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Abundance, Age, Sex, and Size Statistics for Sockeye and Pink Salmon in Lower Cook Inlet, 1990

by

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and

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The Technical Fishery Report Series was established in 1987, replacing the Technical Data Report Series. The scope of this new series has been broadened to include reports that may contain data analysis, although data oriented reports lacking substantial analysis will continue to be included. The new series maintains an emphasis on timely reporting of recently gathered information, and this may sometimes require use of data subject to minor future adjustments. Reports published in this series are generally interim, annual, or iterative rather than final reports summarizing a completed study or project. They are technically oriented and intended for use primarily by fishery professionals and technically oriented fishing industry representatives. Publications in this series have received several editorial reviews and at least one *blind* peer review refereed by the division's editor and have been determined to be consistent with the division's publication policies and standards.

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ABSTRACT

Six Lower Cook Inlet sockeye salmon *Oncorhynchus nerka* fisheries targeting primarily discrete stocks were examined for age, length and weight during the 1990 fishing season. Escapements in one sockeye and eight pink salmon *O. gorbuscha* streams were sampled for mean lengths. No chum salmon *O. keta* samples were collected. A total of 203,896 sockeye, 6,951 chum, and 383,670 pink salmon were harvested in this management area. Another 53,130 sockeye, 61,069 chum, and 315,964 pink salmon were estimated in the escapement. The dominant ages for sockeye salmon throughout Lower Cook Inlet were 1.2, 1.3, 2.2, and 2.3. The proportion of females in the samples varied from 42% in the Kamishak District to 56% in the Southern District. Sockeye salmon harvested in the Outer and Eastern Districts tended to be larger, 549 mm and 2.86 kg, compared to 477 mm and 1.66 kg in the Southern and Kamishak Districts. Pink salmon mean lengths for sexes combined were between 430 and 467 mm.

KEY WORDS: Age, length, Lower Cook Inlet, pink salmon, *Oncorhynchus*, sex, sockeye salmon, weight

INTRODUCTION

The Lower Cook Inlet Management Area for salmon is comprised of all waters west of the longitude of Cape Fairfield in the Gulf of Alaska, north of the latitude of Cape Douglas in Shelikof Straits, and south of the latitude of Anchor Point in Cook Inlet. The area is divided into four management districts: Kamishak, Southern, Outer, and Eastern (Figure 1). Purse seine and set gill net are the only legal commercial gear types for salmon. Entry into the commercial fishery has been limited since 1972. There were 71 seine and 20 set gill net permits fished during 1990.

Since 1961 catches of all five species of Pacific salmon have been documented in this area. In 1970 the Alaska Department of Fish and Game (ADF&G) began sampling the sockeye *Oncorhynchus nerka* and chum salmon *O. keta* catch for age, sex, weight and length (AWL) data. AWL data between 1970 and 1986, 1988 and 1989 has been summarized by Schroeder (1984, 1985, 1986); Morrison (1987); and Yuen et al. (1989, 1990). There was no catch sampling program in 1987. Aerial and ground escapement surveys of pink salmon *O. gorbuscha* began in 1960. Chum salmon surveys began in 1964 and sockeye salmon surveys began in 1969. Annual escapement data are summarized in annual management reports for Lower Cook Inlet Area (e.g., Schroeder and Morrison 1990).

Historically, fishing for a single species within a bay or drainage lasts 3-6 weeks. The sockeye salmon fisheries generally begin in June and overlap the chum salmon fisheries which typically end in August (Table 1). Commercial fishing for chinook salmon *O. tshawytscha* has begun as early as May while fishing for coho salmon *O. kisutch* has extended into September. Current management strategy has established fishing districts which allow for the management of discrete stocks. Commercial harvests are monitored so that predetermined escapement goals are met and the escapement is obtained from all segments of the run. In areas where interception fisheries have occurred historically, the fishery has been allowed to continue provided that the harvests are not detrimental to the individual contributing stocks.

The focus of the Lower Cook Inlet salmon catch-sampling program has been on collecting sockeye and chum salmon AWL data from the purse seine fisheries. However, the chum salmon fishery was not sampled again in 1990 due to its small size and remoteness. Chum salmon catches were low due to poor runs. The only sizable chum catches were in the Tutka Bay, Bruin Bay, and Chenik areas of the Kamishak District. This year, the pink salmon escapement in eight streams were measured for length. Two of the streams, Humpy and Port Graham, were on the Cook Inlet side of the Kenai peninsula while the others, Windy Left, Windy Right, Port Dick, Island, South Nuka, James Lagoon, were on the Gulf of Alaska side.

Catch samples were obtained from selected purse seine fisheries considered to be stock specific. These single-stock fisheries normally account for about 97% of the total sockeye and chum catch from Lower Cook Inlet. The purse seine fisheries in the Halibut Cove, Halibut Cove Lagoon, Tutka Bay, and Douglas River areas, as well as the three set net fisheries in Lower Cook Inlet were not sampled because they did not target on any specific local stock.

Chinook salmon samples were also not collected because the total chinook salmon harvest was expected to be < 1% of the total salmon catch. The coho and pink salmon catch are normally not sampled because they were expected to exhibit no variation in their annual age compositions.

The objectives of the 1990 salmon catch-sampling program were to estimate the sockeye salmon age and size composition of the six fisheries listed in Table 1, obtain age and size composition statistics for the English Bay sockeye escapement, and obtain length statistics for eight pink salmon escapements. This information is used to track changes in the sockeye age composition during the fishing season, allow fishery managers to respond inseason to the unexpected strengths or weaknesses of a particular age group, prepare a preseason forecast of abundance, and to evaluate escapement goals.

METHODS

The Lower Cook Inlet salmon harvest has been managed as 16 independent purse seine fisheries, most of which target on a discrete stock of sockeye or chum salmon. Each of the discrete stocks had its own unique escapement goal. Seven sockeye and eight pink salmon stocks were sampled in 1990. Each stock was considered to be a geographical sampling strata (Figures 2 and 3).

