishing schedule and gear type also remained unchanged throughout most of the sockeye run, fishing 200 fm of gillnet for about 1 hour each at five or six 10-mi (16 km) intervals.

The 22 m "WALTER N" was chartered for the 1981 test fishing project. The 200 fm of net were set from and retrieved with a hydraulic reel which required the net to be picked before it could be wound on the drum. This created a tendency for the sets with large catches to be slightly longer in time than sets with smaller catches. The direction of each set was perpendicular to the overall direction of fish movement into Bristol Bay to avoid catch variability because of net orientation.

All catches were expressed as "index" points or fish caught per 100 fm of net fished per hour. Indices from each station fished were then summed to yield a daily index. Each of these daily indices were multiplied by return per index values based upon mean fish length to produce estimates of daily passage (Table 1).

The updated mean length to return per index relationship was in the form of a least squares fit power curve as follows:

Mean length adjusted return per index:

$$\text{Daily passage} = aL^{b}$$

Where $a = 1.889 \times 10^{74}$

$b = -26.536$

L = Daily mean length (mm)

Mean lengths and weights by station were weighted by fathom-hours actually fished to achieve daily means, as fathom-hour was the two-dimensional sample unit used.

Indices from stations missed during the fishing scheule because of weather or mechanical breakdowns were linearly interpolated from indices from stations fished on both sides of the missed station on the transect and from indices from the missed station on the day prior to and following the day of the missing data.

All sockeye, chum, and pink salmon *(Oncorhynchus gorbuscha)* caught were sampled for length, weight, and sex. Scale samples were also taken from sockeye and chum salmon.

Climatological data were recorded during each set including water surface temperatures, wind direction and velocity, tide state, air temperature, and

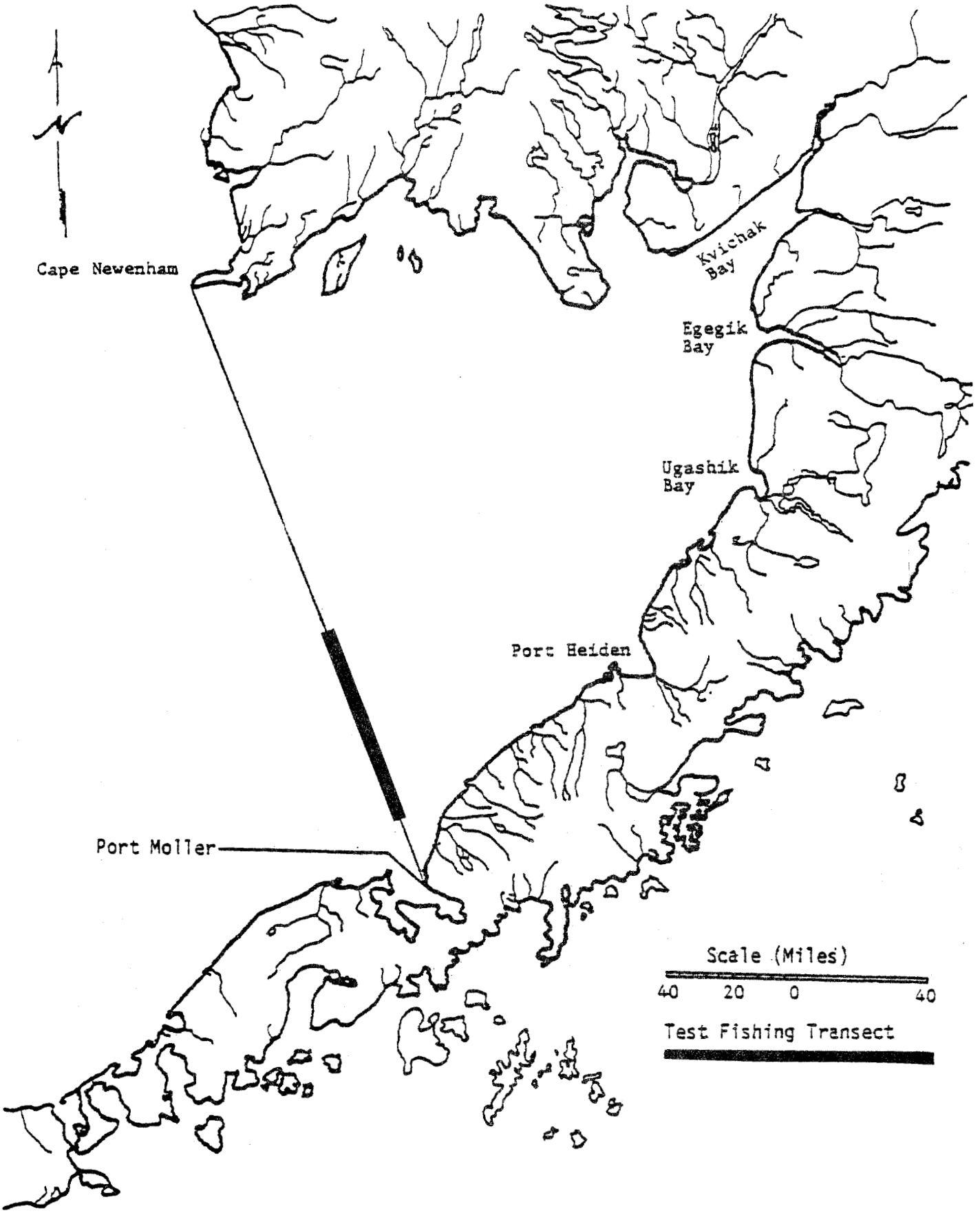

Figure 1. Transect area fished during the Port Moller offshore gillnet test fishery.

Table 1. Relationship between average fork length and weight of sockeye salmon captured offshore of Port Moller and inshore run size and return per index, Bristol Bay, 1971-1981.

DATE	INSHORE RUN (million)	RETURN PER INDEX (thousands)	PORT MOLLER LENGTH (mm)	PORT MOLLER WEIGHT (kg)	INSHORE LENGTH (mm)
1971	15.82	24.2	549.9	2.65	552.4
1972	5.37	-	566.8	2.94	543.6
1973	2.42	7.2	584.9	3.31	572.9
1974	10.94	-	-	-	527.6
1975	24.20	18.8	547.9	2.38	522.7
1976	11.47	16.7	552.1	2.78	543.5
1977	9.47	12.2	567.8	3.18	557.5
1978	19.65	-	545.4	2.76	536.8
1979	40.80	39.4	548.0	2.71	538.8
1980	62.28	124.5	545.0	2.68	524.6
1981	34.58	32.9	567.5	3.00	556.0

Power Curve $y = ax^b$

Inshore Run Versus:

Length	$r^2 = 0.58$	$a = 1.654 \times 10^{87}$	$b = -31.32$
Weight	$r^2 = 0.40$	$a = 1.327 \times 10^{4}$	$b = -6.48$

Return Per Index Versus:

Length	$r^2 = 0.47$	$a = 1.985 \times 10^{66}$	$b = -31.32$
Weight	$r^2 = 0.23$	$a = 1.307 \times 10^{3}$	$b = -3.86$

cloud cover. In addition, Loran coordinates were recorded for each station fished.

RESULTS

In 1981, 1,309 sockeye salmon were caught during sampling activities off Port Moller. These catches generated 1,051.41 total indices including values interpolated for missed fishing. Seasonal mean length and weight of sockeye captured was 567.51 mm and 3.00 kg, respectively. Catch data by day and station are presented in Appendix Table 1 and 2.

Initially, an estimate of sockeye return per index point was determined from Port Moller mean fish length. Mean weight was not used to generate adjusted return per index values in 1981 because of the high degree of variability associated with weight-adjusted indices in the past. By 1 July it was apparent that the actual inshore return per index point was nearly twice that indicated by this length-catchability relationship. Therefore, it became necessary to rely solely upon the actual inshore return per index point method of estimating daily passage rates (Figure 2). The final forecast of total sockeye abundance based upon 30,194 inshore fish per index point was 31.7 million, about 8% below the actual return of 34.58 million (Table 2).

The earliest in-season forecast of total sockeye abundance on 15 June was 29 million, about 16% below the actual return of 34.58 million. It was based upon the mean length of all sockeye caught during the first 5 days of sampling at Port Moller, and was generated by a model describing the relationship between sockeye inshore mean length and total abundance as follows:

$$Z = 40.7533 - 13.1493x + 9.9231y$$

Where: x = ln mean length
y = ln temperature

Port Moller mean length was substituted for inshore mean length for in-season use, and while the test fishery average fish length has varied regularly from inshore average length (Table 1), it has been the best early indicator of relative sockeye size (Huttunen 1980).

The in-season forecast of total sockeye abundance based upon entry pattern analysis at Port Moller on 26 June, was 12.4 million, not quite one-third of the actual return. This entry pattern model utilizes the historic mean peak of the run at Port Moller as day 17, taken to be the seventeenth day following the first day of sockeye catches at Port Moller (Mundy and Mathisen 1978). In 1981, there were slight but significant catches of sockeye at Port Moller at the onset of the project (Table 2). Following, there were 4 days of little or no fish presence indicated by the project just prior to the arrival of the main portion of the sockeye run. Presently, this entry pattern model cannot describe the variance about the mean peak abundance date or the mean duration of the season. The variances about both parameters will have to be described by measurable attributes before more confidence can be placed upon estimates so derived in-season.

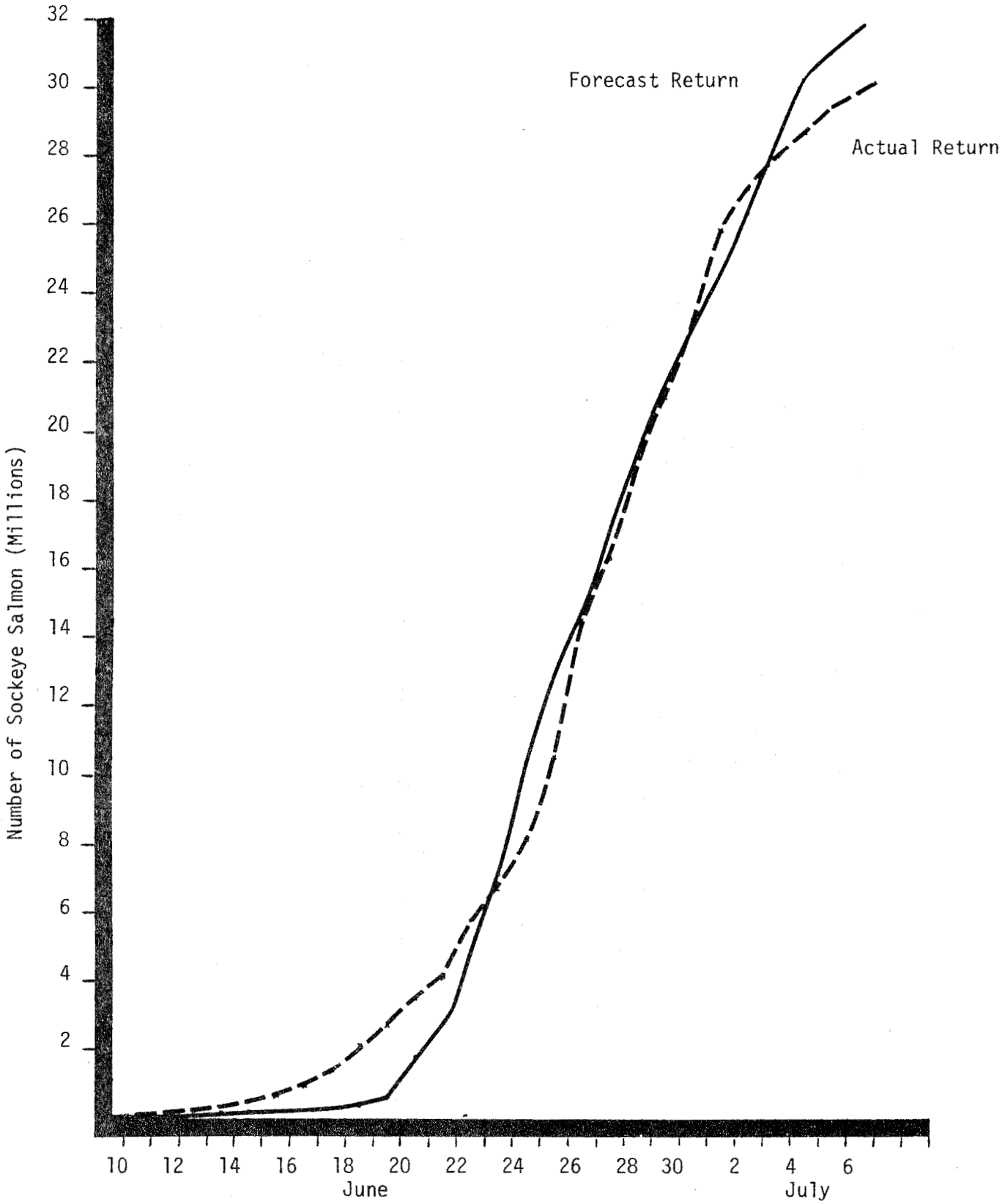

FIGURE 2. Forecast and actual inshore run of sockeye salmon to Bristol Bay, 1981. Forecast is based upon inseason catch and escapement per Port Moller index point. Curves were matched by lagging Port Moller data eight days.

Table 2. Daily summary of sockeye salmon catch and index, running mean weight and length, and estimated cumulative passage at the Port Moller test fishery, 1981.

DATE	SETS	CATCH	INDEX [1]	RUNNING MEAN WEIGHT (kg)	RUNNING MEAN LENGTH (mm)	ESTIMATED [2] ACCUM PASSAGE
6/10	6	6	2.73	3.00	566.8	82,430
6/11	5	3	1.34	3.02	560.8	122,890
6/12	6	2	1.04	2.96	559.0	154,291
6/13	5	3	1.54	2.82	550.8	200,790
6/14	6	4	1.94	2.83	551.5	259,366
6/15	4	0	0	2.83	551.5	259,366
6/16	0	0	0	2.83	551.5	259,366
6/17	5	0	0	2.83	551.5	259,366
6/18	6	0	2.09	2.83	551.5	322,472
6/19	2	14	12.45	2.97	563.1	698,387
6/20	6	78	35.28	2.96	562.2	1,763,631
6/21	6	75	33.16	3.03	564.1	2,764,865
6/22	6	176	69.76	3.02	565.5	4,871,198
6/23	6	156	76.65	3.02	566.5	7,185,568
6/24	5	205	105.72	3.00	566.2	10,377,678
6/25	0	0	84.00	3.00	566.2	12,913,974
6/26	5	103	58.31	3.01	567.8	14,674,586
6/27	6	137	81.31	3.00	568.0	17,129,660
6/28	0	0	72.45	3.00	568.0	19,317,215
6/29	0	0	63.59	3.00	568.0	21,237,252
6/30	5	93	54.73	3.00	567.6	22,889,769
7/1	3	55	55.48	2.99	567.3	24,564,932
7/2	0	0	59.42	2.99	567.3	26,359,059
7/3	0	0	63.35	2.99	567.3	28,271,850
7/4	5	111	67.29	3.00	567.5	30,303,604
7/5	6	43	23.50	3.00	567.4	31,013,063
7/6	5	45	24.28	3.00	567.5	31,746,273

[1] Includes interpolated values for missed fishing time.

[2] Passage is based upon 30,194 inshore returns per index point calculated from a cumulative inshore run of 19,317,100 sockeye through 7/6 and 639.77 cumulative Port Moller index points through 6/28 with a lag time of 8 days.

Peak sockeye catches at the Port Moller test fishery occurred on 24 June, predicting peak abundance inshore on 2 July based on a 5-day lag time between the two. The actual peak of abundance inshore was 4 July. While comparison of peak dates at the test fishery and inshore suggested a 10-day lag time between the two, curve matching cumulative entry data (Figure 2) indicated that an 8-day lag was more appropriate.

The percent age class composition of the run as predicted from Port Moller was different from that realized inshore. As expected from previous work (Huttunen 1980) the Port Moller project intercepted proportionately fewer 2-ocean fish and more 3-ocean fish than actually arrived inshore because of size and gillnet catchability differences. The age class compositions at both Port Moller and inshore compared to the pre-season forecast are given in Table 3.

Surface water temperatures were noted at nearly every station fished and are presented in Table 4. The seasonal mean surface water temperature in 1981 was 10.16 C, nearly double those of 1980 (Appendix Table 3). Available Port Moller water temperature are listed by year below for comparison:

1) 1976 5.0 C,
2) 1977 7.0 C,
3) 1978 7.2 C,
4) 1980 5.9 C, and
5) 1981 10.2 C

In 1981, 391 chum salmon were caught during sampling at Port Moller, generating 218.29 total indices including values interpolated for missed fishing. The seasonal chum salmon forecast based upon the historic mean (1979 data not included) of 10,450 inshore fish per index point was some 2.281 million, roughly 9.5% above the actual run of 2.084 million. No catchability adjustments have been used to describe any variability about the historic mean return per index value because of the relative stability in Bristol Bay chum salmon mean weight.

Table 3. Age class composition at Port Moller and inshore compared to the pre-season forecast.

Age Class	Port Moller	Inshore	Pre-season forecast
4^2	16.2	16.4	13.8
5^3	21.8	29.7	34.6
2-ocean	38.0	46.1	48.4
5^2	45.9	40.3	28.9
6^3	16.1	13.2	22.7
3-ocean	62.0	53.5	51.6

Table 4. Surface water temperatures (°C) encountered during the 1981 Port Moller offshore test Fishing project by station.

