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Abundance, Age, Sex, and Size of Norton Sound and Kotzebue Sound Salmon Catch and Escapement, 1987

by

Helen H. Hamner

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ABSTRACT

The 1987 commercial and subsistence harvest of the five species of Pacific salmon (*Oncorhynchus*) found in the Norton Sound-Kotzebue Sound Area are presented by age, sex, and length. The 1987 Norton Sound District commercial harvest totaled 136,283 salmon and was comprised of 7,080 chinook, 102,457 chum, 2,260 pink, 207 sockeye, and 24,279 coho salmon. Harvests of all salmon species were below their 1982-86 averages. Escapements of all salmon except coho salmon were below escapement goals in Norton Sound. The chinook salmon harvest was predominantly age-1.4 (70.8%). Chum salmon catches in Norton Sound consisted of nearly equal percentages of age-0.3 and age-0.4 and these two age classes comprised 95% of the catch. The coho harvest consisted of more age-3.1 and age-1.1 fish than has been observed in previous years. In the Kotzebue District, the harvest totaled 109,467 chum salmon and 44 chinook salmon. The chum salmon harvest was the lowest since 1969. Escapements of chum salmon in the Kotzebue District were below escapement goals. The age composition of chum salmon caught in the Kotzebue District commercial catch was 14.2% age 0.2, 43.5% age-0.3, 30.7% age-0.4, and a record 11.6% age-0.5. Age-0.5 chum salmon have historically comprised less than 1% of the catch.

KEY WORDS: Norton Sound, Kotzebue Sound, harvest, escapement, *Oncorhynchus tshawytscha*, *O. nerka*, *O. keta*, *O. kisutch*, *O. gorbuscha*, age-size-sex composition, fishery synopsis

INTRODUCTION

The Norton Sound, Port Clarence, and Kotzebue Sound commercial salmon management districts include all waters of Alaska from Canal Point Light, south of Stebbins, to Point Hope, north of Kotzebue. The Port Clarence District located within this region has been closed to commercial salmon fishing since 1966. The Norton Sound District is comprised of all waters of Alaska from Canal Point Light north to Cape Douglas (Figure 1). This district consists of six subdistricts: Nome (Subdistrict 1), Golovin (Subdistrict 2), Moses Point (Subdistrict 3), Norton Bay (Subdistrict 4), Shaktoolik (Subdistrict 5), and Unalakleet (Subdistrict 6). The Kotzebue Sound District includes all waters of Alaska from Point Hope to Cape Prince of Wales, but commercial salmon fishing is restricted to ocean waters north of the Baldwin Peninsula (Figures 2 and 3).

Five species of Pacific salmon are found in the Norton and Kotzebue Sound areas. In descending order of economic importance (average ex-vessel value) are chum salmon (*Oncorhynchus keta*), chinook salmon (*O. tshawytscha*), coho salmon (*O. kisutch*), pink salmon (*O. gorbuscha*), and sockeye salmon (*O. nerka*). Numerically, the even-year returns of pink salmon are the largest of the five species followed by chum, coho, chinook, and sockeye salmon.

Knowledge of the magnitude, distribution, timing and age-sex-size composition of both the harvest and escapement by stock is fundamental to managing salmon fisheries and achieving full production; i.e., salmon recruitment is directly related to the number of fish in each age, sex, and size category of the breeding population (escapement). Therefore, the age, sex, and size composition for selected harvests and escapements in the Norton and Kotzebue Sound areas have been estimated annually since 1962 and are presented in this report for 1987.