Catch samples were obtained dockside when the tenders were delivering catches from a single stock. If tenders were expected to gather the catch from several fisheries before returning to port, then samples were obtained on board a tender before the fish were put into the hold. The catch sampling crew interviewed the fishermen delivering fish to ascertain the origin of the catch before obtaining any samples. If samples were collected from fish removed from a tender hold, the skipper was also interviewed to confirm that no fish from an earlier sampling period were present. Pink salmon escapement samples were obtained from the spawning streams and sockeye salmon escapement samples were obtained from a hatchery egg take in English Bay.

Fish were measured from mid-eye to the fork of the tail with a digital measuring board to an accuracy of ± 1 mm. Fish were weighed with a hand held spring scale to the nearest 0.1 kg. Sex was determined from external secondary sexual characteristics.

Either scales or otoliths were collected to determine age. Scales were collected from the preferred area of each salmon, approximately 3 rows above the lateral line and posterior of the dorsal fin, when possible. The scales were cleaned and mounted on a gum card, sculptured side up, from which an acetate impression was made. Images of scales were magnified 35x, and the number of annuli per scale were counted to determine age.

The European age designation system was used where the first digit refers to the number of fresh water annuli, the second digit refers to the number of marine annuli, and the total age is the sum of the two digits plus one. For example,

an age-1.2 fish is an 4-year-old fish that spent 2 years in fresh water (first winter spent in the gravel as an alevin) and 2 years at sea.

Sample sizes were set for each sampling strata to estimate age proportions, p_i , from a population of k age groups simultaneously within a specified distance, d , of their true population age proportions, π_i , 90% of the time ($1 - \alpha$). That is,

$$Pr \left\{ \prod_{i=1}^k | p_i - \pi_i | \leq d \right\} \geq 1 - \alpha,$$

where d and α , the confidence level, was chosen to be 0.05 and 0.10, respectively. Thompson (1987) calculated a maximum sample size of 403 for a worst-case scenario when three age groups were present in equal numbers, $d = 0.05$, and $\alpha = 0.10$. Any deviation in the number of age groups or unequal contributions by age group would require a smaller sample size. An *a priori* estimate of age composition, derived from the length frequency of about 200 males, was used to calculate a sample size n such that

$$\sum \alpha_i < \alpha \quad (\alpha = 0.10), \quad (1)$$

where:

$$\alpha_i = 2(1 - \Phi(z_i)), \quad (2)$$

$\Phi(z_i)$ = area under the standard normal distribution, and

$$z_i = d \sqrt{n_i} / \sqrt{p_i(1-p_i)}. \quad (3)$$

The smallest n that satisfied equations (1) to (3) was rounded up to the nearest 40 fish (salmon scales are mounted on gum cards in groups of 40), increased by the observed unreadable rate, and rounded again up to the nearest 40 fish. This represented the total numbers of fish to process.

Sample size n for mean weight of each sex was determined from the methods described by Snedecor and Cochran (1967), i.e.,

$$n = 4 \sigma^2 / L^2,$$

where:

σ = population standard deviation,
and L = allowable error, i.e. 0.1 kg.

Samples sizes for mean weights ranged between 5 and 50 depending on σ . Most sample sizes were around 20 for a 200 fish sample, or 1 in 10 fish, of each sex.

Estimates of standard errors by age group were derived according to the procedures for stratified random sampling described by Snedecor and Cochran (1967).

$$SE = \sqrt{(\sum C_h^2 * s_h^2 / n_h)},$$

where:

C_h^2 = the salmon catch in the h th stratum, and
 s_h^2 = the sample variance in the h th stratum.

A Chi-square test of independence for age categories by location was used to test the hypothesis that both samples were from the same multinomial population. The null hypothesis was rejected at the $\alpha = 0.05$ or 95% level.

Catch totals were obtained from harvest receipts (fish tickets) which document each sale by a licensed fisherman. Escapement indices obtained from aerial and ground surveys were expanded into total escapement estimates.

RESULTS AND DISCUSSION

A total of 203,896 sockeye were harvested in Lower Cook Inlet in 1990. The sockeye escapement was estimated to be 53,130 from aerial and ground surveys. Catch samples were collected from runs to Aialik Lake, Nuka Bay, Port Dick Bay, China Poot Bay, Mikfik Creek, and Chenik Lake. The harvest of these stocks accounted for 76% of the total sockeye salmon catch. The remaining sockeye salmon catch was not sampled because either the runs were small, they did not represent any specific local stock, or they were the initial returns to a hatchery release of a known age.

Altogether, 12 sampling trips were made. The results from the three China Poot trips and from two English Bay trips were pooled to increase their respective sample sizes. After pooling, five of the eight samples met or exceeded the 95% confidence level ($d = 0.05$) and two exceeded the 90% confidence level ($d = 0.05$). The very small sample collected from the English Bay egg take had a confidence level of 0.02 ($d = 0.05$). English Bay was the only stream where otoliths were collected instead of scales. Altogether there were 3,318 readable scales or otoliths collected. Individual sample sizes and dates are summarized in Table 2.

Chum salmon runs were extremely small this year. The chum harvest for all of Lower Cook Inlet, 6,951, was the lowest on record. Chum escapement was 61,069. No samples were collected this year because the multiple trips and expense required to obtain an adequate sample from the numerous small fisheries did not seem justified.

The total pink salmon harvest was 383,670. The escapement was 315,964. All pink salmon were considered to have matured at age 0.2 and consequently age composition samples were not collected. Size composition data, however, was collected from Humpy Creek, Port Graham Creek, Windy Creek Left, Windy Creek Right, Port Dick Creek, Island Creek, James Lagoon, and South Nuka Island Creek. Twenty males and 20 females were measured at each stream.

Eastern District Sockeye Salmon

In the Eastern District, only Aialik Lagoon was opened for sockeye salmon purse seining. The total sockeye harvest from Aialik Bay was 7,682 fish. The total run was approximately 13,382 salmon with an escapement estimate of 5,700. One catch sample was collected on 14 July. The dominant age groups were 1.2, 1.3, and 2.2. There were equal numbers of males and females in the sample. These fish from the Gulf of Alaska side of the Kenai Peninsula tend to be among the larger of the Lower Cook Inlet sockeye salmon. Their overall mean weight was 2.51 kg (Table 3).