Date	53	52	51	1	2	3	4	5	6	7	8	9	10	11	12	Average
6/10		-		9		9		10		10		10		10		9.67
6/11	-		-		10		10		9		9		-		-	9.50
6/12		-		-		10		10		10		11		11		10.40
6/13	-		-		11		12		11		10		10		-	10.80
6/14		-		8		10		11		11		12		12		10.67
6/15	-		-		-		11		10		10		11		-	10.50
6/16		-		-		-		-	-		-		-		-	
6/17	-		-		9		10		9		10		11		-	9.80
6/18		-		10		11		11		10		10		10		10.33
6/19	-		-		10		10		-		-		-		-	10.00
6/20		-		10		10		10		10		10		10		10.00
6/21	-		9		10		10		10		10		10		-	9.83
6/22		10		10		10		10		10		10		-		10.00
6/23	10		10		10		10		10		10		10		-	10.00
6/24		10		10		10		11		-		-		-		10.25
6/25	-		-		-		-		-		-		-		-	-
6/26		10		11		10		10		11		-		-		10.40
6/27	12		11		11		11		11		11		-		-	11.17
6/28		-		-		-		-		-		-		-		-
6/29	-		-		-		-		-		-		-		-	-
6/30		9		10		10		10		11		-		-		10.00
7/1	-		-		-		10		10		10		-		-	10.00
7/2		-		-		-		-		-		-		-		-
7/3	-		-		-		-		-		-		-		-	-
7/4		9		10		10		10		10		-		-		9.80
7/5	11		10		10		10		10		10		-		-	10.17
7/6		10		10		10		10		10		-		-		10.00
Average	11.00	9.67	10.00	9.80	10.13	10.00	10.40	10.27	10.00	10.30	10.00	10.50	10.40	10.60	-	10.16

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Appendix Table 1. Sockeye salmon actual catch indices by date and station, 1981

	Station																
Date	53	52	51	1	2	3	4	5	6	7	8	9	10	11	12	13	Total
6/10	-	-	-	0.43	-	0.44	-	1.38	-	0.48	-	0	-	0	-	-	2.73
6/11	-	-	-	-	0	-	0	-	0.45	-	0.88	-	0	-	-	-	1.33
6/12	-	-	-	0	-	0	-	0	-	0	-	1.04	-	0	-	-	1.04
6/13	-	-	-	-	0	-	0	-	0	-	1.07	-	0.46	-	-	-	1.53
6/14	-	-	-	0	-	0	-	0	-	0	-	0.97	-	0.49	-	-	1.46
6/15	-	-	-	-	-	-	0	-	0	-	0	-	0	-	-	-	0
6/16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
6/17	-	-	-	-	0	-	0	-	0	-	0	-	-	-	-	-	0
6/18	-	-	-	0	-	0	-	0	-	0	-	0	-	0	-	-	0
6/19	-	-	-	-	6.27	-	0	-	-	-	-	-	-	-	-	-	6.27
6/20	-	-	-	13.38	-	10.99	-	8.91	-	0	-	0	-	0	-	-	33.28
6/21	-	-	2.03	-	17.34	-	11.84	-	1.45	-	0.48	-	0	-	-	-	33.14
6/22	-	15.68	-	14.29	-	22.31	-	16.85	-	0.64	-	0	-	-	-	-	69.77
6/23	14.59	-	26.90	-	23.75	-	23.46	-	2.54	-	0	-	0	-	-	-	91.24
6/24	-	12.50	-	18.21	-	24.78	-	35.63	-	-	-	-	-	-	-	-	91.12
6/25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
6/26	-	9.47	-	31.73	-	7.33	-	4.22	-	5.56	-	-	-	-	-	-	58.31
6/27	6.43	-	12.86	-	16.88	-	21.43	-	18.82	-	4.90	-	-	-	-	-	81.32
6/28	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
6/29	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
6/30	-	8.65	-	15.85	-	11.25	-	11.18	-	7.80	-	-	-	-	-	-	54.73
7/1	-	-	-	-	-	-	8.30	-	12.24	-	12.94	-	-	-	-	-	33.48
7/2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
7/3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
7/4	-	17.14	-	18.82	-	15.92	-	8.48	-	6.92	-	-	-	-	-	-	67.28
7/5	2.14	-	5.59	-	1.67	-	0.64	-	11.45	-	2.00	-	-	-	-	-	23.49
7/6	-	8.85	-	3.89	-	6.35	-	1.73	-	3.46	-	-	-	-	-	-	24.28
Totals	23.16	72.29	47.38	116.60	65.91	99.37	65.67	88.38	46.95	24.86	22.27	2.01	0.46	0.49	0	0	675.80
Percent	3.4	10.7	7.0	17.2	9.8	14.7	9.7	13.1	6.9	3.7	3.3	0.3	0.1	0.1	0	0	100.00

Appendix Table 2. Sockeye and chum salmon catch and index data collected during the Port Moller offshore test fish project, 1981.

DATE	SET NO	STA NO	FATH NET	MIN	SOCKEYE CATCH	SOCKEYE INDEX	MEAN WEIGHT	MEAN LENGTH	CHUM CATCH	CHUM INDEX	TIDE STAGE
6 10	1	1	200	69.0	1	0.43	2.26	540.0	0	0.00	3
6 10	2	3	200	68.5	1	0.44	3.35	588.0	1	0.44	3
6 10	3	5	200	65.0	3	1.38	3.09	565.0	1	0.46	4
6 10	4	7	200	63.0	1	0.48	3.10	577.0	5	2.38	4
6 10	5	9	200	73.0	0	0.00	0.00	0.0	9	3.69	3
6 10	6	11	200	61.0	0	0.00	0.00	0.0	2	0.98	3
6 11	7	10	200	67.0	0	0.00	0.00	0.0	14	6.27	3
6 11	8	8	200	68.0	2	0.88	3.46	581.0	1	0.44	3
6 11	9	6	200	66.0	1	0.45	2.59	526.0	0	0.00	4
6 11	10	4	200	63.0	0	0.00	0.00	0.0	0	0.00	4
6 11	11	2	200	61.0	0	0.00	0.00	0.0	0	0.00	4
6 12	12	1	193	58.0	0	0.00	0.00	0.0	0	0.00	1
6 12	13	3	193	71.0	0	0.00	0.00	0.0	0	0.00	3
6 12	14	5	193	58.0	0	0.00	0.00	0.0	2	1.07	3
6 12	15	7	193	60.0	0	0.00	0.00	0.0	0	0.00	4
6 12	16	9	193	60.0	2	1.04	2.60	534.0	3	1.55	4
6 12	17	11	193	56.0	0	0.00	0.00	0.0	0	0.00	4
6 13	18	10	193	67.0	1	0.46	2.36	535.0	8	3.71	1
6 13	19	8	193	58.0	2	1.07	2.29	522.0	4	2.14	3
6 13	20	6	193	57.0	0	0.00	0.00	0.0	2	1.09	3
6 13	21	4	193	60.50	0	0.00	0.00	0.0	1	0.51	2
6 13	22	2	193	64.0	0	0.00	0.00	0.0	0	0.00	4
6 14	23	1	193	56.0	0	0.00	0.00	0.0	0	0.00	4
6 14	24	3	193	60.0	0	0.00	0.00	0.0	0	0.00	3
6 14	25	5	193	60.0	0	0.00	0.00	0.0	2	1.04	3
6 14	26	7	193	53.0	0	0.00	0.00	0.0	0	0.00	3
6 14	27	9	193	64.0	3	0.97	2.84	546.0	0	0.00	4
6 14	28	11	193	64.0	1	0.49	3.05	570.0	3	1.46	4
6 15	29	10	193	61.0	0	0.00	0.00	0.0	2	1.02	4
6 15	30	8	193	63.0	0	0.00	0.00	0.0	0	0.00	1
6 15	31	6	193	63.0	0	0.00	0.00	0.0	1	0.49	3
6 15	32	4	193	62.0	0	0.00	0.00	0.0	0	0.00	3
6 15	0	0	0	0.0	0	0.00	0.00	0.0	0	0.00	0
6 16	0	0	0	0.0	0	0.00	0.00	0.0	0	0.00	0
6 17	0	0	0	0.0	0	0.00	0.00	0.0	0	0.00	0
6 17	33	2	200	61.0	0	0.00	0.00	0.0	0	0.00	4
6 17	34	4	200	59.0	0	0.00	0.00	0.0	0	0.00	1
6 17	35	6	200	60.0	0	0.00	0.00	0.0	0	0.00	3
6 17	36	8	200	55.0	0	0.00	0.00	0.0	0	0.00	3
6 17	37	10	200	64.0	0	0.00	0.00	0.0	0	0.00	2
6 18	38	11	200	70.0	0	0.00	0.00	0.0	0	0.00	4
6 18	39	9	200	58.0	0	0.00	0.00	0.0	0	0.00	4
6 18	40	7	200	57.0	0	0.00	0.00	0.0	0	0.00	1

-Continued-

Appendix Table 2. Sockeye and chum salmon catch and index data collected during the Port Moller offshore test fish project, 1981 (continued).

DATE	SET NO	STA NO	FATH NET	MIN	SOCKEYE CATCH	SOCKEYE INDEX	MEAN WEIGHT	MEAN LENGTH	CHUM CATCH	CHUM INDEX	TIDE STAGE
6 18	41	5	200	60.0	0	0.00	0.00	0.0	0	0.00	3
6 18	42	3	200	58.0	0	0.00	0.00	0.0	1	0.52	3
6 18	43	1	200	56.0	0	0.00	0.00	0.0	0	0.00	2
6 18	0	0	0	0.0	0	2.09	0.00	0.0	0	0.00	0
6 19	0	0	0	0.0	0	4.18	0.00	0.0	0	0.00	0
6 19	44	2	200	67.0	14	6.27	3.18	579.0	12	5.37	4
6 19	45	4	200	63.0	0	0.00	0.00	0.0	9	4.29	4
6 20	0	0	0	0.0	0	2.00	0.00	0.0	0	1.00	0
6 20	46	1	200	74.0	33	13.38	3.07	564.0	13	5.27	4
6 20	47	3	200	71.0	26	10.99	2.98	568.0	31	13.10	3
6 20	48	5	200	64.0	19	8.91	2.79	551.0	5	2.34	3
6 20	49	7	200	60.0	0	0.00	0.00	0.0	0	0.00	3
6 20	50	9	200	62.0	0	0.00	0.00	0.0	0	0.00	4
6 20	51	11	200	55.0	0	0.00	0.00	0.0	0	0.00	4
6 21	52	10	200	66.0	0	0.00	0.00	0.0	0	0.00	3
6 21	53	8	200	62.0	1	0.48	3.25	607.0	0	0.00	4
6 21	54	6	200	62.0	3	1.45	3.40	598.0	10	4.84	4
6 21	55	4	200	76.0	30	11.84	3.01	565.0	9	3.55	3
6 21	56	2	200	64.0	37	17.34	3.19	565.0	11	5.16	3
6 21	57	51	200	59.0	4	2.03	3.12	561.0	2	1.02	2
6 22	58	52	200	88.0	46	15.68	3.13	574.0	12	4.09	2
6 22	59	1	200	63.0	30	14.29	3.29	577.0	16	7.62	4
6 22	60	3	200	78.0	58	22.31	3.04	570.0	18	6.92	1
6 22	61	5	200	73.0	41	16.85	2.66	549.0	8	3.29	3
6 22	62	7	200	47.0	1	0.64	2.94	548.0	0	0.00	2
6 22	63	9	200	58.0	0	0.00	0.00	0.0	1	0.52	4
6 23	64	10	200	56.0	0	0.00	0.00	0.0	0	0.00	3
6 23	65	8	200	54.0	0	0.00	0.00	0.0	0	0.00	3
6 23	66	6	200	59.0	5	2.54	2.82	543.0	1	0.51	4
6 23	67	4	200	78.0	61	23.46	2.84	556.0	30	11.54	4
6 23	68	2	200	48.0	38	23.75	3.08	574.0	6	3.75	3
6 23	69	51	200	58.0	52	26.90	3.13	577.0	4	2.07	3
6 24	70	53	200	37.0	18	14.59	2.80	555.0	0	0.00	3
6 24	71	52	200	48.0	20	12.50	3.06	575.0	0	0.00	3
6 24	72	1	200	56.0	34	18.21	2.92	564.0	6	3.21	4
6 24	73	3	200	69.0	57	24.78	3.06	570.0	12	5.22	4
6 24	74	5	200	64.0	76	35.63	2.94	564.0	17	7.97	1
6 25	0	0	0	0.0	0	84.00	0.00	0.0	0	12.00	0
6 26	75	52	200	57.0	18	9.47	3.11	583.0	0	0.00	3
6 26	76	1	200	52.0	55	31.73	3.06	578.0	0	0.00	3
6 26	77	3	200	45.0	11	7.33	3.24	574.0	4	2.67	4
6 26	78	5	200	64.0	9	4.22	3.26	589.0	7	3.28	4
6 26	79	7	200	54.0	10	5.56	2.87	560.0	1	0.56	4
6 27	80	8	200	49.0	8	4.90	2.88	555.0	1	0.61	3
6 27	81	6	200	51.0	32	18.82	3.01	580.0	4	2.35	3
6 27	82	4	200	56.0	40	21.43	3.04	566.0	9	4.82	3
6 27	83	2	200	48.0	27	16.88	2.97	570.0	9	5.63	4
6 27	84	51	200	49.0	21	12.86	2.99	576.0	3	1.84	4
6 27	85	53	200	42.0	9	6.43	2.46	537.0	0	0.00	4
6 28	0	0	0	0.0	0	70.00	0.00	0.0	0	11.00	0
6 29	0	0	0	0.0	0	60.00	0.00	0.0	0	9.00	0

-Continued-

Appendix Table 2. Sockeye and chum salmon catch and index data collected during the Port Moller offshore test fish project, 1981 (continued).

DATE	SET NO	STA NO	FATH NET	MIN	SOCKEYE CATCH	SOCKEYE INDEX	MEAN WEIGHT	MEAN LENGTH	CHUM CATCH	CHUM INDEX	TIDE STAGE
6 30	86	52	200	52.0	15	8.65	3.05	571.0	4	2.31	1
6 30	87	1	200	53.0	28	15.85	3.04	566.0	0	0.00	2
6 30	88	3	200	48.0	18	11.25	3.19	571.0	5	3.13	3
6 30	89	5	200	51.0	19	11.18	2.85	558.0	4	2.35	4
6 30	90	7	200	50.0	13	7.80	2.83	552.0	4	2.40	4
7 1	91	8	200	51.0	22	12.94	2.94	560.0	4	2.35	4
7 1	92	6	200	49.0	20	12.24	2.94	562.0	2	1.22	1
7 1	93	4	200	47.0	13	8.30	2.97	566.0	5	3.19	3
7 1	0	0	0	0.0	0	10.00	0.00	0.0	0	0.00	0
7 1	0	0	0	0.0	0	12.00	0.00	0.0	0	0.00	0
7 2	0	0	0	0.0	0	60.00	0.00	0.0	0	0.00	0
7 3	0	0	0	0.0	0	60.00	0.00	0.0	0	0.00	0
7 4	94	52	200	49.0	28	17.14	3.00	576.0	1	0.61	4
7 4	95	1	200	51.0	32	18.82	3.24	581.0	2	1.18	4
7 4	96	3	200	49.0	26	15.92	3.25	566.0	2	1.22	1
7 4	97	5	200	46.0	13	8.48	2.69	549.0	0	0.00	3
7 4	98	7	200	52.0	12	6.92	2.89	558.0	1	0.58	3
7 5	99	8	200	45.0	3	2.00	3.38	577.0	0	0.00	3
7 5	100	6	200	55.0	21	11.45	2.95	567.0	4	2.18	4
7 5	101	4	200	47.0	1	0.64	2.28	499.0	3	1.91	4
7 5	102	2	200	54.0	3	1.67	2.86	559.0	0	0.00	1
7 5	103	51	200	59.0	11	5.59	2.83	561.0	3	1.53	3
7 5	104	53	200	56.0	4	2.14	2.95	563.0	2	1.07	3
7 6	105	52	200	61.0	18	8.85	3.23	582.0	4	1.97	3
7 6	106	1	200	54.0	7	3.89	2.94	567.0	2	1.11	4
7 6	107	3	200	52.0	11	6.35	2.83	564.0	3	1.73	4
7 6	108	5	200	52.0	3	1.73	2.21	514.0	1	0.58	1
7 6	109	7	200	52.0	6	3.46	3.69	586.0	3	0.00	3

Appendix Table 3. Surface water temperatures (°C) encountered during the 1980 Port Moller Offshore Test Fishing Project by station.

	Station													
Date	1	2	3	4	5	6	7	8	9	10	11	12	13	Average
6/7	7		6		6		9		7		6		-	6.83
6/8		7		6		6		-		-		-		6.33
6/9	-		-		-		-		-		-		-	-
6/10		5		5		5		-		-		-		5.00
6/11	-		-		-		-		-		-		-	-
6/12		5.5		5.5		5.5		5.5		5		-		5.40
6/13	-		-		5.5		5		4.5		4.5		-	4.88
6/14		7.5		6		5.5		5.5		5		-		5.90
6/15	6.5		6		5.5		5		4.5		4.5		-	5.33
6/16		6.5		5.5		6		6		6		-		6.00
6/17	7		6		5.5		5.5		5.5		5		-	5.75
6/18		5.5		6		6		6		6		5.5		5.83
6/19	-		-		-		6		6		5.5		-	5.83
6/20		-		-		-		-		-		-		-
6/21	6		6		6		6		6		-		-	6.00
6/22		-		-		-		-		-		-		-
6/23	-		-		-		-		-		-		-	-
6/24		-		6		5.5		5		5		-		5.38
6/25	6		6		5.5		6		5		4.5		-	5.50
6/26		6		6		5.5		5		5		-		5.50
6/27	6		6		5.5		5.5		5		4.5		-	5.50
6/28		6.5		6.5		6		5.5		5.5		5.5		5.92
6/29	7		7		7		6		6		5.5		-	6.42
6/30		7		7		7		6.5		6.5		-		6.80
7/1	7		7		6.5		6.5		6.5		6		-	6.58
7/2		-		-		-		-		-		-		-
7/3	7		6.5		6.5		6.5		6		6		-	6.42
Average	6.61	6.28	6.28	5.95	5.95	5.80	6.09	5.63	5.64	5.50	5.20	5.50		5.86

1981 NUSHAGAK BAY OFFSHORE TEST FISHING

By

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INTRODUCTION

The Nushagak Bay offshore test fish project began in 1980 with test fishing for pink salmon *(Oncorhynchus gorbuscha)* along the outer Nushagak district boundary. In 1981 offshore test fishing was conducted for sockeye and chum salmon along the same outer Nushagak district transect. This involved fishing a drift gillnet to obtain catch per unit effort (CPUE) indices of the number of sockeye and chum salmon moving across the transect (Figure 1).

Long range objectives of this offshore test fishery are to make in-season estimates of the daily run size, total run size, and entry pattern of sockeye, chum, and pink (even years) salmon stocks returning to Nushagak Bay. This report summarizes the transect test fish data collected during 1981 and evaluates the accuracy with which the test fish indices modeled the return of sockeye salmon.

METHODS AND MATERIALS

Fishing for sockeye and chum salmon was conducted from 19 June to 14 July along a transect between Nichols Hills and Etolin Point Bluffs, approximately 1 mile seaward from the sockeye salmon fishing district outside boundary. Six test fish stations were established along this transect (Figure 1). The transect was fished from West to East one tide a day with the first set made one-half hour after actual low tide. Fishing was conducted from the F/V ILIASKA. The gillnets used had 137 mm (5-3/8 inch) stretched mesh multifilament nylon and were 28 meshes deep.

The following information was recorded for each drift and are included in Appendix Table 1; drift number, date, location, tide stage, fathoms of net, fishing times, catch by species, wind velocity, wind direction, sea state, surface water temperature, salinity, ambient light, and boat count. The methods and materials for the 1981 sockeye and chum test fishery were identical to that used in the 1980 pink salmon test fishery (Van Alen 1981).

Length and sex were determined and a scale sample taken from all sockeye salmon captured. The number and total weight of sockeye and chum salmon delivered each day are presented in Appendix Table 2.