Basic fishery statistics for the Norton Sound-Kotzebue Sound Area are available from several additional sources. Commercial and subsistence harvest data for the years 1961-1987 are available from ADF&G (1988). Historical escapement data (1958-1987) are available in a computerized data base (Lean and Wyatt 1987). In addition, the results from Norton Sound escapement enumeration projects are analyzed and reported yearly for the Unalakleet River (Bue and Lean 1988) and the Kwiniuk River (Merkouris and Lean 1988). The North River counting tower project, which was operated in 1972, 1973, 1974, 1984, and 1985, was most recently summarized by Lean (1987). Two Kotzebue area escapement projects were discontinued in 1984: the Squirrel River counting tower, which was operated from 1982 to 1984, was most recently summarized by Dinnocenzo (1984) and Noatak River sonar, which operated from 1982 to 1984, has been reviewed by several authors (D. Mesiar, Alaska Department of Fish and Game, Anchorage, personal communication; Bigler 1985a; Berning et al. 1987). A test fishing project established on the Noatak River in 1987, has been described by Kneupfer (1987). A historical summary of age, sex and size composition of salmon from Kotzebue Sound from 1962 to 1983 is provided by Bigler (1985b). Age, sex, and size composition of salmon is summarized for 1984, 1985, and 1986 (Lean et al. 1984; Hamner 1987, Bigler and Lean 1986; Hamner In press). Age, sex, and size data from 1962-1983 are summarized in the report series entitled ADF&G Arctic-Yukon-Kuskokwim Region, Age-Sex-Size Composition of Salmon.

METHODS

Harvest and Escapement

Commercial catch data presented in this report were compiled from harvest receipts (fish tickets) which document each sale by a licensed fisherman. These data were summarized by microcomputer in the Nome area office and the Kotzebue seasonal office during the commercial fishing season.

Subsistence catches have not been monitored as closely as commercial catches in the Norton Sound-Kotzebue Sound Area. Due to budget constraints, no subsistence harvest surveys were conducted in the Norton Sound area in 1987. A subsistence permit is required to subsistence fish in the Nome Subdistrict and catch limits are set by permit for each river and species. In the Kotzebue area, household interviews were conducted in several villages during September. The members of each household were asked how many of each species was caught for subsistence use. During these surveys it was assumed that fishermen could accurately recall their harvests which may have occurred over several weeks. The reported subsistence harvests are estimates of total catch for each village. A mean catch per fishing family was calculated for each village surveyed. This mean was applied to those families known to have fished but who were not available for interview.

Aerial surveys are the primary method for monitoring salmon escapement in the Norton Sound and Kotzebue Sound drainages. Aerial surveys of escapements are not a total enumeration of salmon spawning abundance. Ideally, a series of surveys is flown and counts on approximately the same dates can be compared across years. Therefore, aerial survey escapement counts can be regarded as an index of relative abundance for the surveyed stream and can be used for interannual or interdrainage comparisons of escapement. Counting towers provide a better estimate of total escapement. Test fishing catches provide an index of escapement and species composition for turbid or large drainages that are difficult to count visually. Either test catches or catch per unit of effort (CPUE) is used as an index of relative abundance for comparisons of escapements across years. Both test fisheries and counting towers provide data on migratory timing. In 1987, a counting tower on the Kwiniuk River in the Moses Point Subdistrict and test fishing projects on the Unalakleet River in the Unalakleet Subdistrict and the Noatak River in the Kotzebue District were used to monitor escapements.

Age, Sex, and Length Data Collection

Chum salmon, which comprise the bulk of the commercial catch, were sampled in the Kotzebue District, which consists of only one subdistrict, and in three subdistricts of Norton Sound. Salmon were also sampled at counting towers, in test fisheries, and on the spawning grounds. A limited sample was collected from the Kotzebue subsistence catch.

Only scales, for age analysis, were collected from the Noatak River test fish and Kotzebue Sound subsistence catch samples. Most other salmon were sampled for age, sex, and length. Sex was determined by examining external morphology,

including the snout, vent, body symmetry and extruded eggs, ovipositor or milt of live fish. The sex of dead fish was determined by examining the gonads. Fish length from mid-eye to fork-of-tail was measured to the nearest millimeter.

Age was determined from scales removed from the left side of the fish in an area above the lateral line and crossed by a diagonal from the posterior insertion of the dorsal fin to the anterior insertion of the anal fin. Scales were mounted on gum cards and impressions made in cellulose acetate. Ages were reported in European notation (the first digit refers to the freshwater age and does not include the year spent in the gravel; the second digit refers to the ocean age).