Outer District Sockeye Salmon

In the Outer District, sockeye harvests were 5,728 in Nuka Bay, 11,657 in Port Dick and 19 in Port Chatham. The harvests in Nuka Bay were from natural runs of sockeye salmon. Escapements in Nuka Bay were 9,500 estimated in Desire Lake, 5,200 in Delight Lake, and 300 in Ecstasy Lake (a newly formed Lake). The Port Dick enhanced run was the result of a lake stocking project in 1987. Although a catch was reported in Port Chatham, there is no natural run of sockeye salmon in Port Chatham.

Two age and size composition samples were collected from Nuka Bay on 4 and 11 July. The predominant age groups were 1.2, 1.3, 2.2, and 2.3. The Nuka Bay sockeye salmon, also from the Gulf of Alaska side of the Kenai Peninsula, tend to be among the larger of the Lower Cook Inlet sockeye with a mean weight of 2.86 kg in 1990. Over 56% of the samples were female (Table 4).

One size composition sample was obtained from Port Dick. It had a mean weight of 1.64 kg (Table 5). The entire Port Dick run was considered age 1.2 as this was the first returns from the outmigration of age-1.0 smolts in 1988 from a lake stocking of age-0 fry in 1987.

Southern District Sockeye Salmon

The only discrete stock fishery in the Southern District was China Poot. This run to China Poot Bay (Leisure Lake) supported the second largest sockeye fishery in Lower Cook Inlet during 1990. It was the result of an ongoing lake stocking program that began in 1976. Age groups 1.2, 1.3, and 2.2 were common in the catch samples. Mean weight was 1.66 kg and females were 56.46% of the samples (Table 6).

Within China Poot Bay, the commercial harvest was 49,990 and the sport and personal use catch was 3,500 (McKean 1991). Because this lake does not provide access for returning sockeye salmon, the management strategy was to harvest all sockeye salmon in this terminal fishery. In 1990, however, about 1,000 late-arriving sockeye salmon were not harvested.

Adjacent to China Poot Bay, other purse seine fisheries reported mixed stock catches of 2,349 in Halibut Cove Lagoon, 14,016 in Halibut Cove, and 284 in Tutka

Bay. Mean weights reported on the fish tickets were 1.57 g in Halibut Cove Lagoon, 1.76 g in Halibut Cove, and 1.93 kg in Tutka Bay.

The total commercial sockeye salmon harvest in the Southern District was 82,412 and this included catches in the set gill net fisheries (i.e., 3,904 in Halibut Cove, 7,638 in Barabara-Kasitsna, and 4,321 in Seldovia). Sockeye caught in the set net fisheries may be destined for Upper Cook Inlet since their mean weights are larger than those from China Poot Bay, i.e., 2.12, 2.71, and 2.55 kg, respectively, compared 1.74 kg (the China Poot mean weights on the fish tickets were greater than those obtained from the catch samples).

The only sizable escapement of sockeye salmon was 3,300 reported in English Bay. No commercial fishing was allowed on the English Bay stocks during 1990. Otoliths for age composition analysis and lengths were obtained from the English Bay hatchery egg take (Tables 7 and 8). Four age groups, 1.2, 1.3, 2.2, and 2.3, were present in the samples.

Kamishak District Sockeye Salmon

The harvest of local sockeye salmon stocks in the Kamishak District numbered 18 in the Douglas River area, 34 in the Kamishak River area, 9,006 from Mikfik Creek, 70,347 from Chenik Lake, 2,224 from the Bruin Bay area, and 14,465 in the Kirschner Lake area. The corresponding escapements were 600 in the Douglas River for a total run of 618, 200 in the Kamishak River for a total run to 234, 8,800 in Mikfik Creek for a total run of 17,866, and 17,000 in Chenik Lake for a total run of 87,347. The Bruin Bay area had an escapement of 700 in Bruin Bay and another 1,800 in Amakdedori Creek for a total run of 4,727.

Another 243 sockeye salmon were also reported harvested in the Augustine Island area, but these were most likely Upper Cook Inlet salmon because they had a mean weight of 3.04 kg reported on the fish tickets. That was almost double the reported weight from the other Kamishak areas, i.e., 1.59 kg in Douglas River, 2.34 kg in Kamishak River, 1.48 kg in Mikfik (less than the catch sample mean weights below), 1.84 in Chenik (greater than the catch sample mean weights below), 1.74 in Bruin Bay, and 1.45 in Kirschner.

Catch samples were obtained from the harvest of local stocks. A catch sample from the Mikfik run was collected on 4 June. The 1.2 and 1.3 age groups dominated the sample. Mean weight was 1.67 kg which was more than the mean weight reported on the fish tickets above. There were more males (57.89%) than females (Table 9). Two catch samples were obtained from the Chenik run on 29 June and on 15 July. Two age groups, 1.2 and 1.3, also dominated the Chenik catch. Mean weight was 1.74 kg which was less than the mean weight reported on the fish tickets above. There were slightly more males (52.27%) than females (Table 10).

Two of the local sockeye salmon stocks in Kamishak Bay were enhanced runs. Chenik Lake's natural run was supplemented with hatchery reared sockeye salmon juveniles as early as 1978. Kirschner Lake had its first lake stocking of age-0.0 fry in 1987. These juveniles migrated to sea as age-1.0 smolt in 1988 and the 1990 harvest represented the first returns of age-1.2 adults.

Pink Salmon

Spawning pink salmon were measured for length in 8 streams (Tables 11-18). Two of the streams, Humpy Creek and Port Graham, were in the Southern District. The remaining streams, Windy Right, Windy Left, Port Dick (i.e., Head End Creek), Island Creek, South Nuka Island Creek and James Lagoon were in the Outer District. Males exhibited a wider range of lengths than the females but were larger than the females in only half of the streams. Mean lengths (sex combined) were fairly uniform, with six of the samples being in the 440-450 mm range. The smallest mean length was 430 mm from Windy Right and the largest was 467 mm from Humpy Creek. Catch, escapement, and total run estimates of pink salmon for the six streams are presented in Table 19.

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Table 1. Daily catch of sockeye salmon in six Lower Cook Inlet fisheries, 1990.