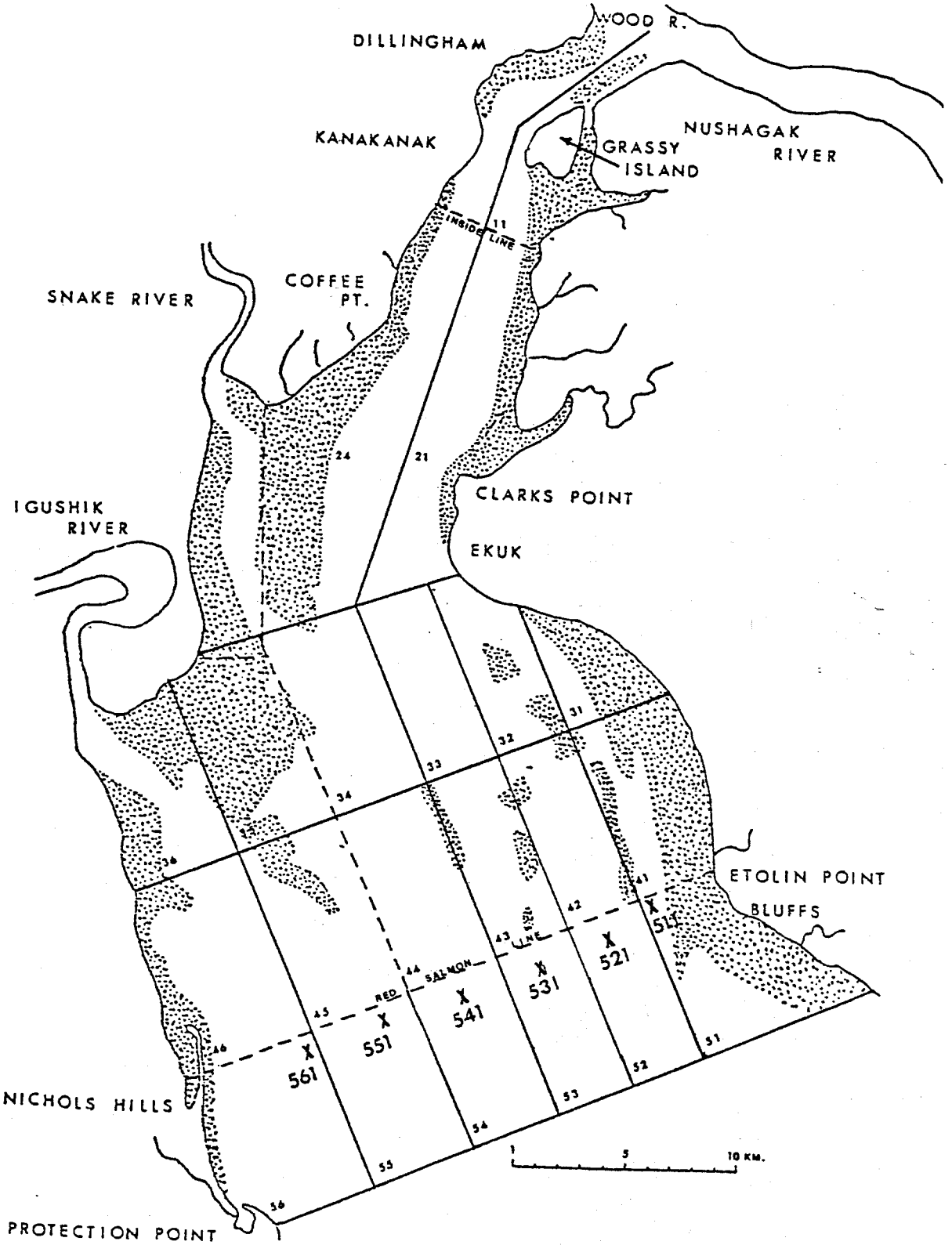

Figure 1. Nushagak Bay test fish stations, 1981.

Table 1. Sockeye salmon test fish indices by date and station, Nushagak Bay offshore test fish project, 1981.

	Station						
Date	561	551	541	531	521	511	Total
6/20	0.0	0.0	0.0	0.0	0.0	22.5	22.5
6/21	0.0*	0.9*	9.2*	0.9*	0.0*	23.6*	34.6
6/22	0.0	1.8	18.4	1.9	0.0	24.8	46.9
6/23	1.5	0.0	1.8	1.9	12.5	1.9	19.6
6/24	5.8	3.3	0.0	1.9	3.6	69.6	84.2
6/25	21.7*	6.3*	9.7*	2.8*	21.0*	60.3*	121.8
6/26	37.6	9.3	19.4	3.7	38.4	51.0	159.4
6/27	22.5*	26.7*	11.3*	1.8*	19.2*	25.5*	107.0
6/28	7.5	44.2	3.2	0.0	0.0	0.0	54.9
6/29	3.7*	30.6*	9.4*	0.0*	8.5*	21.9*	74.1
6/30	0.0	17.1	15.7	0.0	17.0	43.8	93.6
7/1	8.8	33.7	0.0	0.0	22.4	53.0	117.9
7/2	0.0	12.2	0.0	8.3	27.6	174.5	222.6
7/3	6.4	31.0	7.6	3.2	66.8	241.4	356.4
7/4	23.5	69.4	12.9	6.4	17.0	134.0	263.2
7/5	3.4	42.9	5.1	4.8	44.5	132.2	232.9
7/6	7.4	3.4	19.5	9.5	31.3	34.8	105.9
7/7	5.9	12.2	14.4	7.0	28.2	154.1	221.8
7/8	23.9	49.7	28.0	10.0	17.1	83.7	212.4
7/9	14.1	45.1	11.2	12.1	50.0	34.5	167.0
7/10	13.6	7.0	14.0*	8.7	6.9	64.7	114.9
7/11	17.0	37.5	16.7	11.0	10.2	46.4	138.8
7/12	31.7	50.3	0.0	0.0	26.5	173.6	284.8
7/13	3.8	8.0	5.9	3.8	16.5	25.1	63.1
7/14	6.1	2.2	1.9	0.0	6.0	3.9	20.1
Totals	265.9	544.8	235.3	99.7	491.2	1,703.5	3,340.4
Percents	8.0	16.3	7.0	3.0	14.7	51.0	100.0

* Estimated by taking average of adjacent days.

Table 2. Daily sockeye salmon test fish index, commercial catch, Igushik, Wood, and Nuyakuk River tower counts, 1981.

Date	Index	Catch	Igushik R.	Wood R.	Nuyakuk R.
6/20	22.5	0	0	1110	0
6/21	34.6	0	1416	1062	0
6/22	46.9	89285	1716	4530	0
6/23	19.6	59524	1578	7002	0
6/24	84.2	67437	1908	1752	0
6/25	121.8	195430	3642	222	0
6/26	159.4	161711	2550	180	0
6/27	107.0	14018	702	690	702
6/28	54.9	354572	1302	1716	900
6/29	74.1	36254	600	10032	1752
6/30	93.6	477344	1050	15210	2214
7/01	117.9	22611	2562	59316	2406
7/02	222.6	974672	8304	24720	1068
7/03	356.4	0	3270	20022	2346
7/04	263.2	456307	5406	137712	5982
7/05	232.9	667946	7680	308028	36018
7/06	105.9	725851	15762	214920	31146
7/07	221.8	653674	21720	70818	36732
7/08	212.4	592099	27768	69246	79860
7/09	167.0	531340	39990	55080	118062
7/10	114.9	289933	45678	67056	126396
7/11	138.8	161074	41226	43752	96288
7/12	284.8	241637	36918	23550	91848
7/13	63.1	318511	58116	19710	56316
7/14	20.1	138064	55422	14058	43002
7/15		6711	47340	15630	32586
7/16		70152	42912	14394	25146
7/17		83501	33120	8664	13500
7/18		54563	23238	5334	7818
7/19			19140	8382	6168
7/20			12546	7974	5244
7/21			11088	1158	5928
7/22			8190	0	3600
7/23			3876	0	1176
7/24			3408	0	0

Standard CPUE indices of sockeye and chum salmon were calculated for each drift. Indices from stations missed because of weather or mechanical breakdown were linearly interpolated from indices from the missed station on the day prior to and following the missing data.

RESULTS

During the sockeye and chum salmon sampling a total of 128 drifts were made at the six test fish stations. Total catches of sockeye and chum salmon were 1,555 and 304 salmon, respectively. A daily test fish index for sockeye salmon was calculated by summing together the daily indices from each station (Table 1). Peak test fish indices for sockeye occurred between 2 and 5 July. Stations on the east side of the transect (511,521) frequently had higher sockeye indices than stations on the west side (551). The lowest indices were obtained at station 531 near the middle of the transect.

The regression of accumulative sockeye salmon test fish indices on the accumulative Nushagak district commercial catch plus Wood, Igushik, and Nuyakuk River tower counts had the highest correlation coefficient (R = .99719) when the catch was lagged 0 days, Wood River lagged 2 days, Igushik River lagged 6 days, and Nuyakuk River lagged 14 days. Daily sockeye salmon test fish indices and Wood, Igushik, and Nuyakuk River tower counts are presented in Table 2.

The abundance of sockeye per index point was computed by dividing the accumulative sockeye salmon test fish index on the last day of test fishing into the sum of catch plus Wood plus Igushik plus Nuyakuk River tower counts, at 0, 2, 6, and 14 days respectively. Thus,

$$\frac{9,805,778}{3,340.4} = 2,935.5 \text{ sockeye abundance/index points.}$$

Post-season estimates of the daily abundance of sockeye salmon crossing the transect are then made by multipyling this abundance/index point constant by the accumulative test fish index on each day (Table 3).

The regression of the accumulative abundance of sockeye salmon estimated post-season by the test fish project on the accumulative commercial catch plus accumulative tower counts had a correlation coefficient of 0.99717. The estimated number of sockeye salmon moving across the test fish transect each day closely followed the actual run as estimated by catch plus tower counts (Figure 2).

Table 3. Daily sockeye salmon run into Nushagak Bay as estimated post-season by the Nushagak Bay offshore test fishery, 1981.

Date	Accum. Index	Estimated Abundance	Actual Abundance	Accuracy
6/20	22.5	66,049	13,062	5.06
6/21	57.1	167,618	56,784	2.95
6/22	104.0	305,293	180,269	1.69
6/23	123.6	362,829	277,347	1.31
6/24	207.8	609,999	425,874	1.43
6/25	329.6	967,544	742,618	1.30
6/26	489.0	1,435,464	1,040,745	1.38
6/27	596.0	1,749,564	1,164,353	1.50
6/28	650.9	1,910,723	1,631,389	1.17
6/29	725.0	2,128,245	1,790,955	1.19
6/30	818.6	2,403,009	2,351,783	1.02
7/1	936.5	2,749,105	2,448,722	1.12
7/2	1,159.1	3,402,550	3,614,020	0.94
7/3	1,515.5	4,448,766	3,975,538	1.12
7/4	1,778.7	5,221,392	4,700,261	1.11
7/5	2,011.6	5,905,072	5,486,419	1.08
7/6	2,117.5	6,215,943	6,323,678	0.98
7/7	2,339.3	6,867,039	7,096,476	0.97
7/8	2,551.7	7,490,541	7,814,653	0.96
7/9	2,718.7	7,980,771	8,438,261	0.95
7/10	2,833.6	8,318,061	8,794,656	0.95
7/11	2,972.4	8,725,510	9,008,560	0.97
7/12	3,257.2	9,561,543	9,287,493	1.03
7/13	3,320.3	9,746,774	9,640,774	1.01
7/14	3,340.4	9,805,778	9,805,778	1.00

1. Estimated abundance = (accum. test fish index on day n) X (2,935.5 abundance/index point).

2. Actual abundance = (accum. Nushagak district catch on day n + 0) + (accum. Wood R. tower count on day n + 2) + (accum. Igushik R. tower count on day n + 6) + (accum. Nuyakuk R. tower count on day n + 14).

3. Accuracy = estimated abundance / actual abundance.

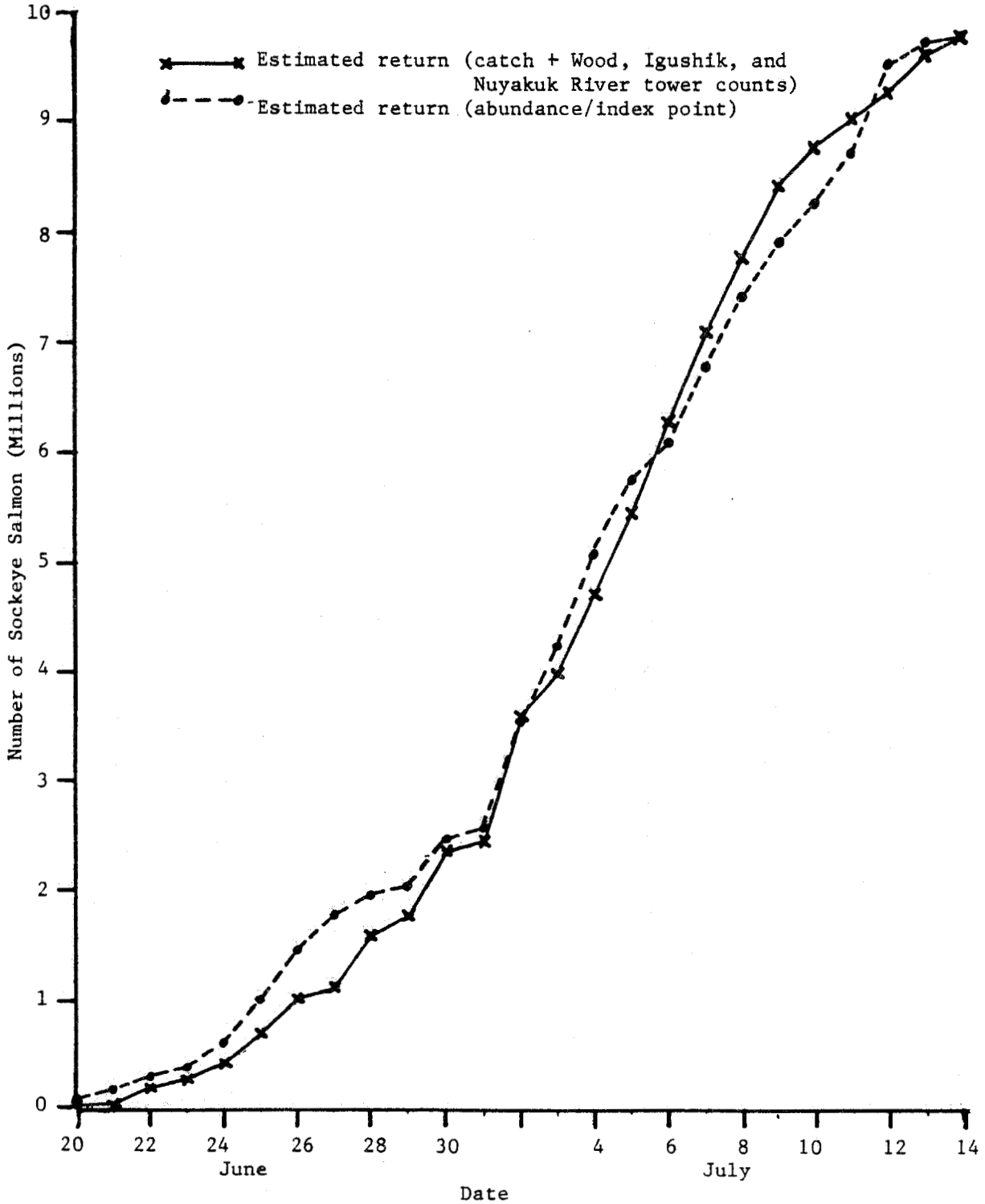

Figure 2. Comparison of the estimated actual (catch + tower counts) daily return with the test fish estimates of daily return for Nushagak Bay sockeye salmon, 1981.

LITERATURE CITED

Van Alen, B.W. 1981. 1980 Nushagak Bay test fishing. In: 1980 Bristol Bay salmon test fishing project. (Ed. Henry J. Yuen). Alaska Department of Fish and Game Technical Data Report No. 65. p. 15-41.

Appendix Table 1. Catch, index, and climatological data collected during the Nushagak Bay sockeye and chum salmon offshore test fish project, 1981.

Date	Set No.	Sta No.	Tide[1]	Fath Net	Time Set	Fishing Time	Sockeye Catch	Sockeye Index	Chum Catch	Chum Index	Wind Vel. (Knots)	Wind Dir.[2] (Coded)	Sea State[3] (Coded)	Water Temp. (Cent.)	Salinity (PPT)	Light[4] (Coded)	Boat[5] Count
6/19	1	561	1	100	2231	0.601	0	0.	1	1.7	15	5	4	14	22.0	11	57
6/19	2	551	1	50	2330	0.365	0	0.	0	0.	15	5	5	14	17.9	4	28
6/20	3	541	1	50	29	0.568	4	14.1	0	0.	20	5	5	14	18.0	1	6
6/20	4	561	5	50	1215	0.554	0	0.	0	0.	15	6	4	13	25.8	17	48
6/20	5	551	5	50	1306	0.510	0	0.	0	0.	15	6	4	15	19.6	17	20
6/20	6	541	5	50	1354	0.566	0	0.	5	17.7	15	6	4	13	20.9	18	
6/20	7	531	5	50	1507	0.468	0	0.	0	0.	20	6	5	13	24.6	18	
6/20	8	521	5	50	1556	0.545	0	0.	1	3.7	20	6	5	13	27.2	18	
6/20	9	511	5	50	1652	0.530	6	22.5	1	3.8	20	6	5	13	25.1	18	
6/22	10	561	5	100	1330	0.556	0	0.	0	0.	15	6	3	13	21.2	18	
6/22	11	551	5	100	1429	0.568	1	1.8	1	1.8	15	6	3	14	21.4	18	
6/22	12	541	5	100	1531	0.610	11	18.4	1	1.6	15	6	4	14	23.1	17	136
6/22	13	531	5	100	1634	0.512	1	1.9	7	13.7	15	6	4	13	25.9	18	95
6/22	14	521	5	100	1733	0.571	0	0.	8	14.0	15	6	5	13	25.8	15	70
6/22	15	511	5	100	1823	0.484	12	24.8	0	0.	15	6	5	13	24.8	18	41
6/23	16	561	5	100	1431	0.672	1	1.5	1	1.5	10	7	2	13	20.9	14	0
6/23	17	551	5	100	1552	0.563	0	0.	0	0.	5	7	2	15	25.6	18	96
6/23	18	541	5	100	1652	0.548	1	1.8	7	12.8	10	5	4	15	24.4	18	145
6/23	19	531	5	100	1753	0.523	1	1.9	2	3.8	10	5	4	12	23.5	15	105
6/23	20	521	5	100	1843	0.559	7	12.5	2	3.6	10	5	4	13	27.7	15	76
6/23	21	511	5	100	1934	0.526	1	1.9	1	1.9	10	5	4	14	26.9	15	51
6/24	22	561	5	100	1500	0.517	3	5.8	3	5.8	15	1	4	14	23.3	17	11
6/24	23	551	5	100	1557	0.606	2	3.3	0	0.	15	1	4	14	22.0	17	92
6/24	24	541	5	100	1659	0.494	0	0.	1	2.0	10	1	3	15	25.8	17	168
6/24	25	531	5	100	1801	0.528	1	1.9	1	1.9	10	3	3	13	27.1	17	180
6/24	26	521	5	100	1857	0.551	2	3.6	0	0.	10	4	3	13	25.9	16	127
6/24	27	511	5	100	1948	0.546	38	69.6	1	1.8	5	4	2	13	26.5	17	98
6/26	28	561	5	100	1626	0.532	20	37.6	0	0.	10	5	2	14	21.4	15	23
6/26	29	551	5	100	1721	0.537	5	9.3	1	1.9	15	6	3	14	23.8	16	63
6/26	30	541	5	100	1813	0.567	11	19.4	3	5.3	15	7	3	13	20.4	16	78
6/26	31	531	5	100	1912	0.545	2	3.7	4	7.3	15	7	3	13	25.9	16	99
6/26	32	521	5	100	2007	0.521	20	38.4	3	5.8	15	7	3	13	23.8	16	74
6/26	33	511	5	100	2052	0.530	27	51.0	3	5.7	10	7	2	13	26.4	14	38
6/28	34	561	2	100	537	0.567	4	7.5	1	1.8	10	6	3	14	22.6	12	0
6/28	35	551	2	100	645	0.543	24	44.2	0	0.	10	6	3	14	21.4	14	40
6/28	36	541	2	100	751	0.628	2	3.2	0	0.	10	6	3	13	23.4	15	83
6/28	37	531	2	100	853	0.476	0	0.	0	0.	7	7	3	13	26.1	16	82
6/28	38	521	2	100	944	0.583	0	0.	0	0.	7	7	2	13	26.7	16	87
6/28	39	511	2	100	1038	0.512	0	0.	0	0.	7	7	2	13	24.6	17	68
6/30	40	561	2	100	741	0.536	0	0.	0	0.	20	7	4	12	23.8	17	13
6/30	41	551	2	100	833	0.527	9	17.1	0	0.	15	7	4	12	19.2	17	16
6/30	42	541	2	100	928	0.574	9	15.7	4	7.0	15	7	4	13	20.4	17	8
6/30	43	531	2	100	1032	0.506	0	0.	0	0.	5	7	3	13	22.4	17	4
6/30	44	521	2	100	1122	0.646	11	17.0	2	3.1	5	7	2	13	26.7	18	14
6/30	45	511	2	150	1224	0.594	39	43.8	2	2.2	5	7	1	15	25.5	18	27
7/ 1	46	561	2	100	843	0.453	4	8.8	0	0.	10	0	3	12	23.0	17	54
7/ 1	47	551	2	100	930	0.534	18	33.7	0	0.	10	0	3	13	20.8	17	58
7/ 1	48	541	2	100	1028	0.521	0	0.	0	0.	10	7	3	13	24.6	17	42
7/ 1	49	531	2	100	1126	0.556	0	0.	0	0.	10	6	3	14	25.9	18	
7/ 1	50	521	2	100	1221	0.491	11	22.4	1	2.0	5	6	2	13	26.3	16	
7/ 1	51	511	2	100	1306	0.566	30	53.0	1	1.8	10	6	3	13	24.6	16	
7/ 2	52	561	2	50	943	0.490	0	0.	0	0.	25	7	6	12	22.7	18	5
7/ 2	53	551	2	50	1028	0.490	3	12.2	0	0.	25	7	6	12	20.9	18	5
7/ 2	54	541	2	50	1122	0.482	0	0.	0	0.	25	7	6	13	23.8	18	
7/ 2	55	531	2	50	1211	0.483	2	8.3	0	0.	25	7	6	13	22.2	18	0
7/ 2	56	521	2	50	1248	0.508	7	27.6	1	3.9	25	7	6	13	24.6	18	4
7/ 2	57	511	2	50	1329	0.504	44	174.5	2	7.9	20	7	5	13	24.8	18	3
7/ 3	58	561	2	100	1046	0.471	3	6.4	2	4.2	15	7	4	12	22.7	18	
7/ 3	59	551	2	100	1140	0.485	15	31.0	0	0.	15	7	4	13	22.0	18	
7/ 3	60	541	2	100	1229	0.523	4	7.6	1	1.9	15	7	4	13	23.7	18	
7/ 3	61	531	2	100	1331	0.516	1	3.2	1	3.2	10	7	3	14	25.0	18	
7/ 3	62	521	2	100	1419	0.599	40	66.8	5	8.3	15	7	4	13	25.9	18	
7/ 3	63	511	2	100	1517	0.563	136	241.4	2	3.5	15	7	4	14	26.3	18	
7/ 4	64	561	2	50	1153	0.594	7	23.5	2	6.7	15	7	4	13	23.1	18	

-Continued-

Appendix Table 1. Catch, index, and climatological data collected during the Nushagak Bay sockeye and chum salmon offshore test fish project, 1981 (continued).