A pre-season outlook based on sibling returns to the commercial fishery has been calculated each year for the Kotzebue District. Due to an exceptionally poor return, only nine fishing periods were scheduled during the 1987 season, compared to a normal schedule of fifteen periods. In addition, chum salmon in the Kotzebue District exhibit migratory timing stratified by age, with older fish dominating in the early segment of the migration and declining proportionately during the course of the migration. Depending on the length and date of closures, a disproportionate segment of a particular age class may be missed. For example, for years in which the fishery closed early, it is likely that a major portion of the 0.2 age class was not sampled. Therefore, the number of fish that would have been caught had the fishery remained open was estimated for each missed period using the 1981-86 average proportion of catch for the missed period. The age composition of the missed catch was estimated using subsistence catches, interpolation and the Noatak test fish age composition.

Sample Size

Minimum sample size goals within temporal strata were derived for each species of interest (L. K. Brannian, Alaska Department of Fish and Game, Anchorage, personal communication). The objective was to obtain an estimated proportion by age class that was within 5 percentage points of the true proportion 90% of the time. This resulted in a per strata sample size goal for readable scales of 502 fish for species with three major age classes (chinook salmon), 450 fish for species with two major age classes (chum salmon), and 247 fish for species with one major age class (coho salmon). Minor age classes comprising less than 10% of the return were pooled and treated as a single age class in this analysis. Actual collection goals required that sample sizes be increased to include an expected proportion of unreadable scales. In cases where the total number of readable samples collected was less than the goal, data from several strata were pooled and a standard error of the mean was calculated.

RESULTS

Data, summarily presented below, are more fully detailed in Appendix A for Norton Sound and Appendix B for Kotzebue Sound.

Norton Sound

Commercial and Subsistence Harvest

The 1987 Norton Sound commercial salmon harvest totaled 136,283 fish and was comprised of 7,080 chinook, 102,457 chum, 2,260 pink, 207 sockeye, and 24,279 coho salmon (Table 1). Harvests of all salmon species were below their 1982-86 averages. Although Norton Sound consists of six subdistricts, salmon are primarily harvested in the Golovin (35%), Unalakleet (26%), Shaktoolik (17%) and Moses Point (14%) Subdistricts (Tables 2-7).

The chinook salmon harvest was 30% below the 1982-86 average and comprised 5% of the district total salmon harvest. The majority (77%) of the catch was taken in the Unalakleet and Shaktoolik Subdistricts. Poor returns required that fishing time be reduced in these subdistricts to allow for additional escapement. Most fishermen in the Unalakleet and Shaktoolik Subdistricts targeted on chinook salmon, especially from mid-June to early July, using set gill nets with 210 mm (8-1/4 in) stretched mesh. North of Shaktoolik Subdistrict, fishermen used 149 mm (5-7/8 in) mesh gill nets throughout the fishing season and targeted on chum salmon with chinook salmon harvested incidentally.

Chum salmon, the most economically important (ex-vessel value) species in Norton Sound, comprised 75% of the total district harvest and the 1987 harvest was 45% below the 1982-86 average. The majority of catch was taken between June 25 and July 20. Golovin fishermen landed 43% of the district chum catch, followed by Moses Point (17%) and Unalakleet (17%) fishermen. Poor chum and pink salmon returns required that commercial fishing time be reduced in the Nome, Moses Point, Shaktoolik and Unalakleet Subdistricts. Sport and subsistence fishing was also restricted or closed in an effort to increase escapements.

Pink salmon returns in Norton Sound follow an even-year cycle of high abundance. The 1987 harvest was the lowest on record and was 98% below the 1982-86 average of 94,296 pink salmon. Pink and sockeye salmon comprised less than 2% and 1%, respectively, of the district total salmon catch.

The coho salmon harvest was 45% below the 1982-86 average and accounted for 18% of the district total salmon catch. The bulk of the catch occurred between August 7 and August 31. Fishermen in the Unalakleet Subdistrict harvested 62% of the catch, followed by Shaktoolik fishermen with 26%. Commercial fishing time was reduced in both of these subdistricts in 1987 due to low returns.

Although many of the 13,000 residents of the Norton Sound area are dependent to varying degrees on the fish and game resources of the area, subsistence catches have not been monitored since 1983 except in the Nome Subdistrict. Prior to 1983 the Department conducted annual household surveys in many of the villages in the

area. For the last 5 years in which complete surveys were conducted (1978-82), the average subsistence catch in the Norton Sound area was 73,000 salmon of all species combined; since not all fishermen are contacted, this should be considered a minimum estimate. In the Nome subdistrict, the subsistence permit requires that fishermen document their harvest by species. Two-hundred and twenty-seven subsistence permits were issued in 1987. One-hundred and thirty-five of these were fished and resulted in a harvest of 10,818 salmon: 200 chinook, 107 sockeye, 1,100 coho, 1,084 pink and 8,327 chum salmon (Table 8).