Month	Day	Aialik Bay	Port Dick Bay	Nuka Bay	China Poot Bay	Mikfik Creek	Chenik Lake
Jun	1 Fri					50	
	4 Mon					4481	
	5 Tue					2923	
	7 Thu					1609	
	21 Thu						699
	22 Fri						544
	23 Sat						40
	25 Mon				43	2	1492
	26 Tue				37		3677
	27 Wed				123		1153
	28 Thu			1956	116		2250
	29 Fri			434	147	1	2567
	30 Sat						380
Jul	2 Mon			442	1000		7196
	3 Tue			561	496		2682
	4 Wed			131	908		4896
	5 Thu	13		286	760		4678
	6 Fri	1316		480	1196		3401
	7 Sat	987			442		2066
	9 Mon			692	3671		8383
	10 Tue			212	1758		4895
	11 Wed				1735		2295
	12 Thu	2958			862		3017
	13 Fri				1467		3746
	14 Sat		154				794
	16 Mon	127			7284		
	17 Tue	134			5600		
	18 Wed				3675		
	19 Thu	1626	5753		2801		
	20 Fri	180			2846		
	21 Sat				514		
	23 Mon			306	6573		
	24 Tue	277		126	1796		3949
	25 Wed	52			978		
	26 Thu			102	919		2296
	27 Fri				248		
	28 Sat						96
	30 Mon				1070		1101
	31 Tue				653		133
Aug	1 Wed		3273		180		
	2 Thu		1583				570
	3 Fri		522				610
	4 Sat		70				
	6 Mon						741
	7 Tue		110				
	8 Wed		69				
	9 Thu		36				
	10 Fri		13				

-continued-

Table 1. (page 2 of 2)

Month	Day	Aialik Bay	Port Dick Bay	Nuka Bay	China Poot Bay	Mikfik Creek	Chenik Lake
Aug	13 Mon		45				
	14 Tue		18				
	15 Wed		6				
	16 Thu		1		2		
	17 Fri		2				
	20 Mon		2				
	22 Tue	2					
	23 Wed	3					
	24 Thu	7					
Total		7682	11657	5728	49900	9066	70347

Table 2. Sample sizes of readable salmon scales and corresponding simultaneous confidence levels for age composition in Lower Cook Inlet, 1990.

Species	Fishery	Dates	Sample Size	Simultaneous Confidence Level	Fraction Unreadable Scales
Sockeye	Aialik	7/14	532	.97	0.11
	Nuka	7/4	477	.97	0.21
		7/11	478	.96	0.17
	Port Dick	7/27	0	100	0.00 ^a
	China Poot	7/23,26,27	441	.95	0.21
	English Bay	8/7,24	90	.02	0.00 ^b
	Mikfik	6/4	406	.92	0.13
	Chenik	6/29	419	.92	0.13
		7/15	475	.97	0.09

^a Only lengths were collected. These fish were returns to a lake stocking project and the age of the fish, 1.2, was already known from the date of the release.

^b Otoliths were used instead of scales.

Table 3. Age, sex, and size composition of sockeye salmon commercial catch from Aialik Bay, 1990.

	Age Group								Total
	0.2	1.1	0.3	1.2	1.3	2.2	1.4	2.3	
Sample period:	14 July								
Males	14	14	14	1,054	722	1,821	29	173	3,841
Percent	0.18	0.18	0.18	13.72	9.40	23.70	0.38	2.25	50.00
Sample Size	1	1	1	73	50	126	2	12	266
Mean Length	478	524	659	541	613	545	610	610	560
Std. Error				5	4	2	4	9	2
Sample Size	1	1	1	73	50	126	2	12	266
Mean Weight				2.48	3.69	2.61		3.10	2.80
Std. Error				0.52	0.19	0.10			0.16
Sample Size				4	7	15		1	27
Females				953	809	1,978	14	87	3,841
Percent				12.41	10.53	25.75	0.18	1.13	50.00
Sample Size				66	56	137	1	6	266
Mean Length				529	579	520	632	594	537
Std. Error				3	4	2		6	2
Sample Size				66	56	137	1	6	266
Mean Weight				1.85	3.10	2.02		3.10	2.23
Std. Error				0.04	0.21	0.08			0.06
Sample Size				6	3	18		1	28
Both Sexes	14	14	14	2,007	1,531	3,799	43	260	7,682
Percent	0.18	0.18	0.18	26.13	19.93	49.45	0.56	3.38	100.00
Sample Size	1	1	1	139	106	263	3	18	532
Mean Length	478	524	659	535	595	532	617	604	549
Std. Error				3	3	2	4	6	1
Sample Size	1	1	1	139	106	263	3	18	532
Mean Weight				2.18	3.38	2.30		3.10	2.51
Std. Error				0.27	0.14	0.06			0.08
Sample Size				10	10	33		2	55

Table 4. Age, sex, and size composition of sockeye salmon commercial catch from Nuka Bay, 1990.

	Age Group					Total
	0.3	1.2	1.3	2.2	1.4	
Sample Period 1: 28 June - 4 July						
Males	288	917	273			1,596
Percent	8.17	26.02	7.75			45.29
Sample Size	39	124	37			216
Mean Length	498	571	499			545
Std. Error	4	2	3			2
Sample Size	39	124	37			216
Mean Weight	2.46	3.64	2.62			3.26
Std. Error	0.16	0.18				0.11
Sample Size	6	7	1		1	15
Females	369	1,130	266		163	1,928
Percent	10.47	32.07	7.55		4.63	54.71
Sample Size	50	153	36		22	261
Mean Length	481	547	483		553	526
Std. Error	4	2	4		5	1
Sample Size	50	153	36		22	261
Mean Weight	1.88	2.97	1.81		2.95	2.60
Std. Error	0.09	0.07	0.15		0.06	0.05
Sample Size	5	21	4		2	32
Both Sexes	657	2,047	539		281	3,524
Percent	18.64	58.09	15.30		7.97	100.00
Sample Size	89	277	73		38	477
Mean Length	488	558	491		555	535
Std. Error	3	1	2		4	1
Sample Size	89	277	73		38	477
Mean Weight	2.13	3.27	2.22		3.26	2.90
Std. Error	0.09	0.09	0.15		0.06	0.05
Sample Size	11	28	5		3	47