Date	Set No.	Stn No.	Tide[1]	Path	Net	Time Set	Fishing Time	Sockeye Catch	Sockeye Index	Chum Catch	Chum Index	Wind Vel. (Knots)	Wind Dir.[2] (Coded)	Sea State[3] (Coded)	Water Temp. (Cent.)	Salinity (PPT)	Light[4] (Coded)	Boat Count[5]
7/ 4	65	551	2	100		1305	0.476	33	69.4	4	8.0	15	7	4	14	22.0	18	
7/ 4	66	541	2	100		1358	0.544	7	12.9	2	3.7	15	7	4	15	25.4	18	
7/ 4	67	531	2	100		1458	0.622	4	6.4	5	8.0	15	7	4	14	28.8	18	
7/ 4	68	521	2	100		1556	0.523	9	17.0	3	5.7	15	7	4	14	27.4	18	0
7/ 4	69	511	2	100		1645	0.470	63	134.0	6	12.8	15	7	4	13	24.3	18	0
7/ 5	70	561	2	100		1241	0.596	2	3.4	1	1.7	15	4	4	13	25.1	18	0
7/ 5	71	551	2	100		1338	0.606	26	42.9	1	1.6	15	4	4	15	27.1	18	0
7/ 5	72	541	2	100		1435	0.583	3	5.1	10	17.1	15	5	4	14	24.8	18	0
7/ 5	73	531	2	100		1537	0.619	3	4.8	4	6.5	15	5	4	13	24.3	18	0
7/ 5	74	521	2	100		1635	0.585	26	44.5	7	12.0	15	5	4	13	25.1	18	11
7/ 5	75	511	2	100		1732	0.492	65	132.2	8	16.3	15	5	5	14	27.1	18	7
7/ 6	76	561	2	100		1334	0.540	4	7.4	1	1.8	5	7	2	13	28.0	15	0
7/ 6	77	551	2	100		1424	0.581	2	3.4	0	0.	5	7	2	14	26.7	17	2
7/ 6	78	541	2	100		1600	0.462	9	19.5	11	23.8	5	7	2	14	25.4	16	1
7/ 6	79	531	2	100		1657	0.528	5	9.5	11	20.8	5	7	2	13	28.5	16	57
7/ 6	80	521	2	100		1749	0.511	16	31.3	6	11.7	5	7	2	14	28.2	16	58
7/ 6	81	511	2	100		1836	0.603	21	34.8	1	1.7	5	7	2	14	27.2	17	81
7/ 7	82	561	2	100		1425	0.504	3	5.9	3	5.9	25	6	5	13	27.2	17	1
7/ 7	83	551	2	100		1512	0.493	6	12.2	4	8.1	25	6	6	13	23.5	18	1
7/ 7	84	541	2	100		1601	0.485	7	14.4	7	14.4	25	6	6	14	27.2	17	6
7/ 7	85	531	2	100		1706	0.717	5	7.0	3	4.2	25	6	6	13	25.9	17	12
7/ 7	86	521	2	100		1813	0.461	13	28.2	9	19.5	25	6	6	13	24.6	17	31
7/ 7	87	511	2	100		1857	0.545	84	154.1	3	5.5	25	6	6	13	27.2	17	17
7/ 8	88	561	2	100		1514	0.543	13	23.9	2	3.7	15	5	4	13	26.4	17	1
7/ 8	89	551	2	100		1604	0.523	26	49.7	4	7.6	15	5	4	13	21.3	16	1
7/ 8	90	541	2	100		1700	0.571	16	28.0	7	12.3	15	5	4	13	23.0	16	4
7/ 8	91	531	2	100		1809	0.601	6	10.0	7	11.6	15	5	4	13	23.3	16	1
7/ 8	92	521	2	100		1907	0.585	10	17.1	0	0.	10	5	3	13	24.0	16	27
7/ 8	93	511	2	100		2000	0.597	50	83.7	1	1.7	5	5	3	13	22.0	15	30
7/ 9	94	561	2	100		1558	0.778	11	14.1	1	1.3	5	4	3	13	24.3	15	0
7/ 9	95	551	2	100		1717	0.555	25	45.1	2	3.6	5	4	4	13	22.2	15	0
7/ 9	96	541	2	100		1826	0.537	6	11.2	2	3.7	10	4	4	13	24.6	15	3
7/ 9	97	531	2	100		1933	0.497	6	12.1	3	6.0	10	4	4	13	24.6	14	10
7/ 9	98	521	2	100		2026	0.500	25	50.0	1	2.0	5	4	4	13	25.4	14	13
7/ 9	99	511	2	100		2119	0.550	19	34.5	1	1.8	10	3	3	13	23.3	13	7
7/10	100	561	5	100		450	0.368	5	13.6	0	0.	5	4	2	13	25.9	8	0
7/10	101	551	5	100		546	0.430	3	7.0	2	4.6	5	4	2	13	20.6	11	0
7/10	102	531	5	100		717	0.574	5	8.7	6	10.4	5	4	2	13	25.6	13	1
7/10	103	521	5	100		816	0.577	4	6.9	8	13.9	10	4	4	13	27.2	14	3
7/10	104	511	5	100		912	0.556	36	64.7	2	3.6	10	4	4	13	24.3	15	5
7/11	105	561	5	100		506	0.645	11	17.0	4	6.2	20	6	4	13	24.0	10	0
7/11	106	551	5	100		610	0.560	21	37.5	6	10.7	20	6	5	13	17.4	13	0
7/11	107	541	5	100		705	0.598	10	16.7	8	13.4	20	6	5	12	19.4	14	3
7/11	108	531	5	100		810	0.543	6	11.0	5	9.2	20	6	5	12	23.3	15	4
7/11	109	521	5	100		903	0.587	6	10.2	2	3.4	15	6	5	13	25.1	77	6
7/11	110	511	5	100		949	0.560	26	46.4	1	1.8	15	6	5	13	24.0	16	18
7/12	111	561	5	100		605	0.693	22	31.7	2	2.9	5	3	2	13	24.8	13	0
7/12	112	551	5	100		712	0.540	27	50.3	1	1.8	10	3	4	13	22.0	14	0
7/12	113	541	5	100		808	0.529	0	0.	2	3.8	10	3	4	13	23.3	15	0
7/12	114	531	5	100		916	0.504	0	0.	1	2.0	10	4	4	12	24.8	15	0
7/12	115	521	5	100		1011	0.529	14	26.5	0	0.	10	4	4	13	23.8	16	5
7/12	116	511	5	100		1100	0.601	106	176.3	7	11.6	10	4	4	13	23.3	16	11
7/13	117	561	5	100		643	0.530	2	3.8	5	9.4	15	3	3	13	23.5	13	0
7/13	118	551	5	100		737	0.624	5	8.0	2	3.2	15	3	4	13	22.1	15	0
7/13	119	541	5	100		833	0.507	3	5.9	1	2.0	15	3	5	13	22.0	16	4
7/13	120	531	5	100		951	0.521	2	3.8	2	3.8	15	3	6	13	24.8	15	5
7/13	121	521	5	100		1047	0.546	9	16.5	1	1.8	15	3	6	13	26.7	17	5
7/13	122	511	5	100		1145	0.558	14	25.1	2	3.6	15	3	5	13	23.3	17	9
7/14	123	561	5	100		740	0.491	3	6.1	0	0.	20	3	5	13	23.3	14	0
7/14	124	551	5	100		842	0.494	1	2.2	0	0.	20	3	5	13	22.2	15	0
7/14	125	541	5	100		938	0.535	1	1.9	3	5.6	20	3	5	13	22.0	15	4
7/14	126	531	5	100		1106	0.460	0	0.	2	4.3	15	3	4	12	23.5	15	9
7/14	127	521	5	100		1200	0.496	3	6.0	1	2.0	15	3	4	13	25.4	16	4
7/14	128	511	5	100		1253	0.510	2	3.9	2	3.9	15	3	4	13	24.8	16	4

1 Tide Stage= 0-low low, 1-low flood, 2-high high, 3-high ebb, 4-high low, 5-high flood, 6-low high, 7-low ebb.

2 Wind Direction= 0-North, 1-Northeast, 2-East, 3-Southeast, 4-South, 5-Southwest, 6-West, 7-Northwest.

3 Sea State= 0-calm to 6-rough.

4 Lightness= 0-dark to 18-bright sunlight.

5 Missing values indicate commercial fishing closure.

Appendix Table 2. The number, total weight, and mean weight of sockeye and chum salmon caught and delivered during the Nushagak offshore test fishery, 1981.

	Sockeye			Chum		
Date	Number	Total Weight (kg)	Mean Weight (kg)	Number	Total Weight (kg)	Mean Weight (kg)
6/22	25	79.83	3.19	17	62.14	3.65
6/24	46	140.62	3.06	4	14.97	3.74
6/26	84	259.46	3.09	13	45.81	3.52
6/28	30	92.53	3.08	0		
6/30	68	208.20	3.06	6	16.78	2.80
7/1	63	189.15	3.00	2	5.67	2.83
7/2	56	174.64	3.12	3	11.57	3.86
7/3	199	607.69	3.05	11	37.60	3.41
7/4	127	391.46	2.98	22	59.87	2.72
7/5	125	391.46	3.13	31	102.51	3.30
7/6	57	176.00	3.09	32	97.52	3.05
7/7	128	363.79	2.84	28	95.71	3.41
7/8	121	378.76	3.13	17	58.97	3.47
7/9	91	276.70	3.04	8	24.95	3.12
7/10	52	156.95	3.02	13	54.88	4.22
7/11	80	229.07	2.86	23	71.21	3.10
7/12	169	536.15	3.17	11	38.10	3.46
7/13	35	113.40	3.24	13	51.71	3.98
Total	1,556	4,752.70	3.05	254	849.97	3.35

1. Weight was taken from the commercial harvest fish tickets.

1981 NUSHAGAK DISTRICT TEST FISHING

By

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INTRODUCTION

District test fishing is conducted both within the commercial fishing boundaries and in areas adjacent to these boundaries. This phase of the test fishing program was initiated in the Naknek-Kvichak district in 1962 and since then has been expanded to the Egegik, Ugashik, and Nushagak districts on an "as required" basis.

The primary objective of the district test fish program is to monitor the magnitude and pattern of entry of salmon prior to, and immediately after they have reached the individual fishing districts and prior to the time these fish are exposed to the fishing fleet. One of the most important pieces of information obtained pertains to the degree to which salmon are milling within the fishing boundaries. Salmon may mill in a fishing district for a number of days before migrating into the rivers. Due to the extremely large amount of fishing gear in Bristol Bay, milling fish must often receive additional protection prior to the time they resume their migration. On the other hand, district test fishing often makes known the presence of large concentrations of fish, thereby allowing the managing agency to anticipate a large return and adjust the fishing periods to allow maximum harvest.

METHODS AND MATERIALS

District test fishing is conducted only during the closed periods as the fishing fleet provides similar information during open fishing periods. During closed periods one or two fishing boats, with Alaska Department of Fish and Game observers aboard, are sent to fishing districts as required to make test drifts in different locations. Test drifts are generally made with 25 to 100 fm of 5-3/8 inch gill net for a period of 30 minutes or less. Soaking the gear for long periods of time in one place does not provide useful information. The best procedure has been to make as many relatively short drifts as possible throughout the district so as to provide a more complete picture of the salmon present in the fishing districts. The catch per drift is adjusted according to the amount of gear and the length of time fished so that fishing success of different drifts may be compared. Information on each drift is radioed immediately to the management offices at King Salmon and Dillingham.

RESULTS

In 1981 only one district test fishing trip was required in Bristol Bay because of the strong continuing sockeye salmon run to all fishing districts.

In Nushagak district, the district test boat was used on 3 July to help detemine continuing sockeye run strength in the inner district (Figure 1), after a record commercial catch of over 1.0 million fish was made in a 12-hour period on 2 July.

The high sockeye catch indices within the inner Nushagak district, only 17 hours after a record commercial catch the previous day, showed conclusively that the sockeye run was continuing unabated (Table 1 and Appendix Table 1). Along with catch trends and actual sockeye escapements to this district's various river systems, the district test fish program helped to define continuing run strength. The fishing period announced for 4 July was largely a result of the management staff's knowledge of sockeye run strength indications within the district on 3 July.

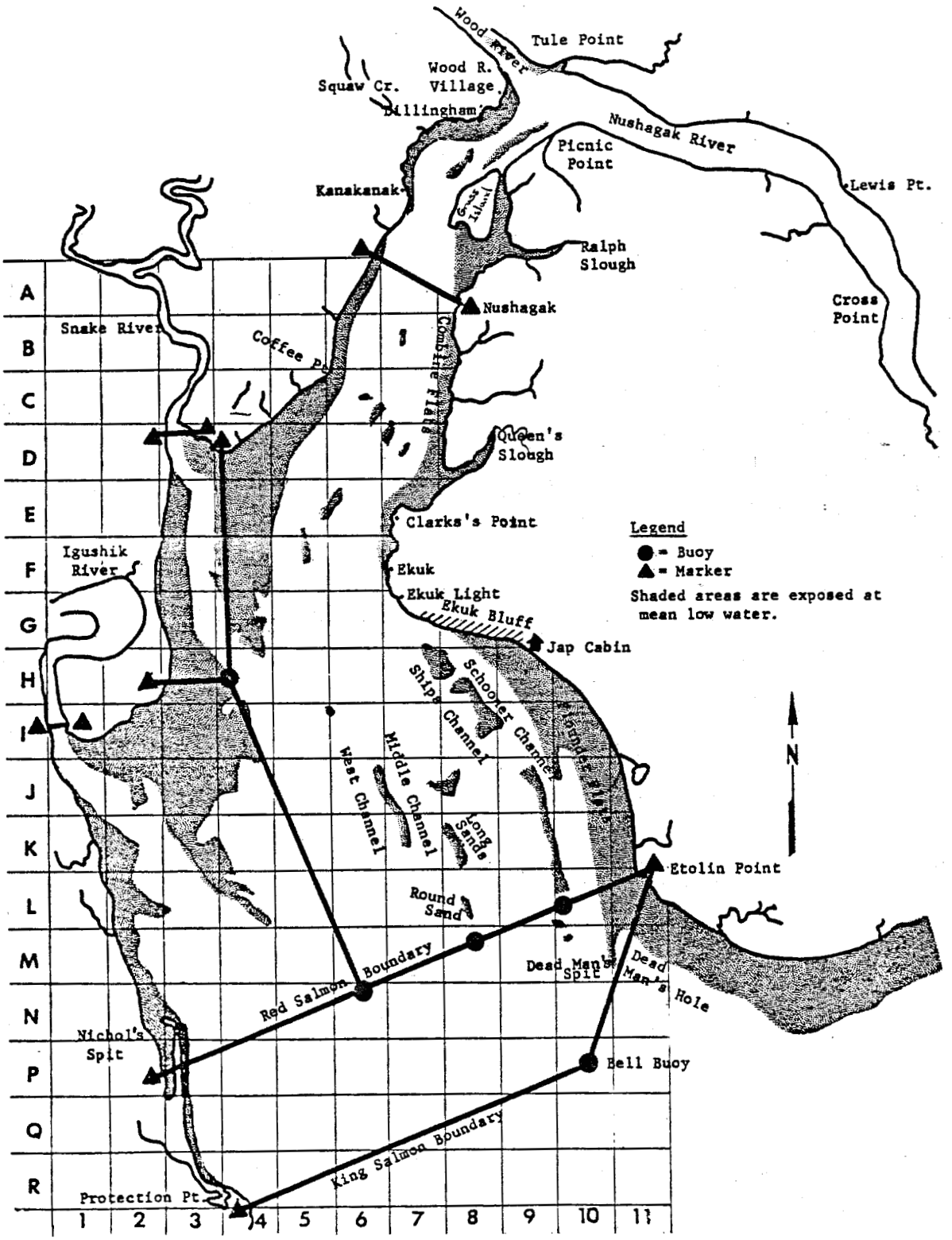

Figure 1. Nushagak district test fishing areas.

Table 1. Summary of district sockeye salmon test fishing indices in the Nushagak district by index area and date, Bristol Bay, 1981[1].

Index area	Date July 3
Nushagak River	
Wood River	
Kanakanak Beach	11,779
Grassy Island	15,264
Nushagak Point	16,374
Coffee Point	
Combine Flats	13,858
Clarks Point	6,299[2]
Ekuk Bluff	8,107
Schooner Channel, N.W.	
Schooner Channel, S.E.	
Ships Channel, N.W.	
Ships Channel, S.E.	
Middle Channel, N.W.	
Middle Channel, S.E.	
West Channel, N.W.	
West Channel, S.E.	
Dead Man's Spit	
Nichols Spit	

[1] All indices expressed in number of fish/100 fathom hours to the nearest full index point.

[2] Average of two consecutive drifts in the same index area.