Escapement Abundance

Chinook escapements were only half of the escapement goals in the Unalakleet and Shaktoolik Subdistricts, where the major chinook salmon-producing streams are located. Conversely, Moses Point, Norton Bay and Golovin chinook escapements were above historic levels (1962-86).

Chum salmon escapements were below escapement goals in all rivers for which escapement goals have been established (Table 9). Escapements were generally below average in all subdistricts, when compared to past surveys. Very few pinks were seen in any Norton Sound streams.

Coho salmon escapements were believed adequate (ADF&G 1988). Since historical data for coho salmon escapements is very incomplete, escapement goals and historic averages have not yet been determined.

Age, Sex, and Length Composition

Comparisons of sex and length composition were not substantiated by statistical testing. Commercial catch samples were collected in three subdistricts in 1987: Unalakleet, Shaktoolik and Moses Point. Chinook samples were collected in both the Unalakleet commercial and test fisheries.

Chinook salmon from the commercial catch were predominantly (70.8%) age-1.4 from the 1981 brood year (Table 10). Only 162 samples were collected from the commercial fishery and too few samples (39) were collected from test net catches to accurately assess the age, sex or length of chinook salmon in the test fishery. Unalakleet and Shaktoolik fishermen target on chinook salmon with 210 mm (8-1/4 in) mesh gill nets for at least the first commercial opening whereas test net catches are taken with a 149 mm (5-1/2 in) mesh gill net. The Unalakleet commercial chinook catch consisted of 56.5% females.

Chum salmon were sampled in Moses Point and the Unalakleet commercial and test fisheries (Table 11). Age composition in all three fisheries were similar. All catches were dominated (95%) by age-0.3 and age-0.4 which were present in nearly equal percentages. Less than 1% of catches were age-0.2 fish. The percentage of age-0.5 ranged from 2.5% to 4.6%. Nearly equal percentages of males and females were taken in the Unalakleet commercial catch. A greater percentage (65.4%) of males were taken in the test fishery. The Moses Point commercial catch consisted of fewer males (44.5%) than either the Unalakleet commercial or test fishery catches.

Coho salmon were sampled in the Unalakleet commercial and test fisheries (Table 12). Age-2.1 fish dominated both fisheries: 64.4% and 64.7% in the commercial and test fisheries, respectively. The catch consisted of more age-3.1 and -1.1 fish than has been observed in previous years. Males and females were caught in nearly equal numbers in the Unalakleet commercial fishery. The test fish catches consisted of slightly more females (53.8%); however, only a small (119) number of fish were sampled.

Kotzebue Sound

Commercial and Subsistence Harvest

The 1987 commercial harvest of salmon in the Kotzebue District totaled 109,467 chum salmon and 44 chinook salmon (Table 13). The harvest was the lowest since 1969 and is 32% of the 1982-86 average of 339,320 chum salmon. Due to the exceptionally weak return, several closures were necessary in order to allow additional fish to reach the spawning grounds. Only nine fishing periods were scheduled in 1987 compared to a normal season of fifteen periods. Catches were well below the 7-year (1980-86) average throughout most of the season. The peak catch occurred during the 5th period (8/3 - 8/4) when 27,084 chum salmon were sold. Commercial fishing gear in the Kotzebue area consists of set gill nets of 140 mm (5-1/2 in) to 152 mm (6 in) stretched mesh and up to 274 m (150 fm) in aggregate length per fisherman.

Door-to-door subsistence fishermen interviews were conducted in two Kobuk River villages, Shungnak and Noorvik, and one Noatak River village, Noatak, during the last three weeks of September (Table 14). Fishermen from the upper Kobuk River village of Shungnak reported better than average catches. The average catch per fishing family in Shungnak was 329 chum salmon compared to the 1982-86 average of 242. Relatively stable water levels allowed for sustained effort as compared to previous seasons when nets had to be pulled for 2-3 weeks because of high water. Noorvik fishermen reported a below average catch of 189 chum salmon per fishing family compared to the 1982-86 average of 265. Noatak village fishermen were still fishing at the time of the survey but reported a partial harvest of 225 chum salmon per fishing family, which is below the 1980-84 average of 287. Total chum salmon harvests for the three villages were 4,279, 6,604, and 2,921 for Shungnak, Noorvik and Noatak, respectively.