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Table 4. (page 2 of 3)

	Age Group						Total
	0.3	1.2	1.3	2.2	1.4	2.3	
Sample Period 2: 5 - 26 July							
Males	14	120	484	180		124	922
Percent	0.64	5.44	21.96	8.17		5.63	41.83
Sample Size	3	26	105	39		27	200
Mean Length	585	496	586	509		584	559
Std. Error	18	6	3	4		6	2
Sample Size	3	26	105	39		27	200
Mean Weight		2.05	3.44	2.77		3.70	3.16
Std. Error		0.15	0.13	0.18			0.08
Sample Size		2	8	3		1	14
Females	28	198	659	235	5	157	1,282
Percent	1.27	8.98	29.90	10.66	0.23	7.12	58.17
Sample Size	6	43	143	51	1	34	278
Mean Length	553	484	553	480	549	548	528
Std. Error	8	4	2	3		4	2
Sample Size	6	43	143	51	1	34	278
Mean Weight		1.96	2.71	1.99		3.20	2.52
Std. Error		0.17	0.06	0.07		0.30	0.06
Sample Size		5	17	9		2	33
Both Sexes	42	318	1,143	415	5	281	2,204
Percent	1.91	14.43	51.86	18.83	0.23	12.75	100.00
Sample Size	9	69	248	90	1	61	478
Mean Length	564	488	567	492	549	564	541
Std. Error	8	3	2	2		4	1
Sample Size	9	69	248	90	1	61	478
Mean Weight		1.99	3.02	2.33		3.42	2.79
Std. Error		0.12	0.07	0.09		0.30	0.05
Sample Size		7	25	12		3	47

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Table 4. (page 3 of 3)

	Age Group						Total
	0.3	1.2	1.3	2.2	1.4	2.3	
All Periods Combined:							
Males	14	408	1,401	453		242	2,518
Percent	0.24	7.12	24.46	7.91		4.22	43.96
Sample Size	3	65	229	76		43	416
Mean Length	585	497	576	503		572	550
Std. Error	18	3	2	2		4	1
Sample Size	3	65	229	76		43	416
Mean Weight		2.34	3.57	2.68		3.70	3.22
Std. Error		0.12	0.12	0.18			0.07
Sample Size		8	15	4		2	29
Females	28	567	1,789	501	5	320	3,210
Percent	0.49	9.90	31.23	8.75	0.09	5.59	56.04
Sample Size	6	93	296	87	1	56	539
Mean Length	553	482	549	481	549	550	527
Std. Error	8	3	1	2		3	1
Sample Size	6	93	296	87	1	56	539
Mean Weight		1.91	2.87	1.89		3.07	2.57
Std. Error		0.09	0.05	0.09		0.15	0.04
Sample Size		10	38	13		4	65
Both Sexes	42	975	3,190	954	5	562	5,728
Percent	0.73	17.02	55.69	16.66	0.09	9.81	100.00
Sample Size	9	158	525	163	1	99	955
Mean Length	564	488	561	492	549	559	537
Std. Error	8	2	1	2		3	1
Sample Size	9	158	525	163	1	99	955
Mean Weight		2.09	3.18	2.27		3.34	2.86
Std. Error		0.07	0.06	0.08		0.15	0.04
Sample Size		18	53	17		6	94

Table 5. Length frequency and size statistics for sockeye salmon commercial catch from Port Dick, 1990.

Length(mm)	Male	Female	Sex Combined
440	1	1	2
450	1	1	2
460		2	2
470	3	2	5
480	8	5	13
490	7	1	8
500	5	3	8
510	5	3	8
520			
530	1	1	2
Mean Length(mm)	485	480	483
Std. Dev.	19	21	20
Mean Weight(g)	1.69	1.56	1.64
Std. Dev.	0.22	0.16	0.21

Table 6. Age, sex, and size composition of sockeye salmon commercial catch from China Poot Bay, 1990.

	Age Group						Total
	1.1	1.2	2.1	1.3	2.2	2.3	
Sample period:	23 - 27 July						
Males	540	7,429	203	1,823	2,904	68	12,967
Percent	1.81	24.94	0.68	6.12	9.75	0.23	43.54
Sample Size	8	110	3	27	43	1	192
Mean Length	361	474	352	554	479	530	480
Std. Error	4	2	5	5	4		2
Sample Size	8	110	3	27	43	1	192
Mean Weight	3.85	1.54		2.83	1.70		1.86
Std. Error	3.15	0.06		0.59	0.23		0.17
Sample Size	2	11		5	3		21
Females		11,008		1,283	4,457	68	16,816
Percent		36.96		4.31	14.96	0.23	56.46
Sample Size		163		19	66	1	249
Mean Length		472		546	473	574	478
Std. Error		2		6	2		1
Sample Size		163		19	66	1	249
Mean Weight		1.49			1.51	2.60	1.50
Std. Error		0.05			0.06		0.04
Sample Size		17			6	1	24
Both Sexes	540	18,437	203	3,106	7,361	136	29,783
Percent	1.81	61.90	0.68	10.43	24.72	0.46	100.00
Sample Size	8	273	3	46	109	2	441
Mean Length	361	473	352	550	475	552	479
Std. Error	4	1	5	4	2		1
Sample Size	8	273	3	46	109	2	441
Mean Weight	3.85	1.51		2.83	1.58	2.60	1.66
Std. Error	3.15	0.04		0.59	0.10		0.08
Sample Size	2	28		5	9	1	45

Table 7. Age frequency for sockeye salmon escapement from English Bay, 1990.

Age	Frequency	Percent
1.2	11	12
1.3	30	33
2.2	15	16
2.3	34	39
Total	90	100

Table 8. Length frequency for sockeye salmon escapement from English Bay, 1990.