Appendix Table 1. Nushagak district sockeye salmon test fishing catch, index, fishing time, gillnet length, area code, and date.

YR	MO	DA	SET NO.	AREA CODE	GEAR LENGTH	MEAN FISH. (FMS)	SOCKEYE CATCH TIME (MIN.)	SOCKEYE INDEX	CATCH KING	CATCH CHUM	TIDE STAGE
81	7	3	1	GR.IS.	25	2.50	159	15,264	2	0	3
81	7	3	2	KANA.	10	2.00	32	11,779	0	0	3
81	7	3	3	A8	15	1.50	70	16,374	0	0	3
81	7	3	4	C7	15	2.50	88	13,858	0	0	3
81	7	3	5	E7	25	3.75	29	1,856	0	0	3
81	7	3	6	E7	25	2.75	128	10,741	0	0	3
81	7	3	7	F6	25	4.50	152	8,107	0	0	3

1981 KVICHAK, EGEGIK, AND UGASHIK ESCAPEMENT TEST FISHING

By

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INTRODUCTION

The escapement test fishing program which began in 1960 was designed to provide an early indication of spawning escapement for management decision. Because the Bristol Bay sockeye salmon escapement cannot be accessed at a counting tower until 3 to 15 days after passing through the commercial fishery, and because 80% of the salmon run occurs within a two-week period, an early estimate of escapement is necessary for timely management decision.

To be successful a test fishery must: (1) Forecast the escapement accurately, and (2) provide this information as soon as possible after the fish pass through the commercial fishing district. The difficulty in estimating escapements with test fish projects is the extreme variability in tower counts per test fish index values between years. Some of the variance in tower counts per index values can be accounted for by considering the relative catchability of the fish as measured by their mean length. This relationship along with an entry pattern model which utilizes lag time (the time it takes for fish to pass from the test fishery to the counting tower) was used to forecast tower counts from test fish indices in 1981.

METHODS AND MATERIALS

Test Fishing

Test fishing was conducted in the river mouths, usually immediately upstream from the commercial fishing district boundaries (Figure 1). The Ugashik River test fish sites were relocated upriver from their former location to minimize the effects of fish milling in the lower river. Each tide was fished for 30 minutes or less with 25 to 50 fm of 137 mm (5-3/8 in) stretch mesh gillnet. The objective was to minimize the catch while still obtaining a good estimate of fish passage rates. Fishing began at the start of floodtide on the Kvichak River, 1-1/2 hours before high slack tide on the Egegik River, and at 1-1/2 hours prior to low slack at the Ugashik River.

After each tide, the standard test fish index (fish per 100 fm hour) was calculated for each set along with standard age, weight, and length sampling of the catch.

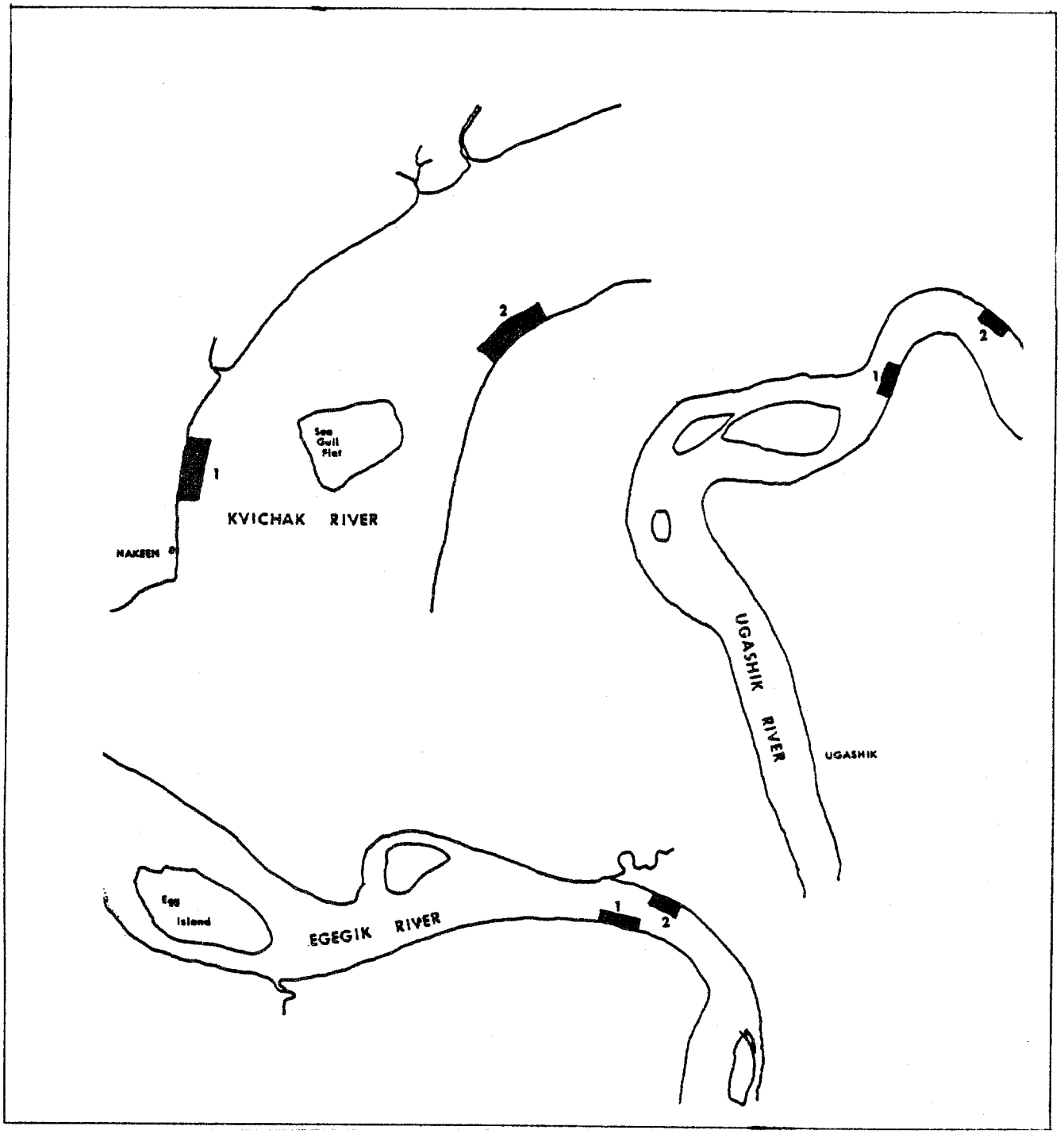


Figure 1. Locations of escapement test fishing sites, Kvichak, Egegik, and Ugashik Rivers, 1981.

Escapement Estimates

A daily fish index was generated by computing the mean daily index weighted by fathom-hours fished each set:

$$\text{Daily Test Fish Index} = \frac{\sum_{i=1}^{n} [\ (F)(T)(I)\ ]}{\sum_{i=1}^{n} [\ (F)(T)\ ]}$$

Where I = Standard test fish index
F = Fathoms of net
T = Total time fished with F fathoms of net
n = Number of set fished on day i

Daily escapement estimates were made from the test fisheries using: (1) a catchability model based on daily mean length, and (2) lag time to compare cumulative tower counts to cumulative daily test fish indices.

The relationship between fish length and catchability was determined from historic data (Appendix Table 1) with a power regression curve:

$$Y = ax^b$$

Where Y = Cumulative tower count/cumulative daily test fish index point
x = Mean length of fish (mm)
a,b = Constants

Escapement estimates were made by multiplying the cumulative daily test fish indices by the expected tower count per index point calculated from the mean length of fish caught. Lengths used for in-season forecasting were from the fish caught by the individual test fish projects.

Lag time was determined by matching cumulative test fish curves with cumulative escapement curves. After lag time was determined, the actual cumulative escapement was compared with the associated cumulative test fish indices to generate another count per index value.

RESULTS

Kvichak River

Test fishing began 14 June and continued to 11 July. At the end of the project 1,086 fish had been caught resulting in 9,225.11 index points. The mean sockeye length was 528.8 mm and the mean weight was 2.54 kg (Table 1). Based on the mean length of the fish caught, an estimate of 209 sockeye salmon passing per index point was made resulting in an estimated escapement of 1,928,048 fish at the time of project termination. The actual final tower count was 1,754,358. This resulted in an overestimation of 10% using the catchability model. Data by set and station is presented in Appendix Table 2.

Table 1. Test fish daily and accumulative index values, weight (kg), and length (mm) statistics summarized by day for the Kvichak River, 1981.

Date	Fishing time	Catch	Index	Accumulative Index	Mean weight	Mean length
6/14	23.00	5.00	26.10	26.10	2.94	542.00
6/15	63.00	2.00	3.79	29.89	2.61	532.00
6/16	71.00	1.00	1.68	31.57	2.44	535.00
6/17	95.00	0.	0.	31.57	0.	0.
6/18	107.00	4.00	4.50	36.06	2.36	512.00
6/19	102.50	6.00	7.01	43.07	2.33	520.00
6/20	105.00	6.00	6.85	49.92	2.51	530.43
6/21	98.00	20.00	24.50	74.42	2.84	540.59
6/22	111.50	10.00	10.77	85.19	2.71	538.29
6/23	53.00	2.00	4.54	89.73	2.85	532.00
6/24	118.00	1.00	1.01	90.74	2.36	533.00
6/25	103.00	11.00	12.82	103.56	2.24	502.55
6/26	103.50	5.00	5.81	109.37	2.37	521.24
6/27	87.00	85.00	117.23	226.60	2.86	529.58
6/28	56.50	62.00	129.79	356.39	2.82	527.96
6/29	38.00	115.00	367.99	724.39	2.36	518.29
6/30	30.25	60.00	240.98	965.37	2.68	510.39
7/01	87.90	5.00	4.38	969.74	2.90	521.87
7/02	44.00	66.00	179.98	1149.73	2.74	534.23
7/03	35.00	106.00	375.51	1525.24	2.55	532.06
7/04	23.00	73.00	403.00	1928.24	2.71	537.92
7/05	36.75	35.00	113.54	2041.79	2.50	524.82
7/06	46.50	37.00	103.83	2145.62	2.64	534.89
7/07	38.85	75.00	247.25	2392.87	2.56	539.08
7/08	7.37	179.00	5829.03	8221.90	2.79	534.24
7/09	29.69	67.00	541.56	8763.47	2.75	531.20
7/10	49.88	24.00	115.47	8878.94	3.27	575.51
7/11	16.62	24.00	346.17	9225.11	3.33	567.02
TOTAL		1086.00		9225.11		
MEAN					2.54	528.80

Escapement estimation using lag time did not work on the Kvichak River in 1981. This was due to the method of calculating the daily test fish index. The in-season method of calculating this index assumed no knowledge of spatial and temporal variance in the population, no knowledge of population size and assumed a somewhat even distribution between both sides of the river. Thus the sample with the most sampling effort (fathom hours) was considered to be the most representative sample and all other samples were weighted accordingly. These assumptions plus the test fishermen's desire to minimize catch resulted in erroneous daily test fish indices.

These erroneous indices became apparent when large numbers of fish were present on one side of the river while few were present on the other side. This situation was encountered on the Kvichak River in 1981. When the large population on one side of the river was sampled, many fish were caught in a very short set resulting in few fathom hours fished. On the other side of the river few fish were caught, so the net was fished longer. This resulted in significantly more fathom hours fished. Subsequent weighting by fathom hours gave the smaller catch more weight out of proportion to the differences in fishing effort and resulted in an underestimation of total fish for the day. This problem wouldn't have surfaced if the population was evenly distributed.

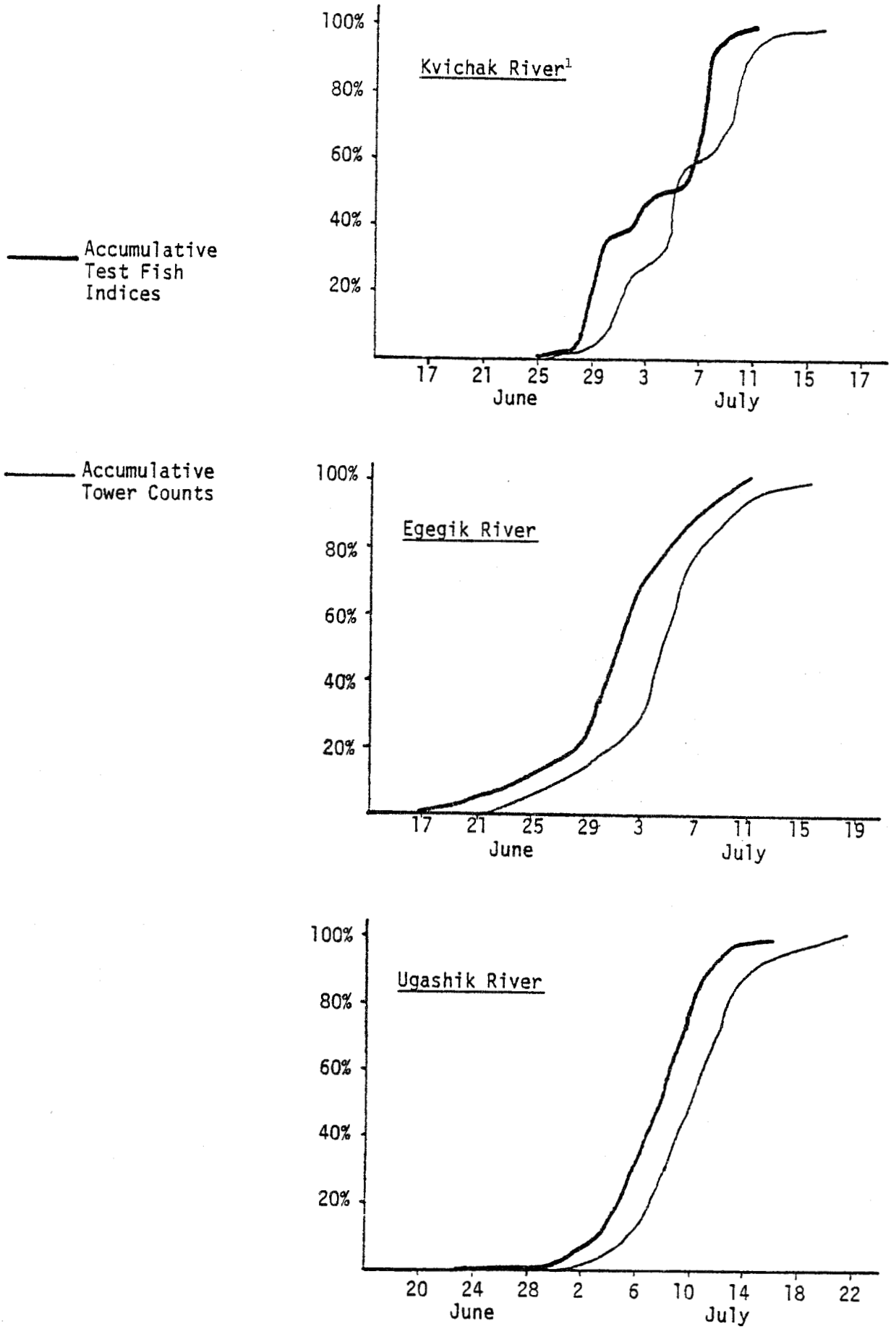
To obtain a meaningful lag time estimate, a different method of computing daily test fish indices was developed post-season. Each set was considered equally representative of the fish present at the test fish site during the tide fished and no weighting was used. A new daily test fish index was calculated for each day by totaling all indices for the day and dividing by the corresponding number of drifts.

Lag time based on the new method was 2 days (Figure 2). This resulted in an estimated 83 sockeye salmon per daily test fish index or a forecast escapement of 1,718,897. The model underestimated by 0.3% the actual tower count 2 days after test fishing of 1,723,506.

Egegik River

Test fishing began 14 June and continued to 11 July. This was the third season that the upriver site was used. The data collected from this site has given a good forecast of the escapement for all three seasons. Data by set and station is presented in Appendix Table 2.

At the end of the season 1,524 fish had been caught, resulting in 14,510.30 daily index points. The mean length was 544.0 mm and the mean weight 2.65 kg (Table 2). This led to an estimated 65 sockeye salmon passing per index point based on mean length and an estimated escapement of 898,762 fish. The actual final tower count was 694,680. This resulted in an overestimation of 29% using the catchability model. Lag time between the test fishing site and the counting tower was variable, increasing as the run progressed, then decreasing towards the end (Figure 2). Lag time based on curve matching was 3 days. This resulted in an estimated 52 sockeye per daily test fish index or a forecast escapement of 711,405. The forecast escapement based on lag time was an overestimation of 2%.



[1] Post-season method of calculating daily index values.

Figure 2. Accumulative test fishing indices and tower counts, 1981.

Table 2. Test fish daily and accumulative index values, weight (kg), and length (mm) statistics summarized by day for the Egegik River, 1981.

Date	Fishing time	Catch	Index	Accumulative Index	Mean weight	Mean length
6/14	67.00	50.00	179.12	179.12	2.77	547.36
6/15	67.05	40.00	129.81	308.92	2.63	543.83
6/16	81.75	2.00	5.87	314.79	3.00	577.00
6/17	91.00	13.00	34.29	349.08	2.60	526.85
6/18	99.00	4.00	9.72	358.80	2.80	542.13
6/19	92.80	5.00	12.93	371.73	2.70	538.14
6/20	57.00	4.00	16.84	388.58	2.36	521.97
6/21	38.50	76.00	473.77	862.35	2.88	547.35
6/22	24.30	65.00	641.97	1504.32	2.72	544.79
6/23	87.05	26.00	71.68	1576.00	2.54	529.40
6/24	93.15	29.00	74.72	1650.72	2.59	536.55
6/25	82.87	41.00	118.73	1769.44	2.54	538.74
6/26	91.85	41.00	107.13	1876.57	2.62	539.65
6/27	57.75	122.00	507.01	2383.59	2.87	545.49
6/28	54.20	42.00	185.92	2569.50	2.67	538.39
6/29	20.00	22.00	264.00	2833.50	2.91	549.17
6/30	13.25	108.00	1956.23	4789.73	2.80	545.27
7/01	28.00	80.00	685.71	5475.44	2.65	547.30
7/02	19.50	89.00	1095.38	6570.83	3.09	554.34
7/03	10.00	133.00	3192.05	9762.88	2.76	538.39
7/04	13.50	69.00	1284.86	11047.74	2.80	545.77
7/05	42.25	73.00	414.67	11462.41	2.65	543.76
7/06	53.25	75.00	338.04	11800.45	2.78	532.47
7/07	44.25	68.00	348.93	12149.38	2.32	541.24
7/08	44.84	51.00	272.48	12421.86	2.52	549.01
7/09	20.75	59.00	694.57	13116.43	2.71	538.29
7/10	63.38	47.00	177.76	13294.19	2.45	539.23
7/11	32.90	40.00	291.81	13586.00	2.67	548.10
7/12	52.95	31.00	614.98	14200.98	2.69	535.00
7/13	34.50	19.00	309.32	14510.30	2.17	517.39
TOTAL		1524.00		14510.30		
MEAN					2.65	544.00

Ugashik River

Test fishing began 17 June and ended 16 July. At the termination of test fishing 1,589 sockeye salmon had been caught resulting in 71,194 daily index points. Data by set and station is presented in Appendix Table 2. The mean sockeye length was 560.2 mm and the mean weight was 2.92 kg (Table 3). This led to an estimated 23 fish passing per daily index point based on mean length and an estimated escapement of 1,740,588 fish. The actual final tower count was 1,326,762. This resulted in an overestimation of 31% using the catchability mode. Lag time between the test fishery and the counting tower was relatively uniform (Figure 2). Lag time based on curve matching was 2 days. This resulted in an estimated 18 sockeye per daily test fish index or a forecast escapement of 1,278,179. The forecast escapement based on lag time was an underestimation of 4%.