Escapement Abundance

Aerial surveys of index spawning streams in 1987 were hindered by poor weather (Table 15). Generally, escapements were found to be less than the escapement goals. Optimally, all index areas within each river are flown three times to cover three phases of the migration: early, peak and late. A combination of poor weather, turbid water conditions and a lack of suitable survey aircraft and pilots resulted in only one set of surveys being flown on the Noatak River system and only two sets on the upper Kobuk and Tutuksuk Rivers. Escapements in the lower Kobuk River tributaries of the Salmon, Squirrel and Tutuksuk River were less than one half of the escapement goals set for those index areas. The best escapements were observed on the upper Kobuk River where escapements were judged to be 80% of the aerial survey goal. All aerial surveys were flown after

peak spawning. The number of fish counted on the lower and upper Kobuk was 6,247 and 8,210 fish, respectively. Approximately 9,295 salmon were counted on the Noatak River, however poor conditions prevented a complete survey.

Age, Sex, and Length Composition

Comparisons of sex and length composition were not substantiated by statistical testing. Chum salmon were sampled from the Kotzebue Sound commercial and Noatak River test fish catch and spawning areas on the lower Noatak and Kobuk Rivers (Table 16). In addition, subsistence catches were sampled for age prior to the first commercial opening and during the first mid-season closure. The 1987 commercial catch was dominated by age-0.3 (43.5%), followed by age-0.4 (30.7%). Age-0.2 comprised 14.2% of the catch and age-0.5 chum salmon made up a record 11.6%. Age-0.5 fish have historically comprised less than 1% of the catch. A temporal change in age composition was observed with older fish dominating early catches and decreasing proportionately as the season progressed.

Generally, in the Kotzebue District, a total of fifteen fishing periods are scheduled twice weekly from approximately July 10 to August 31. Since only nine fishing periods were scheduled in 1987, it was estimated, using the 1980-86 average period proportions of catch, that 41% of the catch would have occurred during the six closed fishing periods. Using this procedure the estimated age composition, if 15 periods had been scheduled, was 13.5% age-0.2, 41.5% age-0.3, 33.4% age-0.4 and 11.6% age-0.5 chum salmon.

The sex ratio was nearly equal with the commercial catch consisting of 49.4% females and 50.6% males.

The age composition of chum salmon caught in the Noatak River test fishery was similar to the commercial catch. However, the test fish catch consisted of more age-0.4 and fewer age-0.3 than did the commercial catch. Samples collected on the spawning grounds consisted of a higher percentage of age-0.2 than did commercial or test fish catches. This may be a result of sampling the latter part of the migration which would tend towards a higher percentage of younger fish.

In general, female chum salmon are smaller than males for a given age and both show an increase in mean length with age. In addition, Noatak River chum salmon were observed to be larger than Kobuk River chum salmon (Table 17).