Length	Male	Female	Sex Combined
430		1	1
440		1	1
450		4	4
460	2	2	4
470		1	1
480		2	2
490			
500	1	1	2
510	3	7	10
520	2	5	7
530		3	3
540	6	7	13
550	1	7	8
560	2	7	9
570	3	3	6
580	6		6
590	5		5
600	2		2
610			
620	4		4
630	1		1
Mean	560	519	536
SD	42	39	45

Table 9. Age, sex, and size composition of sockeye salmon commercial catch from Mikfik Creek, 1990.

	Age Group				Total
	1.2	1.3	2.2	2.3	
Sample period:	4 June				
Males	2,188	1,965	313	782	5,248
Percent	24.13	21.67	3.45	8.63	57.89
Sample Size	98	88	14	35	235
Mean Length	441	504	471	510	477
Std. Error	3	3	8	4	2
Sample Size	98	88	14	35	235
Mean Weight	1.45	1.91	1.25	1.80	1.66
Std. Error	0.07	0.09	0.15		0.05
Sample Size	8	9	2	1	20
Females	1,629	1,541	201	447	3,818
Percent	17.97	17.00	2.22	4.93	42.11
Sample Size	73	69	9	20	171
Mean Length	438	511	456	510	477
Std. Error	3	3	10	4	2
Sample Size	73	69	9	20	171
Mean Weight	1.34	1.96	1.70	1.95	1.68
Std. Error	0.05	0.06		0.25	0.04
Sample Size	9	8	1	2	20
Both Sexes	3,817	3,506	514	1,229	9,066
Percent	42.10	38.67	5.67	13.56	100.00
Sample Size	171	157	23	55	406
Mean Length	440	507	465	510	477
Std. Error	2	2	6	3	1
Sample Size	171	157	23	55	406
Mean Weight	1.40	1.93	1.43	1.85	1.67
Std. Error	0.05	0.06	0.15	0.25	0.03
Sample Size	17	17	3	3	40

Table 10. Age, sex, and size composition of sockeye salmon commercial catch from Chenik Lake, 1990.

	Age Group							Total
	0.2	0.3	1.2	0.4	1.3	2.2	2.3	
Sample Period 1: 21 June - 6 July								
Males	90	450	10,173	90	7,292	90	450	18,635
Percent	0.24	1.19	26.97	0.24	19.33	0.24	1.19	49.40
Sample Size	1	5	113	1	81	1	5	207
Mean Length	417	552	500	520	559	476	554	526
Std. Error		26	3		3		8	2
Sample Size	1	5	113	1	81	1	5	207
Females		630	8,012		9,544	540	360	19,086
Percent		1.67	21.24		25.30	1.43	0.95	50.60
Sample Size		7	89		106	6	4	212
Mean Length		537	479		536	491	523	511
Std. Error		7	3		2	7	14	2
Sample Size		7	89		106	6	4	212
Both Sexes	90	1,080	18,185	90	16,836	630	810	37,721
Percent	0.24	2.86	48.21	0.24	44.63	1.67	2.15	100.00
Sample Size	1	12	202	1	187	7	9	419
Mean Length	417	543	491	520	546	489	540	518
Std. Error		11	2		2	7	8	1
Sample Size	1	12	202	1	187	7	9	419

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Table 10. (page 2 of 3)

	Age Group						Total	
	0.2	0.3	1.2	0.4	1.3	2.2		2.3
Sample Period 2: 7 July - 6 August								
Males			14,699		2,267	1,030	137	18,133
Percent			45.05		6.95	3.16	0.42	55.58
Sample Size			214		33	15	2	264
Mean Length			488		538	505	561	495
Std. Error			2		3	6	41	2
Sample Size			214		33	15	2	264
Mean Weight			1.82		2.37			1.89
Std. Error			0.06		0.14			0.05
Sample Size			25		3			28
Females			12,570		1,305	618		14,493
Percent			38.53		4.00	1.89		44.42
Sample Size			183		19	9		211
Mean Length			463		513	479		468
Std. Error			2		4	9		2
Sample Size			183		19	9		211
Mean Weight			1.52		2.10	1.30		1.56
Std. Error			0.04					0.03
Sample Size			16		1	1		18
Both Sexes			27,269		3,572	1,648	137	32,626
Percent			83.58		10.95	5.05	0.42	100.00
Sample Size			397		52	24	2	475
Mean Length			476		529	495	561	483
Std. Error			1		3	5	41	1
Sample Size			397		52	24	2	475
Mean Weight			1.68		2.27	1.30		1.74
Std. Error			0.04		0.14			0.03
Sample Size			41		4	1		46

-Continued-

Table 10. (page 3 of 3)

	Age Group							Total
	0.2	0.3	1.2	0.4	1.3	2.2	2.3	
All Periods Combined:								
Males	90	450	24,872	90	9,559	1,120	587	36,768
Percent	0.13	0.64	35.36	0.13	13.59	1.59	0.83	52.27
Sample Size	1	5	327	1	114	16	7	471
Mean Length	417	552	493	520	554	502	555	511
Std. Error		26	1		3	6	11	1
Sample Size	1	5	327	1	114	16	7	471
Mean Weight			1.82		2.37			1.89
Std. Error			0.06		0.14			0.05
Sample Size			25		3			28
Females		630	20,582		10,849	1,158	360	33,579
Percent		0.90	29.26		15.42	1.65	0.51	47.73
Sample Size		7	272		125	15	4	423
Mean Length		537	469		534	485	523	492
Std. Error		7	2		2	6	14	1
Sample Size		7	272		125	15	4	423
Mean Weight			1.52		2.10	1.30		1.56
Std. Error			0.04					0.03
Sample Size			16		1	1		18
Both Sexes	90	1,080	45,454	90	20,408	2,278	947	70,347
Percent	0.13	1.54	64.61	0.13	29.01	3.24	1.35	100.00
Sample Size	1	12	599	1	239	31	11	894
Mean Length	417	543	482	520	543	494	543	502
Std. Error		11	1		2	4	9	1
Sample Size	1	12	599	1	239	31	11	894
Mean Weight			1.68		2.27	1.30		1.74
Std. Error			0.04		0.14			0.03
Sample Size			41		4	1		46

Table 11. Length frequency and size statistics for pink salmon escapement from Humpy Creek, 1990.