Table 3. Test fish daily and accumulative index values, weight (kg), and length (mm) statistics summarized by day for the Ugashik River, 1981.

Date	Fishing time	Catch	Accumulative Index	Accumulative Index	Mean weight	Mean length
6/17	60.75	13.00	51.34	51.34	3.14	579.81
6/18	50.90	14.00	66.01	117.35	2.89	545.68
6/19	41.80	11.00	63.03	180.38	2.89	559.60
6/20	31.67	26.00	195.78	376.16	3.15	573.87
6/21	23.30	21.00	216.30	592.46	2.96	561.81
6/22	59.25	34.00	137.72	730.18	3.13	568.71
6/23	43.45	29.00	159.94	890.12	3.00	579.94
6/24	46.90	19.00	97.21	987.33	2.99	577.63
6/25	56.10	5.00	21.37	1008.70	3.10	576.01
6/26	47.16	7.00	35.62	1044.32	3.01	557.27
6/27	33.27	4.00	28.90	1073.22	2.55	519.92
6/28	26.10	18.00	161.92	1235.14	3.19	573.36
6/29	47.31	38.00	193.12	1428.26	2.93	576.10
6/30	43.02	66.00	368.38	1796.64	3.09	578.76
7/01	20.19	113.00	1343.24	3139.89	3.08	568.91
7/02	4.33	37.00	2055.20	5195.09	3.12	553.59
7/03	6.94	72.00	2489.90	7684.99	3.15	566.95
7/04	3.26	31.00	2282.21	9967.20	3.13	560.57
7/05	2.93	76.00	6368.18	16335.38	3.23	569.64
7/06	3.00	96.00	7680.00	24015.38	3.36	564.32
7/07	6.23	202.00	7233.68	31249.06	3.13	568.11
7/08	3.07	108.00	8449.01	39698.07	2.82	553.92
7/09	3.72	119.00	7677.40	47375.47	2.94	560.85
7/10	3.78	148.00	9396.71	56772.19	3.06	553.63
7/11	3.15	80.00	6095.22	62867.41	2.84	556.39
7/12	3.25	48.00	3544.61	66412.02	2.93	560.32
7/13	3.13	41.00	3143.77	69555.78	3.08	553.18
7/14	12.88	30.00	559.01	70114.79	2.76	543.15
7/15	20.00	51.00	612.00	70726.79	2.74	536.71
7/16	16.42	32.00	467.72	71194.51	2.72	544.43
TOTAL		1589.00		71194.51		
MEAN					2.92	560.20

Appendix Table 1. Historic data on mean weight, mean length, and return per index values for Kvichak, Egegik, and Ugashik test fisheries.

KVICHAK RIVER

Year	Mean weight (kg)[1]	Mean length (mm)[2]	Return/Index
1969	2.31	516.7	553.3
1970	2.18	497.7	966.4
1971	2.54	536.1	184.9
1972	2.77	540.9	150.4
1973	3.04	538.8	55.1
1974	-	-	-
1975	2.39	508.3	537.8
1976	2.63	529.1	296.6
1977	3.08	534.6	141.3
1978	2.39[3]	499.1	386.6
1979	2.50[3]	519.3[3]	271.6
1980	2.20[3]	514.6[3]	214.5
1981	2.54[3]	528.8[3]	190.2

-Continued-

[1] From commercial processors reports.

[2] From tower samples.

[3] From inside test fish samples.

$Y = ax^b$ $\quad Y =$ Return/Index

$x =$ Mean length (mm)

$a = 1.524 \times 10^{61}$

$b = -21.628$

Appendix Table 1. Historic data on mean weight, mean length, and return per index values for Kvichak, Egegik, and Ugashik test fisheries (continued).

EGEGIK RIVER

Year	Mean weight (kg)[1]	Mean length (mm)[2]	Return/Index
1969	2.49	537.0	293.5
1970	2.18	492.4	359.9
1971	2.68	560.0	217.6
1972	2.72	530.1	206.0
1973	3.22	587.7	78.2
1974	-	-	-
1975	2.58	557.4	104.6
1976	2.68	542.7	49.6
1977	2.87	567.8	121.8
1978	3.04[3]	571.4	80.4
1979	2.69[3]	546.5[3]	60.6[4]
1980	2.19[3]	524.6[3]	124.9[4]
1981	2.65[3]	544.0[3]	47.9[4]

-Continued-

[1] From commercial processors reports.

[2] From tower samples.

[3] From inside test fish samples.

[4] Return/index values are not comparable with those of prior years due to relocation of test fish project up river.

$Y = ax^b$

Y = Return/Index

x = Mean length (mm)

a = 1.779×10^{59}

b = -21.017

Appendix Table 1. Historic data on mean weight, mean length, and return per index values for Kvichak, Egegik, and Ugashik test fisheries (continued).

UGASHIK RIVER

Year	Mean weight (kg)[1]	Mean length (mm)[2]	Return/Index
1961	-	572.7	36.5
1962	-	536.0	15.1
1963	2.81	-	37.1
1964	2.40	-	23.7
1965	2.40	506.1	55.0
1966	2.95	544.6	59.4
1967	2.86	-	26.5
1968	2.68	-	13.3
1978	2.90[3]	543.0	3.8
1979	2.61[3]	538.0[3]	46.1
1980	2.30[3]	520.5[3]	78.6
1981	2.92[3]	560.2[3]	18.6

[1] From commercial processors reports.

[2] From tower samples.

[3] From test fish samples.

$Y = ax^b$ $\quad Y =$ Return/Index

$x =$ Mean length (mm)

$a = 1.457 \times 10^{10}$

$b = -0.037$

Appendix Table 2. Test fish sockeye catch, mean fishing time, index, mean weight (kg), mean length (mm) by set and river system, 1981.

AREA IDENT.	YR	MO	DY	SET NO.	STATION IDENT.	GEAR LENGTH (FMS)	MEAN FISHING TIME (MIN)	SOCKEYE CATCH	TEST FISHING INDEX (DAILY)	MEAN WT	MEAN LN	TIDE
05KVICHAK	81	6	14	1	2	50	23.00	5	26.1	2.82	542.00	4
03KVICHAK	81	6	15	2	1	50	23.00	0	0.	0.	0.	4
05KVICHAK	81	6	15	3	2	50	17.50	0	0.	0.	0.	4
05KVICHAK	81	6	15	4	1	50	22.50	2	10.6	2.50	532.00	4
05KVICHAK	81	6	16	5	2	50	20.00	0	0.	0.	0.	4
05KVICHAK	81	6	16	6	1	50	22.50	1	5.3	2.34	535.00	4
05KVICHAK	81	6	16	7	2	50	28.50	0	0.	0.	0.	4
05KVICHAK	81	6	17	8	1	50	26.00	0	0.	0.	0.	4
05KVICHAK	81	6	17	9	2	50	24.00	0	0.	0.	0.	4
05KVICHAK	81	6	17	10	1	50	22.00	0	0.	0.	0.	4
05KVICHAK	81	6	17	11	2	50	23.00	0	0.	0.	0.	4
05KVICHAK	81	6	18	12	1	50	28.00	0	0.	0.	0.	4
05KVICHAK	81	6	18	13	2	50	20.00	0	0.	0.	0.	4
05KVICHAK	81	6	18	14	1	50	32.50	4	14.8	2.26	512.00	4
05KVICHAK	81	6	18	15	2	50	26.50	0	0.	0.	0.	4
05KVICHAK	81	6	19	16	1	50	28.50	3	12.6	2.46	520.00	4
05KVICHAK	81	6	19	17	2	50	25.50	0	0.	0.	0.	4
05KVICHAK	81	6	19	18	1	50	23.00	0	0.	0.	0.	4
05KVICHAK	81	6	19	19	2	50	25.50	3	14.1	2.03	520.00	4
05KVICHAK	81	6	20	20	1	50	25.50	2	9.4	2.59	540.00	4
05KVICHAK	81	6	20	21	2	50	24.00	0	0.	0.	0.	4
05KVICHAK	81	6	20	22	1	50	26.50	3	13.6	2.40	536.00	4
05KVICHAK	81	6	20	23	2	50	29.00	1	4.1	2.00	490.00	4
05KVICHAK	81	6	21	24	1	50	24.00	7	35.0	2.77	535.00	4
05KVICHAK	81	6	21	25	2	50	25.00	3	14.4	2.19	535.00	4
05KVICHAK	81	6	21	26	1	50	25.50	0	0.	0.	0.	4
05KVICHAK	81	6	21	27	2	50	23.50	10	51.1	2.85	546.00	4
05KVICHAK	81	6	22	28	1	50	29.50	1	4.1	3.35	578.00	4
05KVICHAK	81	6	22	29	2	50	27.50	1	4.4	3.15	555.00	4
05KVICHAK	81	6	22	30	1	50	29.00	0	0.	0.	0.	4
05KVICHAK	81	6	22	31	2	50	25.50	8	37.6	2.45	532.00	4
05KVICHAK	81	6	23	32	1	50	25.00	0	0.	0.	0.	4
05KVICHAK	81	6	23	33	2	50	28.00	2	8.6	2.73	532.00	4
05KVICHAK	81	6	24	34	1	50	29.50	0	0.	0.	0.	4
05KVICHAK	81	6	24	35	2	50	27.00	1	4.4	2.26	533.00	4
05KVICHAK	81	6	24	36	1	50	33.00	0	0.	0.	0.	4
05KVICHAK	81	6	24	37	2	50	28.50	0	0.	0.	0.	4
05KVICHAK	81	6	25	38	1	50	27.50	1	4.4	1.56	454.00	4
05KVICHAK	81	6	25	39	2	50	23.50	1	5.1	2.28	512.00	4
05KVICHAK	81	6	25	40	1	50	29.50	0	0.	0.	0.	4
05KVICHAK	81	6	25	41	2	50	22.50	9	48.0	2.18	506.00	4
05KVICHAK	81	6	26	42	1	50	24.50	0	0.	0.	0.	4
05KVICHAK	81	6	26	43	2	50	28.00	2	8.6	1.86	482.00	4
05KVICHAK	81	6	26	44	1	50	23.50	0	0.	0.	0.	4
05KVICHAK	81	6	26	45	2	50	27.50	3	13.1	2.54	547.00	4
05KVICHAK	81	6	27	46	1	50	27.50	0	0.	0.	0.	4
05KVICHAK	81	6	27	47	2	50	24.00	33	165.0	2.82	535.00	4
05KVICHAK	81	6	27	48	1	50	23.50	5	25.5	3.35	542.00	4

-Continued-

Appendix Table 2. Test fish sockeye catch, mean fishing time, index, mean weight (kg), mean length (mm) by set and river system, 1981 (continued).

AREA IDENT.	YR	MO	DY	SET NO.	STATION IDENT.	GEAR LENGTH (FMS)	MEAN FISHING TIME (MIN)	SOCKEYE CATCH	TEST FISHING INDEX (DAILY)	MEAN WT	MEAN LN	TIDE
05KVICHAK	81	6	27	49	2	50	12.00	47	470.0	2.68	527.00	4
05KVICHAK	81	6	28	50	1	50	4.00	16	480.0	2.75	525.00	4
05KVICHAK	81	6	28	51	2	50	9.00	39	508.0	2.68	531.00	4
05KVICHAK	81	6	28	52	1	50	22.50	2	10.7	2.59	538.00	4
05KVICHAK	81	6	28	53	2	50	21.00	5	28.6	2.19	520.00	4
05KVICHAK	81	6	29	54	1	50	25.50	1	4.7	3.10	576.00	4
05KVICHAK	81	6	29	55	2	50	3.50	54	1851.4	2.58	532.00	4
05KVICHAK	81	6	29	56	1	50	8.00	9	135.0	2.58	536.00	4
05KVICHAK	81	6	29	57	2	25	1.00	51	12240.0	2.21	516.00	4
05KVICHAK	81	6	30	58	1	50	7.00	22	377.1	2.49	520.00	4
05KVICHAK	81	6	30	59	2	25	0.75	31	9920.0	2.57	510.00	4
05KVICHAK	81	6	30	60	1	50	22.50	7	37.3	2.27	516.00	4
05KVICHAK	81	7	1	61	2	50	18.50	0	0.	0.	0.	4
05KVICHAK	81	7	1	62	1	50	23.00	1	5.2	3.50	526.00	4
05KVICHAK	81	7	1	63	2	50	23.00	2	10.4	2.49	515.00	4
05KVICHAK	81	7	1	64	1	50	10.00	2	2.4	2.52	542.00	4
05KVICHAK	81	7	1	65	2	50	13.40	0	0.	0.	0.	4
05KVICHAK	81	7	2	66	1	50	22.75	1	5.3	2.86	550.00	4
05KVICHAK	81	7	2	67	2	50	21.25	65	367.0	2.62	534.00	4
05KVICHAK	81	7	3	68	1	50	22.75	1	5.3	1.90	491.00	4
05KVICHAK	81	7	3	69	2	40	2.50	55	3300.0	2.48	536.00	4
05KVICHAK	81	7	3	70	1	50	8.50	24	338.8	2.04	510.00	4
05KVICHAK	81	7	3	71	2	25	1.25	26	4992.0	2.45	531.00	4
05KVICHAK	81	7	4	72	1	50	3.25	24	886.0	2.46	556.00	0
05KVICHAK	81	7	4	73	2	25	2.50	13	1248.0	2.62	532.00	4
05KVICHAK	81	7	4	74	1	50	12.25	17	167.0	2.27	527.00	4
05KVICHAK	81	7	4	75	1	50	5.00	19	456.0	2.92	523.00	4
05KVICHAK	81	7	5	76	1	50	9.25	10	130.0	2.66	536.40	4
05KVICHAK	81	7	5	77	2	50	17.50	15	103.0	2.23	522.80	4
05KVICHAK	81	7	5	78	1	25	10.00	10	120.0	2.25	514.00	4
05KVICHAK	81	7	6	79	1	50	22.25	19	120.0	2.41	540.00	4
05KVICHAK	81	7	6	80	2	50	24.25	18	89.0	2.68	528.00	4
05KVICHAK	81	7	7	81	1	50	12.70	5	47.2	2.35	521.00	4
05KVICHAK	81	7	7	82	2	50	16.90	3	21.3	2.00	507.00	4
05KVICHAK	81	7	7	83	1	40	7.25	14	289.6	2.68	524.20	4
05KVICHAK	81	7	7	84	2	25	2.00	53	6360.0	2.45	540.00	4
05KVICHAK	81	7	8	85	1	25	2.05	31	3629.3	2.61	534.50	4
05KVICHAK	81	7	8	86	2	25	1.75	23	3154.2	2.52	532.00	4
05KVICHAK	81	7	8	87	1	25	2.33	27	2781.1	2.75	538.80	4
05KVICHAK	81	7	8	88	2	25	1.24	98	18967.7	2.71	533.90	4
05KVICHAK	81	7	9	89	1	25	2.91	13	1072.2	3.05	514.00	4
05KVICHAK	81	7	9	90	2	25	7.12	18	606.7	2.12	547.00	4
05KVICHAK	81	7	9	91	1	25	8.58	17	475.5	2.31	537.00	4
05KVICHAK	81	7	9	92	2	25	11.08	19	411.5	2.70	546.00	4
05KVICHAK	81	7	10	93	1	25	12.00	12	240.0	3.70	598.00	4
05KVICHAK	81	7	10	94	2	25	11.12	1	21.6	2.65	529.00	4
05KVICHAK	81	7	10	95	1	25	11.16	6	129.0	2.53	565.00	4
05KVICHAK	81	7	10	96	2	25	15.60	5	76.9	2.49	536.00	4

-Continued-

Appendix Table 2. Test fish sockeye catch, mean fishing time, index, mean weight (kg), mean length (mm) by set and river system, 1981 (continued).

AREA IDENT.	YR	MO	DY	SET NO.	STATION IDENT.	GEAR LENGTH (FMS)	MEAN FISHING TIME (MIN)	SOCKEYE CATCH	TEST FISHING INDEX (DAILY)	MEAN WT	MEAN LN	TIDE
05KVICHAK	81	7	11	97	1	25	5.60	14	600.0	3.30	569.20	4
05KVICHAK	81	7	11	98	2	25	11.02	10	217.1	2.90	561.00	4

-Continued-

Appendix Table 2. Test fish sockeye catch, mean fishing time, index, mean weight (kg), mean length (mm) by set and river system, 1981 (continued).

AREA IDENT.	YR	MO	DY	SET NO.	STATION IDENT.	GEAR LENGTH (FMS)	MEAN FISHING TIME (MIN)	SOCKEYE CATCH	TEST FISHING INDEX (DAILY)	MEAN WT	MEAN LN	TIDE
05EGEGIK	81	6	14	1	1	25	17.50	7	96.00	2.43	539.00	4
05EGEGIK	81	6	14	2	2	25	13.75	7	122.20	2.54	548.00	4
05EGEGIK	81	6	14	3	1	25	21.50	17	189.80	2.62	540.00	4
05EGEGIK	81	6	14	4	2	25	14.25	19	320.00	2.78	554.00	4
05EGEGIK	81	6	15	5	1	25	8.00	7	210.00	2.25	537.00	4
05EGEGIK	81	6	15	6	2	25	12.25	11	137.10	2.49	546.00	4
05EGEGIK	81	6	15	7	1	25	30.15	6	49.90	2.76	552.00	4
05EGEGIK	81	6	15	8	2	25	16.65	16	230.60	2.73	547.00	4
05EGEGIK	81	6	16	9	1	25	21.25	0	0.	0.	0.	4
05EGEGIK	81	6	16	10	2	25	13.25	2	36.22	2.88	577.00	4
05EGEGIK	81	6	16	11	1	25	23.50	0	0.	0.	0.	4
05EGEGIK	81	6	16	12	2	25	23.75	0	0.	0.	0.	4
05EGEGIK	81	6	17	13	1	25	20.75	2	23.13	3.15	504.00	4
05EGEGIK	81	6	17	14	2	25	15.75	11	167.62	2.40	530.00	4
05EGEGIK	81	6	17	15	1	25	26.75	0	0.	0.	0.	4
05EGEGIK	81	6	17	16	2	25	27.75	0	0.	0.	0.	4
05EGEGIK	81	6	18	17	1	25	21.75	1	11.16	2.14	524.00	4
05EGEGIK	81	6	18	18	2	25	16.75	2	28.66	2.97	558.00	4
05EGEGIK	81	6	18	19	1	25	26.75	1	8.97	2.44	514.00	4
05EGEGIK	81	6	18	20	1	25	33.75	0	0.	0.	0.	4
05EGEGIK	81	6	19	21	1	25	23.75	2	20.21	2.30	519.00	4
05EGEGIK	81	6	19	22	2	25	12.80	0	0.	0.	0.	4
05EGEGIK	81	6	19	23	1	25	26.00	2	18.46	2.83	557.00	4
05EGEGIK	81	6	19	24	2	25	30.25	1	7.93	2.76	543.00	4
05EGEGIK	81	6	20	25	1	25	28.25	1	8.50	2.72	569.00	4
05EGEGIK	81	6	20	26	2	25	28.75	3	25.04	2.11	506.00	4
05EGEGIK	81	6	21	27	1	25	18.75	6	76.80	2.55	551.00	4
05EGEGIK	81	6	21	28	2	25	6.75	26	924.44	2.76	555.00	4
05EGEGIK	81	6	21	29	1	25	9.25	17	441.10	2.32	536.00	4
05EGEGIK	81	6	21	30	2	25	3.75	27	1728.00	2.89	546.00	4
05EGEGIK	81	6	22	31	1	25	3.80	12	757.89	2.40	540.00	4
05EGEGIK	81	6	22	32	2	25	4.75	23	1162.10	2.62	538.00	4
05EGEGIK	81	6	22	33	1	25	7.75	10	309.68	3.36	568.00	4
05EGEGIK	81	6	22	34	2	25	8.00	20	600.00	2.47	552.00	4
05EGEGIK	81	6	23	35	1	25	17.75	1	13.52	2.00	478.00	4
05EGEGIK	81	6	23	36	2	25	10.00	15	360.00	2.48	528.00	4
05EGEGIK	81	6	23	37	1	25	29.65	1	8.09	2.28	537.00	4
05EGEGIK	81	6	23	38	2	25	29.65	9	72.85	2.33	545.00	4
05EGEGIK	81	6	24	39	1	25	20.65	5	58.11	2.41	528.00	4
05EGEGIK	81	6	24	40	2	25	12.00	6	120.00	2.33	526.00	4
05EGEGIK	81	6	24	41	1	25	30.75	1	7.80	2.82	526.00	4
05EGEGIK	81	6	24	42	2	25	29.75	17	137.14	2.62	550.00	4
05EGEGIK	81	6	25	43	1	25	21.75	6	66.21	2.21	540.00	4
05EGEGIK	81	6	25	44	2	25	14.25	14	235.79	2.66	541.00	4
05EGEGIK	81	6	25	45	1	25	25.50	2	18.82	2.69	571.00	4
05EGEGIK	81	6	25	46	2	25	21.37	19	213.33	2.22	533.00	4
05EGEGIK	81	6	26	47	1	25	21.00	14	160.00	2.23	527.00	4
05EGEGIK	81	6	26	48	2	25	13.10	9	164.89	2.64	543.00	4

-Continued-

Appendix Table 2. Test fish sockeye catch, mean fishing time, index, mean weight (kg), mean length (mm) by set and river system, 1981 (continued).