LITERATURE CITED

- ADF&G (Alaska Department of Fish and Game). 1988. Norton Sound-Port Clarence-Kotzebue Sound Annual Management Report, 1987. Division of Commercial Fisheries, Unpublished Region 3 Report, Anchorage.
- Berning R., D. Mesiar, and D. Gaudet. 1987. Sonar enumeration of migrating fish in the Noatak River, 1984. Alaska Department of Fish and Game, Division of Commercial Fisheries, Informational Leaflet 262, Juneau.
- Bigler, B. 1985a. Noatak River test fish project, 1984. Alaska Department of Fish and Game, Division of Commercial Fisheries, AYK Region Report, Norton Sound/Kotzebue Test Fish Report 3, Anchorage.
- Bigler, B. 1985b. Kotzebue Sound chum salmon catch and escapement data, 1962-1984. Alaska Department of Fish and Game, Division of Commercial Fisheries, Technical Data Report 149, Juneau.
- Bigler, B. S., and C. F. Lean. 1986. Norton Sound and Kotzebue Sound salmon catch and escapement, 1984. Alaska Department of Fish and Game, Division of Commercial Fisheries, Technical Data Report 172, Juneau.
- Bue, F., and C. Lean. 1988. 1987 Unalakleet River test fishing project, 1987. Alaska Department of Fish and Game, Division of Commercial Fisheries. Regional Information Report 3N88-07, Nome.
- Bue F., and S. Merkouris. 1988. Kwiniuk River salmon counting tower project, 1987. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 3N88-18, Nome.
- Dinnocenzo, J. D. 1984. Squirrel River counting tower project, 1984. Alaska Department of Fish and Game, Division of Commercial Fisheries. AYK Region Report, Norton Sound/Kotzebue Sound Salmon Report 32. Anchorage.
- Kneupfer, Gary. 1987. 1987 Lower Noatak test fishing project. Alaska Department of Fish and Game, Division of Commercial Fisheries, AYK Region Report, Norton Sound/Kotzebue Sound Test Fish Report 4.
- Hamner, H. H. 1987. Abundance, age, sex, and size of Norton Sound and Kotzebue Sound salmon catch and escapement, 1985. Alaska Department of Fish and Game, Division of Commercial Fisheries, Technical Data Report 193, Juneau.
- Hamner, H. H. In press. Abundance, age, sex, and size of Norton Sound and Kotzebue Sound salmon catch and escapement, 1986 Alaska Department of Fish and Game, Division of Commercial Fisheries, Technical Fisheries Report, Juneau.
- Lean, C. F., and M. Wyatt. 1987. Norton Sound-Port Clarence-Kotzebue Sound aerial stream survey catalogue. Alaska Department of Fish and Game, Division of Commercial Fisheries, unpublished Region 3 report, Nome.

LITERATURE CITED (Continued)

- Lean, C. F. 1987. 1986 North River salmon counting tower. Alaska Department of Fish and Game, Division of Commercial Fisheries. AYK Region Report, Norton Sound/Kotzebue Sound Salmon Escapement Report 47, Anchorage.
- Lean, C., B. Bigler, and L. Brannian. 1984. Age, sex, and size of Norton Sound and Kotzebue Sound salmon catch and escapement, 1983. Alaska Department of Fish and Game, Division of Commercial Fisheries, ADF&G Technical Data Report 130, Juneau.

TABLES AND FIGURES

Table 1. Norton Sound commercial salmon effort and catch by subdistrict, 1987.

Subdistrict	Fisher- men	Catch (nos.)					Total
		Chinook	Chum	Pink	Sockeye	Coho	
Nome	10	3	5,646	0	0	577	6,226
Golovin	21	166	4,334	1,579	51	2,203	48,333
Moses Point	34	907	17,278	568	15	64	18,832
Norton Bay	12	544	3,586	16	0	145	4,291
Shaktoolik	39	2,214	14,088	0	0	6,193	22,495
Unalakleet	65	3,246	17,525	97	141	15,097	36,106
District Totals	164 ^a	7,080	102,457 ^b	2,260	207	24,279	136,283

^a Total fishermen is total number of fishing permits fished during the 1987 fishing season in Norton Sound.

Table 2. Commercial salmon set gill net catch and effort in Nome, Norton Sound Subdistrict 1, 1987.

Period	Period Dates	Hours Fished	No. of Fishermen	Catch (nos.)		
				Chinook	Chum	Coho
1	7/02-7/03	24	8	0	3,499	0
2	7/06-7/07	24	9	3	2,060	0
3	8/03-8/04	24	0	0	0	0
4	8/06-8/07	24	1	0	24	72
5	8/10-8/11	24	0	0	0	0
6	8/13-8/14	24	2	0	39	316
7	8/17-8/18	24	2	0	24	100
8	8/20-8/21	24	1	0	0	56
9	8/24-8/25	24	1	0	0	18
10	8/27-8/28	24	1	0	0	15
Season Total		240	10	3	5,646	577

Table 3. Commercial salmon set gill net catch and effort in Golovin, Norton Sound Subdistrict 2, 1987.