Length (mm)	Male	Female	Combined Sex
410	1	0	1
420	0	0	0
430	2	0	2
440	1	0	1
450	3	1	4
460	4	3	7
470	1	6	7
480	4	3	7
490	0	3	3
500	3	4	7
510	0	0	0
520	0	1	1
Mean Length	458	475	467
Std. Dev.	25	17	23

Table 12. Length frequency and size statistics for pink salmon escapement from Port Graham Creek, 1990.

Length (mm)	Male	Female	Combined Sex
390	1	0	1
400	0	0	0
410	0	1	1
420	1	3	4
430	5	3	8
440	2	3	5
450	5	4	9
460	0	3	3
470	1	1	2
480	1	2	3
490	2	0	2
500	2	0	2
Mean Length	447	442	445
Std. Dev.	27	19	24

Table 13. Length frequency and size statistics for pink salmon escapement from Windy Right Creek, 1990.

Length(mm)	Male	Female	Sex Combined
370	1	0	1
380	0	0	0
390	0	0	0
400	1	0	1
410	2	1	3
420	6	3	9
430	2	5	7
440	5	4	9
450	2	0	2
460	0	5	5
470	0	1	1
480	1	1	2
Mean Length	423	437	430
Std. Dev.	22	19	22

Table 14. Length frequency and size statistics for pink salmon escapement from Windy Left Creek, 1990.

Length(mm)	Male	Female	Combined Sex
380	1	0	1
390	0	0	0
400	3	0	3
410	1	0	1
420	1	0	1
430	3	2	5
440	2	3	5
450	4	7	11
460	2	1	3
470	2	3	5
480	0	2	2
490	1	1	2
500	0	1	1
Mean Length	436	454	445
Std. Dev.	24	19	23

Table 15. Length frequency and size statistics for pink salmon escapement from Port Dick Creek, 1990.

Length(mm)	Male	Female	Combined Sex
400	1	0	1
410	2	0	2
420	0	0	0
430	1	0	1
440	2	2	4
450	4	3	7
460	2	3	5
470	3	7	10
480	2	4	6
490	2	1	3
500	1	0	1
Mean Length	451	462	456
Std. Dev.	23	14	23

Table 16. Length frequency and size statistics for pink salmon escapement from Island Creek, 1990.

Length(mm)	Male	Female	Sex Combined
410	2	0	2
420	0	0	0
430	2	0	2
440	1	3	4
450	2	1	3
460	8	4	12
470	1	7	8
480	2	3	5
490	2	2	4
Mean Length	453	461	457
Std. Dev.	22	15	19

Table 17. Length frequency and size statistics for pink salmon escapement from South Nuka Island Creek, 1990.

Length(mm)	Male	Female	Combined Sex
410	1	0	1
420	2	1	3
430	1	2	3
440	0	2	2
450	4	4	8
460	2	6	8
470	3	1	4
480	1	1	2
490	4	1	5
500	1	1	2
510	0	0	0
520	0	1	1
530	1	0	1
Mean Length	461	455	458
Std. Dev.	30	24	27

Table 18. Length frequency and size statistics for pink salmon escapement from James Lagoon Creek, 1990.

Length(mm)	Male	Female	Combined Sex
380	1	0	1
390	0	0	0
400	0	0	0
410	0	1	1
420	1	1	2
430	4	4	8
440	4	4	8
450	1	4	5
460	4	2	6
470	0	2	2
480	2	2	4
490	1	0	1
500	1	0	1
510	1	0	1
Mean Length	449	444	446
Std. Dev.	30	18	25

Table 19. Pink salmon catch, escapement, and total run estimates for six Lower Cook Inlet streams, 1990.

Fishery	Catch	Escapement	Total Run
SOUTHERN DISTRICT			
Humpy Creek	0	27,042	27,042
Port Graham	0	20,053	20,053
OUTER DISTRICT			
Windy Bay			
Windy River Left		7,521	
Windy River Right		7,097	
Windy Bay Total	0	14,618	14,618
Port Dick			
Port Dick (Head End Creek)		41,706	
Slide Creek		7,992	
Middle Creek		234	
Island Creek		25,000	
Port Dick Total	169,056	74,932	243,988
South Nuka Island	0	13,299	13,299
East Nuka Bay			
James Lagoon		3,787	
Desire Lake		1,000	
Delight Lake		400	
East Nuka Bay Total	161	5,187	5,348