AREA IDENT.	YR	MO	DY	SET NO.	STATION IDENT.	GEAR LENGTH (FMS)	MEAN FISHING TIME (MIN)	SOCKEYE CATCH	TEST FISHING INDEX (DAILY)	MEAN WT	MEAN LN	TIDE
05EGEGIK	81	6	26	49	1	25	30.50	4	31.47	2.56	538.00	4
05EGEGIK	81	6	26	50	2	25	27.25	14	123.30	2.69	552.00	4
05EGEGIK	81	6	27	51	1	25	2.75	22	1920.00	2.91	544.00	4
05EGEGIK	81	6	27	52	2	25	2.50	40	3840.00	2.71	546.00	4
05EGEGIK	81	6	27	53	1	25	20.90	11	126.32	2.69	559.00	4
05EGEGIK	81	6	27	54	2	25	5.35	19	852.32	2.66	544.00	4
05EGEGIK	81	6	27	53	1	25	20.90	11	126.32	2.69	559.00	4
05EGEGIK	81	6	27	54	2	25	5.35	19	852.32	2.66	544.00	4
05EGEGIK	81	6	28	55	1	25	21.65	12	133.03	3.07	559.00	4
05EGEGIK	81	6	28	56	2	25	19.40	17	210.31	2.76	554.00	4
05EGEGIK	81	6	28	57	1	25	6.65	7	252.63	2.61	528.00	4
05EGEGIK	81	6	28	58	2	25	6.50	6	221.00	2.00	523.00	4
05EGEGIK	81	6	29	59	1	25	8.25	8	232.73	2.60	542.00	4
05EGEGIK	81	6	29	60	2	25	11.75	14	285.96	2.94	555.00	4
05EGEGIK	81	6	30	61	1	25	5.00	22	1056.00	2.92	540.00	4
05EGEGIK	81	6	30	62	2	25	4.25	27	1524.71	2.61	545.00	4
05EGEGIK	81	6	30	63	1	25	1.75	25	3428.57	2.81	550.00	4
05EGEGIK	81	6	30	64	2	25	2.25	34	3626.67	2.54	541.00	4
05EGEGIK	81	7	1	65	1	25	15.75	4	60.95	2.16	536.00	4
05EGEGIK	81	7	1	66	2	25	7.25	21	695.17	2.57	538.00	4
05EGEGIK	81	7	1	67	1	25	2.25	19	2026.67	2.52	542.00	4
05EGEGIK	81	7	1	68	2	25	2.75	36	3141.82	2.56	553.00	4
05EGEGIK	81	7	2	69	1	25	6.25	7	268.80	3.09	532.00	4
05EGEGIK	81	7	2	70	1	25	7.25	15	496.55	2.60	536.00	4
05EGEGIK	81	7	2	71	1	25	3.75	28	1792.00	2.67	545.00	4
05EGEGIK	81	7	2	72	2	25	2.25	39	4160.00	3.12	562.00	4
05EGEGIK	81	7	3	73	1	25	2.75	28	2443.60	2.74	532.00	4
05EGEGIK	81	7	3	74	2	25	2.75	60	5236.40	2.53	532.00	4
05EGEGIK	81	7	3	75	1	25	2.75	16	1396.36	2.67	549.00	4
05EGEGIK	81	7	3	76	2	25	1.75	29	3977.44	2.74	547.00	4
05EGEGIK	81	7	4	77	1	25	6.00	13	520.00	2.83	544.00	4
05EGEGIK	81	7	4	78	2	25	3.75	9	785.50	2.97	536.00	4
05EGEGIK	81	7	4	79	1	25	1.75	16	2194.29	2.58	551.00	4
05EGEGIK	81	7	4	80	2	25	2.00	31	3720.00	2.66	545.00	4
05EGEGIK	81	7	5	81	1	25	12.25	10	195.90	2.76	539.00	4
05EGEGIK	81	7	5	82	2	25	6.00	27	1080.00	2.54	539.00	4
05EGEGIK	81	7	5	83	1	25	16.25	21	310.15	2.55	560.00	4
05EGEGIK	81	7	5	84	2	25	7.75	15	464.52	2.44	546.00	4
05EGEGIK	81	7	6	85	1	25	15.50	12	185.80	2.14	520.00	4
05EGEGIK	81	7	6	86	2	25	7.25	45	1489.70	2.66	529.00	4
05EGEGIK	81	7	6	87	1	25	20.25	9	106.70	3.23	566.00	4
05EGEGIK	81	7	6	88	2	25	10.25	9	210.73	2.89	551.00	4
05EGEGIK	81	7	7	89	1	25	19.25	7	87.27	2.71	539.00	4
05EGEGIK	81	7	7	90	2	25	4.00	33	1760.00	2.24	540.00	4
05EGEGIK	81	7	7	91	1	25	15.00	6	96.00	2.28	550.00	4
05EGEGIK	81	7	7	92	2	25	6.00	22	880.00	2.13	543.00	4
05EGEGIK	81	7	8	93	1	25	10.25	13	304.40	2.35	542.00	4
05EGEGIK	81	7	8	94	2	25	3.00	16	1280.00	2.33	551.00	4

-Continued-

Appendix Table 2. Test fish sockeye catch, mean fishing time, index, mean weight (kg), mean length (mm) by set and river system, 1981 (continued).

AREA IDENT.	YR	MO	DY	SET NO.	STATION IDENT.	GEAR LENGTH (FMS)	MEAN FISHING TIME (MIN)	SOCKEYE CATCH	TEST FISHING INDEX (DAILY)	MEAN WT	MEAN LN	TIDE
05EGEGIK	81	7	8	95	1	25	22.25	8	85.30	2.78	540.00	4
05EGEGIK	81	7	8	96	2	25	9.34	14	359.74	2.68	550.00	4
05EGEGIK	81	7	9	97	1	25	7.00	16	584.60	2.48	547.00	4
05EGEGIK	81	7	9	98	2	25	2.50	20	1920.00	2.46	525.00	4
05EGEGIK	81	7	9	99	1	25	8.25	13	378.20	2.67	540.00	4
05EGEGIK	81	7	9	100	2	25	3.00	10	800.00	2.98	563.00	4
05EGEGIK	81	7	10	101	1	25	19.50	9	110.10	2.47	532.00	4
05EGEGIK	81	7	10	102	2	25	5.25	24	1097.00	2.40	545.00	4
05EGEGIK	81	7	10	103	1	25	29.88	4	32.13	2.06	531.00	4
05EGEGIK	81	7	10	104	2	25	8.75	10	274.29	2.15	520.00	4
05EGEGIK	81	7	11	105	1	25	20.20	21	249.50	2.67	554.00	4
05EGEGIK	81	7	11	106	2	25	12.70	19	359.10	2.48	544.00	4

-Continued-

Appendix Table 2. Test fish sockeye catch, mean fishing time, index, mean weight (kg), mean length (mm) by set and river system, 1981 (continued).

AREA IDENT.	YR	MO	DY	SET NO.	STATION IDENT.	GEAR LENGTH (FMS)	MEAN FISHING TIME (MIN)	SOCKEYE CATCH	TEST FISHING INDEX (DAILY)	MEAN WT	MEAN LN	TIDE
05UGASHIK	81	6	17	1	1	25	11.75	1	20.40	3.35	602.00	3
05UGASHIK	81	6	17	2	2	25	14.50	6	99.30	3.01	580.00	3
05UGASHIK	81	6	17	3	1	25	13.50	1	17.80	2.94	572.00	3
05UGASHIK	81	6	17	4	2	25	21.00	5	57.10	2.90	574.00	3
05UGASHIK	81	6	18	5	1	25	9.70	2	49.50	2.54	537.00	3
05UGASHIK	81	6	18	6	2	25	14.00	8	137.10	2.91	539.00	3
05UGASHIK	81	6	18	7	1	25	7.10	1	33.90	3.05	585.00	3
05UGASHIK	81	6	18	8	2	25	20.10	3	35.80	2.30	546.00	3
05UGASHIK	81	6	19	9	1	25	11.10	2	42.20	3.45	605.00	3
05UGASHIK	81	6	19	10	2	25	12.00	5	100.00	3.08	575.00	3
05UGASHIK	81	6	19	11	1	25	5.20	4	185.80	2.45	541.00	3
05UGASHIK	81	6	19	12	2	25	13.50	0	0.	0.	0.	3
05UGASHIK	81	6	20	13	1	25	7.00	9	308.60	3.20	590.00	3
05UGASHIK	81	6	20	14	2	25	10.08	5	119.00	3.20	578.00	3
05UGASHIK	81	6	20	15	1	25	8.25	7	203.60	2.69	546.00	3
05UGASHIK	81	6	20	16	2	25	6.54	5	183.50	2.97	575.00	3
05UGASHIK	81	6	21	17	1	25	10.70	16	358.90	2.91	566.00	3
05UGASHIK	81	6	21	18	2	25	12.60	5	95.20	2.57	546.00	3
05UGASHIK	81	6	22	19	1	25	18.75	5	64.00	3.01	558.00	3
05UGASHIK	81	6	22	20	2	25	12.00	3	60.00	3.12	573.00	3
05UGASHIK	81	6	22	21	1	25	17.50	20	274.30	3.04	573.00	3
05UGASHIK	81	6	22	22	2	25	11.00	6	130.90	2.86	563.00	3
05UGASHIK	81	6	23	23	2	25	17.00	5	70.00	3.10	582.00	3
05UGASHIK	81	6	23	24	1	25	6.90	3	104.30	3.00	574.00	3
05UGASHIK	81	6	23	25	2	25	8.75	7	192.00	2.70	559.00	3
05UGASHIK	81	6	23	26	1	25	10.80	14	311.10	2.90	594.40	3
05UGASHIK	81	6	24	27	2	25	12.60	1	19.00	3.70	593.00	3
05UGASHIK	81	6	24	28	1	25	9.90	6	145.40	3.20	583.00	3
05UGASHIK	81	6	24	29	2	25	12.80	10	187.50	2.60	578.00	3
05UGASHIK	81	6	24	30	1	25	11.60	2	41.40	2.50	550.00	3
05UGASHIK	81	6	25	31	2	25	11.00	1	21.80	2.90	588.00	3
05UGASHIK	81	6	25	32	1	25	15.50	2	30.90	2.80	560.00	3
05UGASHIK	81	6	25	33	2	25	14.40	2	33.33	3.18	583.00	3
05UGASHIK	81	6	25	34	1	25	15.20	0	0.	0.	0.	3
05UGASHIK	81	6	26	35	2	25	11.37	1	21.10	2.44	540.00	3
05UGASHIK	81	6	26	36	1	25	10.21	1	23.50	2.52	552.00	3
05UGASHIK	81	6	26	37	2	25	12.75	1	18.82	3.40	628.00	3
05UGASHIK	81	6	26	38	1	25	12.83	4	74.82	2.99	546.00	3
05UGASHIK	81	6	27	39	2	25	14.98	2	32.00	1.82	463.00	3
05UGASHIK	81	6	27	40	1	25	18.29	2	26.37	3.20	589.00	3
05UGASHIK	81	6	28	41	2	25	10.70	12	260.39	3.10	578.00	3
05UGASHIK	81	6	28	42	1	25	15.40	6	93.50	2.96	568.00	3
05UGASHIK	81	6	29	43	2	25	13.16	10	182.37	3.02	573.00	3
05UGASHIK	81	6	29	44	1	25	12.42	5	96.62	2.98	579.60	3
05UGASHIK	81	6	29	45	2	25	11.56	14	292.17	2.60	572.60	3
05UGASHIK	81	6	29	46	1	25	10.17	9	212.29	2.84	582.00	3
05UGASHIK	81	6	30	47	2	25	9.70	23	569.90	2.79	570.00	3
05UGASHIK	81	6	30	48	1	25	14.50	18	297.90	3.05	589.00	3

-Continued-

Appendix Table 2. Test fish sockeye catch, mean fishing time, index, mean weight (kg), mean length (mm) by set and river system, 1981 (continued).

AREA IDENT.	YR	MO	DY	SET NO.	STATION IDENT.	GEAR LENGTH (FMS)	MEAN FISHING TIME (MIN)	SOCKEYE CATCH	TEST FISHING INDEX (DAILY)	MEAN WT	MEAN LN	F I D E
05UGASHIK	81	6	30	49	2	25	9.70	14	346.40	3.22	585.00	3
05UGASHIK	81	6	30	50	1	25	9.12	11	289.50	2.90	578.00	3
05UGASHIK	81	7	1	51	2	25	7.63	43	1352.56	3.00	568.00	3
05UGASHIK	81	7	1	52	1	25	5.50	20	872.73	2.49	578.00	3
05UGASHIK	81	7	1	53	2	25	4.63	17	881.21	3.16	561.00	3
05UGASHIK	81	7	1	54	1	25	2.43	33	3259.26	3.00	569.00	3
05UGASHIK	81	7	2	55	2	25	1.58	25	3809.52	3.02	531.00	3
05UGASHIK	81	7	2	56	1	25	2.75	12	1047.27	2.88	563.00	3
05UGASHIK	81	7	3	57	2	25	2.38	10	1008.40	2.55	561.00	3
05UGASHIK	81	7	3	58	1	25	1.88	32	4085.11	2.85	558.00	3
05UGASHIK	81	7	3	59	2	25	1.30	17	3138.40	3.28	574.00	3
05UGASHIK	81	7	3	60	1	25	1.38	13	2260.87	3.17	576.00	3
05UGASHIK	81	7	4	61	2	25	1.88	20	2553.19	2.99	561.00	3
05UGASHIK	81	7	4	62	1	25	1.38	11	1913.04	3.00	560.00	3
05UGASHIK	81	7	5	63	2	18	0.75	9	2880.00	3.25	583.00	3
05UGASHIK	81	7	5	64	2	25	1.00	34	7846.20	2.97	567.00	3
05UGASHIK	81	7	5	65	1	25	1.18	33	6711.90	3.17	567.00	3
05UGASHIK	81	7	6	66	2	25	1.00	30	7200.00	3.71	573.00	3
05UGASHIK	81	7	6	67	1	25	0.75	33	10560.00	3.05	558.00	3
05UGSAHIK	81	7	6	68	2	25	1.00	30	7200.00	2.87	567.00	3
05UGASHIK	81	7	6	69	1	25	1.25	33	6336.00	2.93	565.00	3
05UGASHIK	81	7	7	70	2	25	1.00	58	5555555	2.84	552.00	3
05UGASHIK	81	7	7	71	1	25	0.75	22	7040.00	2.99	576.00	3
05UGASHIK	81	7	7	72	2	25	1.30	36	6646.00	3.13	576.00	3
05UGASHIK	81	7	7	73	2	25	1.13	28	2925.89	3.18	571.00	3
05UGASHIK	81	7	8	74	1	25	0.92	22	5759.18	2.46	552.00	3
05UGASHIK	81	7	8	75	2	25	1.15	46	9600.00	2.78	561.00	3
05UGASHIK	81	7	8	76	1	25	1.00	40	9600.00	2.76	548.00	3
05UGASHIK	81	7	9	77	1	25	1.12	28	6000.00	3.29	579.00	3
05UGASHIK	81	7	9	78	2	25	0.92	30	7826.00	3.24	566.00	3
05UGASHIK	81	7	9	79	1	25	0.76	24	7578.95	2.48	555.00	3
05UGASHIK	81	7	9	80	2	25	0.92	37	9652.20	2.46	550.00	3
05UGASHIK	81	7	10	81	1	25	1.00	23	5520.00	3.02	543.00	3
05UGASHIK	81	7	10	82	2	25	0.95	53	13389.00	2.94	552.00	3
05UGASHIK	81	7	10	83	1	25	1.00	43	10320.00	3.03	553.00	3
05UGASHIK	81	7	10	84	2	25	0.83	29	8385.58	2.76	564.00	3
05UGASHIK	81	7	11	85	2	25	0.75	22	7040.00	2.38	552.00	3
05UGASHIK	81	7	11	86	1	25	0.65	22	8123.00	2.96	561.00	3
05UGASHIK	81	7	11	87	2	25	0.75	16	5120.00	2.94	563.00	3
05UGASHIK	81	7	11	88	1	25	1.00	20	4800.00	2.58	548.00	3
05UGASHIK	81	7	12	89	2	25	1.75	19	2605.70	3.33	568.00	3
05UGASHIK	81	7	12	90	1	25	1.50	29	4640.00	2.51	556.00	3
05UGASHIK	81	7	13	91	2	25	1.25	23	4416.00	3.09	559.00	3
05UGASHIK	81	7	13	92	1	25	1.88	18	2297.87	2.69	542.00	3
05UGASHIK	81	7	14	93	2	25	8.75	7	192.00	3.95	572.00	3
05UGASHIK	81	7	14	94	1	25	4.13	23	1336.56	2.46	539.00	3
05UGASHIK	81	7	15	95	2	25	4.25	21	1185.90	2.42	537.00	3
05UGASHIK	81	7	15	96	1	25	4.75	12	606.30	3.14	549.00	3

-Continued-

Appendix Table 2. Test fish sockeye catch, mean fishing time, index, mean weight (kg), mean length (mm) by set and river system, 1981 (continued).