Period	Period Dates	Hours Fished	No. of Fishermen	Catch (nos.)				
				Chinook	Chum	Pink	Sockeye	Coho
1	6/22-6/24	48	16	52	6,025	0	0	0
2	6/25-6/27	48	18	51	8,513	0	2	0
3	6/29-7/01	48	17	22	5,386	3	7	0
4	7/02-7/04	48	21	15	7,715	72	5	0
5	7/06-7/08	48	19	4	6,514	121	6	0
6	7/09-7/11	48	14	3	2,268	141	1	0
7	7/13-7/15	48	14	8	4,275	429	11	1
8	7/16-7/18	48	14	1	2,272	607	8	0
9	7/20-7/22	48	9	1	1,128	195	7	7
10	7/23-7/25	48	4	0	73	11	4	0
11 ^a	7/27-7/29	48	0					
12 ^a	7/30-8/01	48	0					
13 ^a	8/03-8/05	48	0					
14	8/06-8/08	48	5	0	82	0	0	270
15	8/10-8/12	48	6	2	36	0	0	552
16	8/13-8/15	48	8	2	22	0	0	697
17	8/17-8/19	48	6	2	18	0	0	350
18	8/20-8/22	48	4	3	7	0	0	326
19 ^a	8/24-8/26	48	0					
20 ^a	8/27-8/29	48	0					
Season Total		960	21 ^b	166	4,334	1,579	51	2,203

^a No buyers present.

^b Total fishermen is total number of fishing permits fished during the 1987 fishing season.

Table 4. Commercial salmon set gill net catch and effort in Moses Point, Norton Sound Subdistrict 3, 1987.

Period	Period Dates	Hours Fished	No. of Fishermen	Catch (nos.)				
				Chinook	Chum	Pink	Sockeye	Coho
1	6/22-6/24	48	17	92	1,317	0	0	0
2	6/25-6/27	48	26	186	3,005	1	5	0
3	6/29-7/01	48	23	364	2,932	0	1	0
4	7/02-7/04	48	31	160	3,943	8	5	0
5	7/06-7/08	48	24	58	2,691	34	1	0
6	7/09-7/11	48	19	31	1,736	213	1	0
7	7/13-7/15	48	21	13	1,319	235	1	0
8	7/16-7/17	24	13	3	331	77	1	0
9 ^a	8/03-8/05	48	0					
10	8/06-8/08	48	4	0	4	0	0	64
11 ^a	8/10-8/12	48	0					
12 ^a	8/13-8/15	48	0					
13 ^a	8/17-8/19	48	0					
14 ^a	8/20-8/22	48	0					
15 ^a	8/24-8/26	48	0					
16 ^a	8/27-8/29	48	0					
Season Total		744	34 ^b	907	17,278	568	15	64

^a No buyers present.

^b Total fishermen is total number of fishing permits fished during the 1987 fishing season.

Table 5. Commercial salmon set gill net catch and effort for Norton Bay, Norton Sound Subdistrict 4, 1987.

Period	Period Dates	Hours Fished	No. of Fishermen	Catch (nos.)			
				Chinook	Chum	Pink	Coho
1	6/22-6/24	48	6	16	26	0	0
2	6/25-6/27	48	8	234	241	0	0
3	6/29-7/01	48	7	131	148	0	0
4	7/02-7/04	48	9	130	1,072	2	0
5	7/06-7/08	48	9	18	863	5	0
6	7/09-7/11	48	9	11	690	1	0
7 ^a	7/13-7/15	48	0				
8	7/16-7/18	48	6	0	156	8	0
9 ^b	7/20-7/22	48	0				
10 ^b	7/23-7/25	48	0				
11	7/27-7/29	48	5	2	258	0	9
12 ^b	7/30-8/01	48	0				
13	8/03-8/05	48	5	0	64	0	35
14 ^b	8/06-8/08	48	0				
15	8/10-8/12	48	5	2	68	0	101
16 ^b	8/13-8/15	48	0				
17 ^b	8/17-8/19	48	0				
18 ^b	8/20-8/22	48	0				
19 ^b	8/24-8/26	48	0				
20 ^b	8/27-8/29	48	0				
21 ^b	8/31-9/02	48	0				
22 ^b	9/03-9/05	48	0				
Season Total		1,056	12 ^c	544	3,586	16	145

^a No fishing effort due to severe storm.

^b No buyers present.

^c Total fishermen is total number of fishing permits fished during the 1987 fishing season.