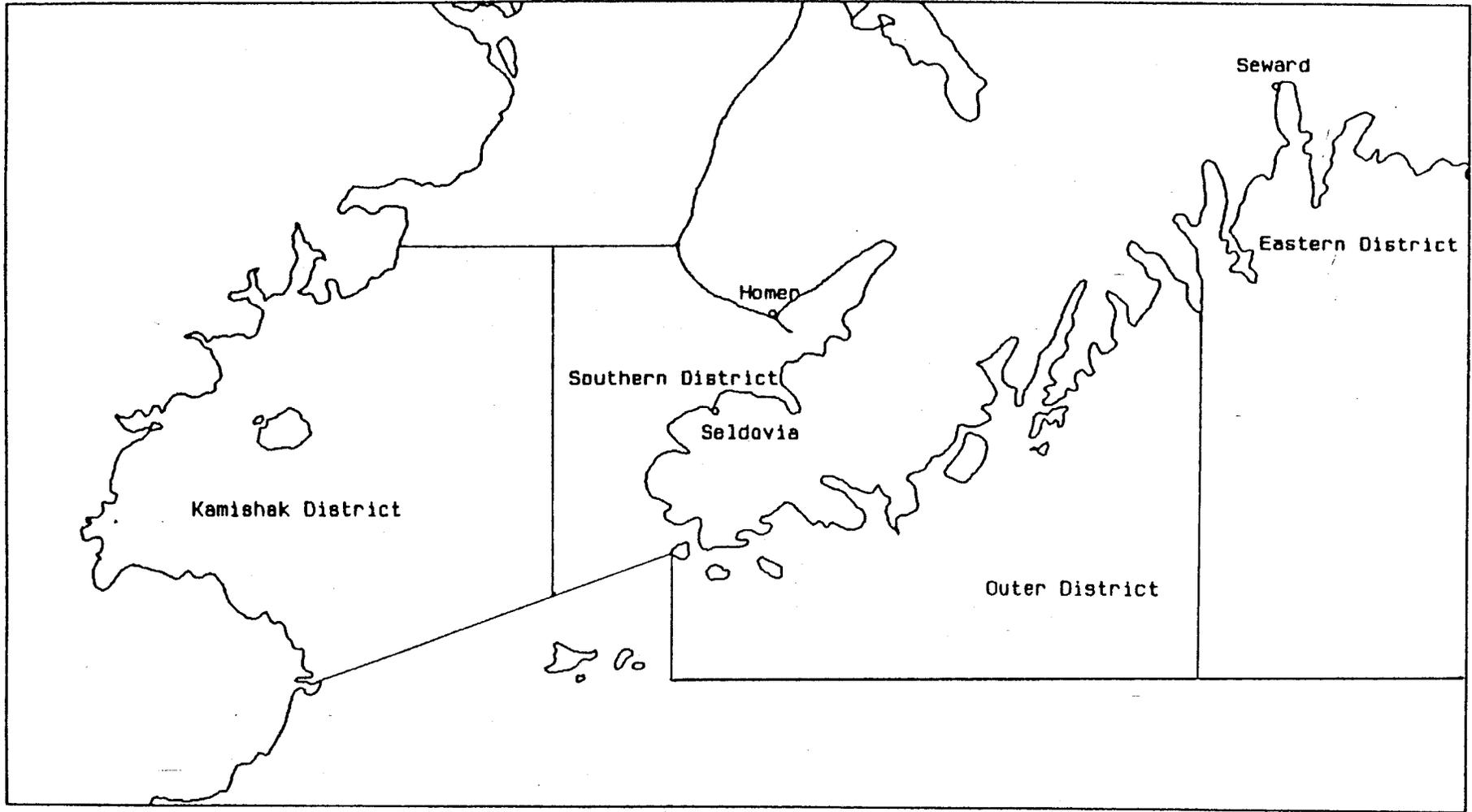


Figure 1. Kamishak, Southern, Outer, and Eastern Districts of the Lower Cook Inlet Management Area.



Figure 2. Salmon catch sampling sites in the Southern, Outer, and Eastern Districts, 1990.

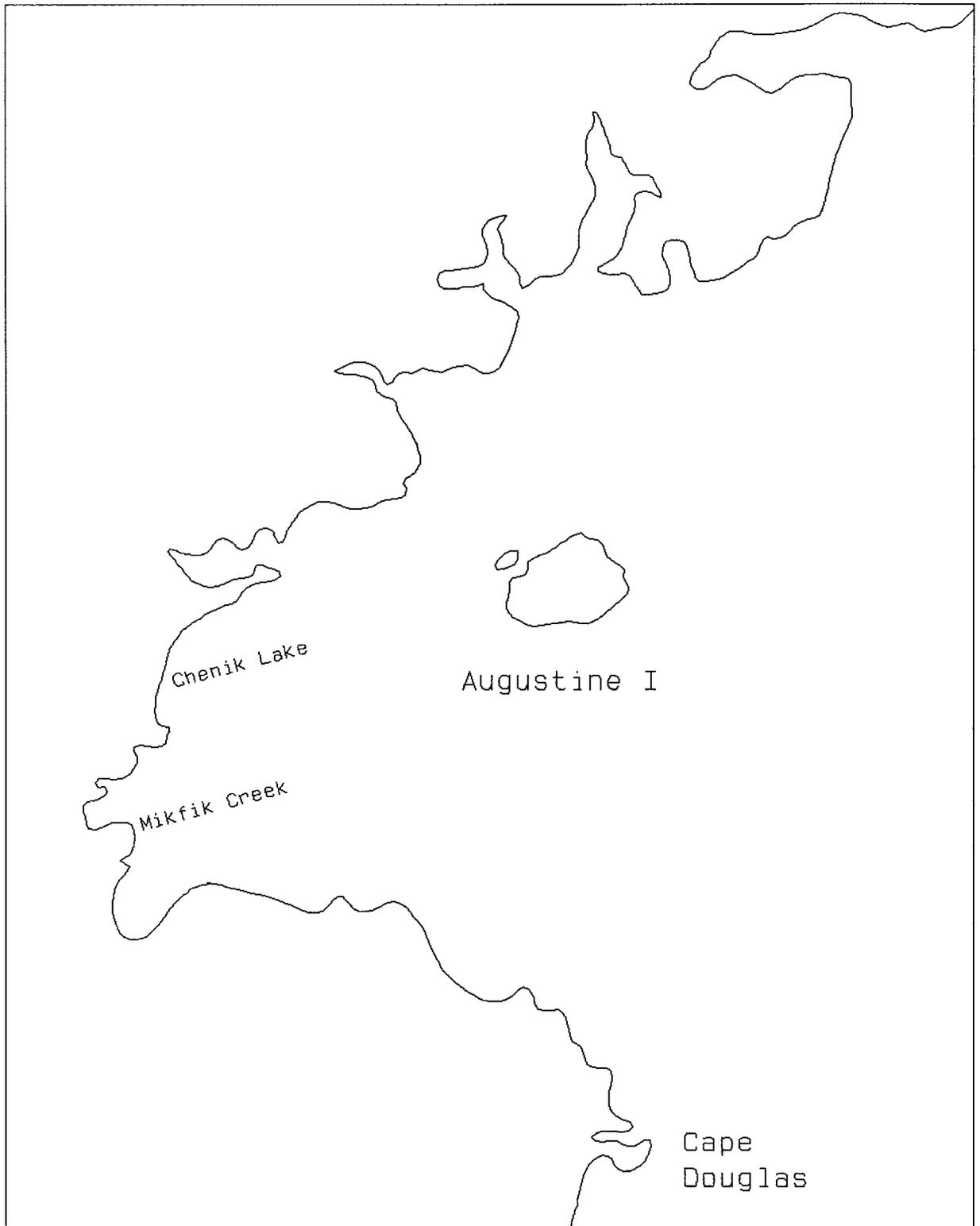


Figure 3. Salmon catch sampling sites in the Kamishak District, 1990.

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