AREA IDENT.	YR	MO	DY	SET NO.	STATION IDENT.	GEAR LENGTH (FMS)	MEAN FISHING TIME (MIN)	SOCKEYE CATCH	TEST FISHING INDEX (DAILY)	MEAN WT	MEAN LN	TIDE
05UGASHIK	81	7	15	97	2	25	4.75	10	505.26	2.37	538.00	3
05UGASHIK	81	7	15	98	1	25	6.25	8	307.20	2.79	527.00	3
05UGASHIK	81	7	16	99	2	25	7.25	17	562.76	2.79	551.00	3
05UGASHIK	81	7	16	100	1	25	9.17	15	392.58	2.35	535.00	3

1981 IGUSHIK RIVER ESCAPEMENT TEST FISHING

By

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INTRODUCTION

An escapement test fishing project for the Igushik River system has been conducted annually since 1976 (McBride 1978; McBride and Clark 1979). The objective of the project is to obtain timely estimates of sockeye salmon escapement into the lower portion of the Igushik River, soon after the fish pass through the commercial fishery (Figure 1). This information is necessary to facilitate management decisions as final enumeration of the Igushik River salmon escapement occurs at the counting tower at the outlet of Amanka Lake; approximately two to ten days removed from the commercial fishery.

METHODS AND MATERIALS

Test Fishing

The location and methodology for gillnet test fishing were similar to that used in 1979 (McBride and Clark 1979) and 1980 (McBride 1980). A 25 fm set gillnet (5-3/8 inch mesh) was fished during each high tide at a single location on the left bank facing upstream. The gillnet was set 15 minutes before each high tide as indicated in the local tide books and remained fishing 30 minutes or until approximately 25 salmon were caught, which ever came first. The objective was to minimize the catch while still obtaining a good estimate of fish passage rates.

The standard test fish index (catch per 100 fathom-hours) was calculated for each set. Also, samples of length and weight composition were obtained throughout the migration.

Tagging Studies

No tagging studies were conducted at the Igushik site in 1981. Reasoning behind this decision came from the success in satisfying objectives set forth in earlier tag experiments (McBride 1980). It had been found for two consecutive years that better estimates of lag time were derived from correlation analysis (McBride and Clark 1979; McBride 1980) than from the tagging experiments, probably because of stress in the tagged fish. Further, the past tagging studies had consistently documented that at the present fishing site, flushing and drift problems were minimal or non-existent (McBride 1980).

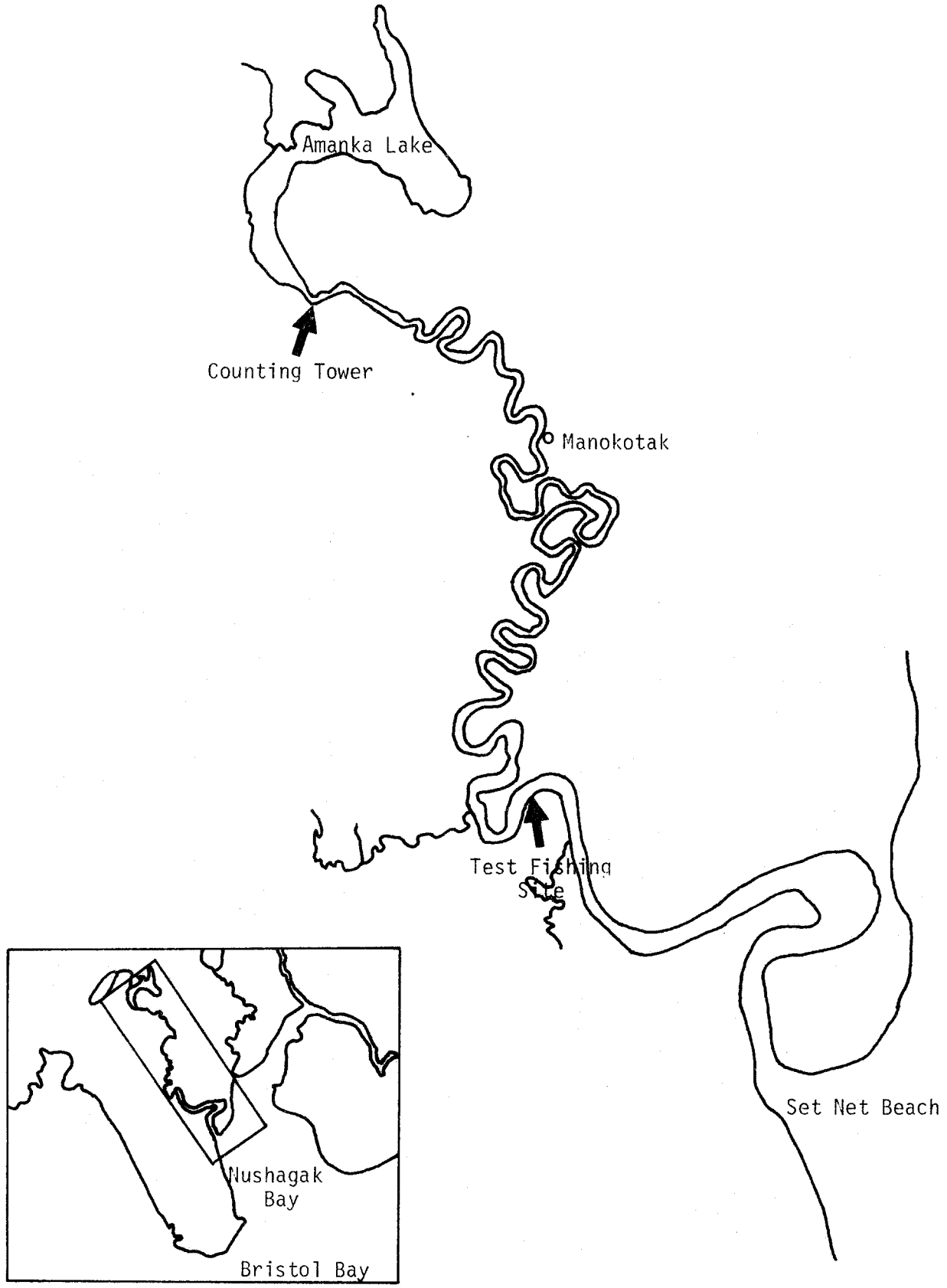

Figure 1 . Location of the Igushik River counting tower, the village of Manokotak and the Igushik inside test fishing site.

Therefore the tagging experiments conducted in prior years were omitted from the 1981 operational plan.

Escapement Estimates

Test fish indices were calculated for each high tide and averaged for each day to yield a daily test fish index value. Intra-season estimates of the accumulative escapement at the test fishing site for a particular day were calculated by multiplying the accumulative test fish index for that day by the best estimates of the number of spawners (at the tower) per test fish index points (i.e., catchability factor) at that time. Intra-season estimates of catchability were determined in two ways. First, catchability was estimated from the relationship between the average size of sockeye caught in the test fishery and catchability curves determined in prior years. Second, catchability was calculated by correlating accumulative test fish indices with accumulative actual escapements at the counting tower during subsequent 24-hour periods (Paulus 1968).

RESULTS

Test fishing was conducted from 19 June until 14 July (Table 1). The accumulative test fish indices were found to closely parallel the accumulative tower count escapement counts (Figure 2). Correlation analysis of the accumulative test fish indices with the accumulative tower escapement estimates showed that a 4-day lag time produced the best statistical fit between tower counts and test fish indices (Table 2).

Escapement estimates in Table 3, based on test fishing indices, remained within 30% of the actual escapement after 28 June (5% of the total escapement had entered the river). The relationship of the number of spawners per index point or catchability for 1981 was calculated by dividing the total tower count escapement by the accumulative test fish indices with a 4-day estimate of lag time:

532,896 spawners/37,974.7 indices = 14.03 spawners/index point.

Individual mean weight of sockeye salmon caught at the test fish site was calculated at 3.3 kg (7.2 lbs). Both statistics were included into the long term prediction model of catchability (Table 4 and Figure 3).

Table 1. Sockeye salmon escapement into the Igushik River system as indexed at the test fish site and enumeration at the counting tower, 1981.

	Test Fish Indices			Tower Counts	
		Average of Both Tides For each Day			
Date	Test Fish Index	Daily Test Fish Index	Accumulative Test Fish Index	Daily Counts	Accumulative Counts
June 19	120.0	120.0	120.0	0	0
20	430.3				
20	12.9	221.6	341.6	0	0
21	226.4				
21	46.5	136.5	478.1	1416	1416
22	454.7				
22	136.1	295.4	773.5	1716	3132
23	709.6				
23	218.2	463.9	1237.4	1578	4710
24	306.7				
24	250.9	278.8	1516.2	1908	6618
25	125.9				
25	195.0	160.5	1676.7	3642	10260
26	114.3				
26	99.0	106.7	1783.3	2550	12810
27	122.9				
27	118.9	120.9	1904.2	702	13512
28	83.1	83.1	1987.1	1302	14814
29	190.2				
29	120.0	155.1	2142.2	600	15414
30	571.4				
30	1072.9	822.2	2964.4	1050	16464
July 1	741.8				
1	562.3	652.1	3616.4	2562	19026
2	504.0				
2	485.9	495.0	4111.4	8304	27330
3	775.4				
3	1876.4	1325.9	5437.3	3270	30600
4	720.0				
4	2923.6	1821.8	7259.1	5406	36006
5	1008.0				
5	4480.0	2744.0	10003.1	7680	43686
6	2125.7				
6	3733.3	2929.5	12932.6	15762	59448
7	1560.0				
7	3564.7	2562.9	15495.5	21720	81168
8	2705.5				
8	4974.5	3840.0	19335.5	27768	108936
9	2800.9				
9	4009.4	3405.2	22740.6	39990	148926
10	3316.4				
10	3908.6	3612.5	26353.1	45678	194604
11	1920.0				
11	4061.5	2990.8	29343.9	41226	235830
12	1600.0	2990.8	32334.7	36918	272748
13	3840.0				
13	2240.0	3040.0	35374.7	58116	330864
14	2400.0				
14	2800.0	2600.0	37974.7	55422	386286
15				47340	433626
16				42912	476538
17				33120	509658
18				23238	532896
19				19140	552036
20				12546	564582
21				11088	575670
22				8190	583860
23				3876	587736
24				3408	591144

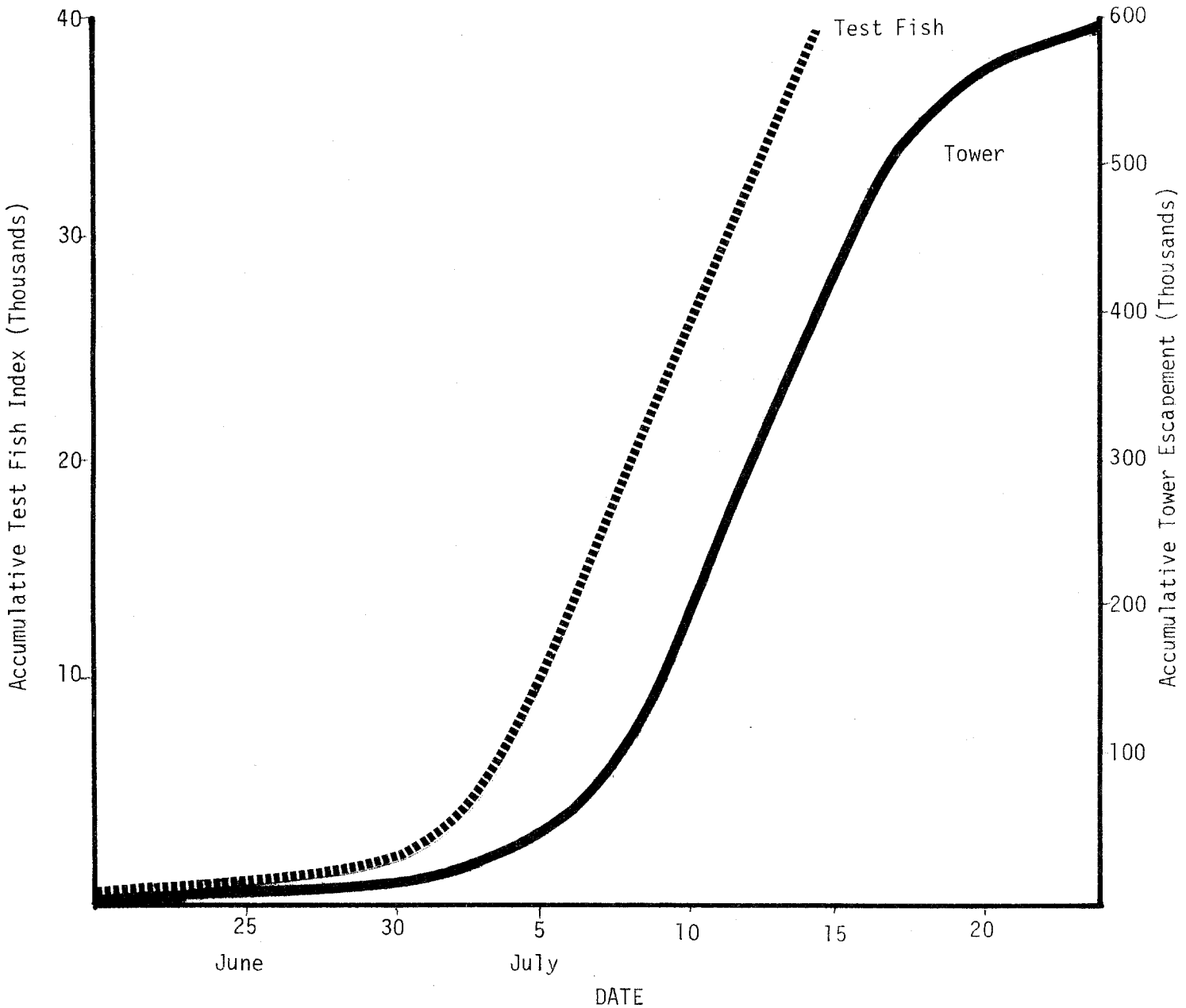

Figure 2. Igushik River accumulative test-fishing indices and tower counts, 1981.

Table 2. Correlation of accumulative test fish indices with escapement counts at Igushik Tower with lag times from 3 to 6 days, 1981.

Lag Time	Correlation Coefficient
2 Day Lag	.99341
3 Day Lag	.99847
4 Day Lag	.99928*
5 Day Lag	.99515
6 Day Lag	.98533

* 4 Day Lag Time demonstrated highest correlation coefficient and was used in this analysis.

Table 3. Sockeye salmon escapement into the Igushik River system as estimated by the Igushik River inside test fishing project, 1981.

Date	Accumulative Test Fish Index	Estimated Escapement[1]	Actual Escapement[2]	Accuracy[3]
June 19	120.0	1685	4710	0.4
20	341.6	4796	6618	0.7
21	478.1	6713	10260	0.7
22	773.5	10860	12810	0.8
23	1237.4	17373	13512	1.3
24	1516.2	21287	14814	1.4
25	1676.7	23541	15414	1.5
26	1783.3	25038	16464	1.5
27	1904.2	26735	19026	1.4
28	1987.1	27899	27330	1.0
29	2142.2	30076	30600	1.0
30	2964.4	41620	36006	1.2
July 1	3616.4	50774	43686	1.2
2	4111.4	57724	59448	1.0
3	5437.3	76340	81168	0.9
4	7259.1	101918	108936	0.9
5	10003.1	140444	148926	0.9
6	12932.6	181574	194604	0.9
7	15495.5	217557	235830	0.9
8	19335.5	271470	272748	1.0
9	22740.6	319278	330864	1.0
10	26353.1	369998	386286	1.0
11	29343.9	411988	433626	1.0
12	32334.7	453979	476538	1.0
13	35374.7	496661	509658	1.0
14	37974.7	533165	532896	1.0

[1] Estimated escapement = (accumulative test fisn index) x (no. spawners/index point).
[2] Actual escapement = accumulative escapement on day n + 4 (4 day lag time).
[3] Accuracy = estimated escapement/actual escapement.

Table 4. Individual mean weight and spawners per index point of sockeye salmon measured at the Igushik River test fishing site from 1976 to 1981.

Year	Individual x weight (kg)	Spawners/ Index Point
1976	3.0[1]	46.8
1977	3.6[1]	13.1
1978	3.0	40.4
1979	3.4	17.4
1980	3.1	50.3
1981	3.3	14.0

[1] Weight data from Igushik Subsection commercial catch.

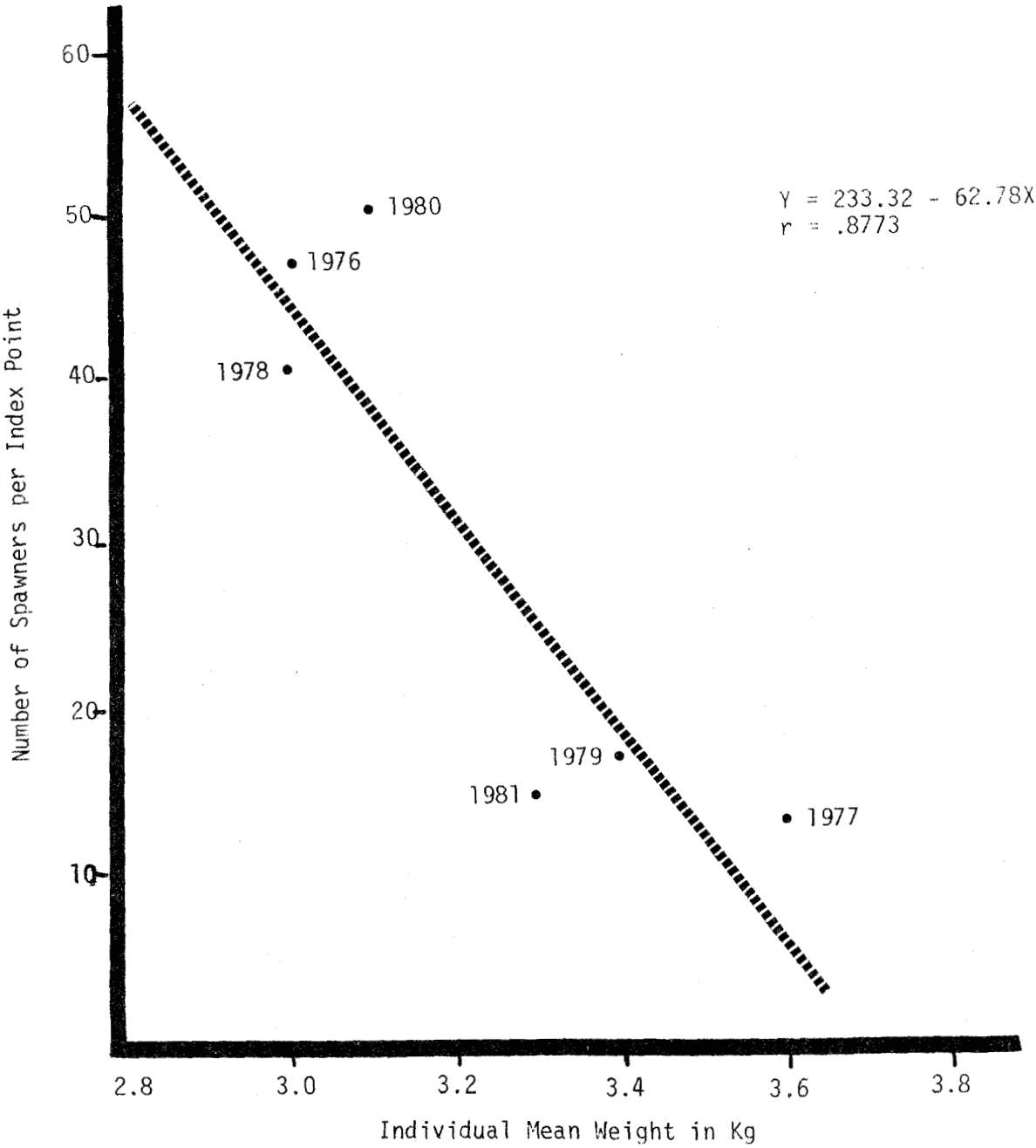

Figure 3. Correlation analysis of individual mean weight of Igushik River system sockeye salmon with the number of spawners per test fishing index point, 1976-1981.

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