Table 6. Commercial salmon set net gill catch and effort in Shaktoolik, Norton Sound Subdistrict 5, 1987.

Period	Period Dates	Hours Fished	No. of Fishermen	Catch (nos.)		
				Chinook	Chum	Coho
1	6/22-6/23	24	21	287	136	0
2	6/25-6/26	24	19	648	573	0
3	6/29-7/01	48	30	772	1,356	0
4	7/02-7/04	48	30	273	2,285	0
5	7/06-7/08	48	23	122	3,919	0
6	7/09-7/11	48	16	54	1,840	0
7	7/13-7/15	48	22	20	1,633	0
8	7/16-7/18	48	19	16	662	4
9	7/27-7/29	48	16	8	762	288
10	8/03-8/05	48	21	2	401	912
11	8/06-8/08	48	18	2	263	1,188
12	8/10-8/12	48	21	0	138	2,097
13	8/13-8/15	48	20	3	77	1,196
14	8/17-8/19	48	13	7	43	508
15 ^a	8/24-8/26	36	0			
16 ^a	8/27-8/28	36	0			
17 ^a	8/31-9/01	36	0			
18 ^a	9/03-9/04	36	0			
Season Total		760	39 ^b	2,214	14,088	6,193

^a No buyers present.

^b Total fishermen is total number of fishing permits fished during the 1987 fishing season.

Table 7. Commercial salmon set gill net catch and effort in Unalakleet, Norton Sound Subdistrict 6, 1987.

Period	Period Dates	Hours Fished	No. of Fishermen	Catch (nos.)			
				Chinook	Chum	Sockeye	Coho
1	6/22-6/23	24	42	629	196	0	0
2	6/25-6/26	24	42	1,146	389	0	0
3	6/29-6/30	24	49	521	321	0	0
4	7/02-7/03	24	47	323	1,962	0	0
5	7/06-7/08	48	47	317	5,170	0	0
6	7/09-7/11	48	27	153	2,865	0	0
7	7/13-7/15	48	36	38	1,712	0	1
8	7/16-7/18	48	35	30	1,187	0	1
9	7/27-7/29	48	34	12	961	36	279
10	8/03-8/05	48	31	7	785	26	1,047
11	8/06-8/08	48	35	18	664	8	2,229
12	8/10-8/12	48	38	11	262	6	1,704
13	8/13-8/15	48	35	9	532	8	3,704
14	8/17-8/19	48	37	11	319	5	2,384
15	8/24-8/26	36	37	7	73	3	1,247
16	8/27-8/28	36	34	9	79	1	1,007
17	8/31-9/01	36	11	2	17	0	293
18	9/03-9/04	36	20	3	31	4	601
Season Total		720	65 ^a	3,246	17,525	97	15,097

^a Total fishermen is total number of fishing permits fished during the 1987 fishing season.

Table 8. Subsistence salmon catch and effort in Nome, Norton Sound Subdistrict 1, 1987. ^a

Location	Permits Issued	Permits Returned	Permits Fished	Catch (nos.)					Total
				Chi-nook	Chum	Pink	Sock-eye	Coho	
Nome R.	60	56	34	6	578	650	1	266	1,501
Marine Waters	110	106	70	187	5,366	326	83	496	6,458
Sinuk R.	12	8	4	1	85	26	4	28	144
Eldorado R.	2	2	2	1	74	0	0	84	159
Flambeau R.	1	1	0	0	0	0	0	0	0
Snake R.	7	6	6	4	24	15	5	63	111
Penny R.	0	0	0	0	0	0	0	0	0
Solomon R.	5	5	2	0	137	7	0	0	144
Feather R.	0	0	0	0	0	0	0	0	0
Bonanza R.	2	1	0	0	0	0	0	0	0
Cripple R.	1	1	1	0	0	0	0	0	0
Safety Sound	0	0	0	0	0	0	0	0	0
Eld/Flam R.	27	24	17	1	2,063	60	14	163	2,301
Totals	227	210	136	200	8,327	1,084	107	1,100	10,818

^a Harvested by beach seine or set gill net.

Table 9. Salmon aerial survey counts and chum salmon aerial survey goals for Norton Sound streams, 1987.

Subdistrict	Stream	Chinook	Chum		Pink	Coho ^b
			Goal ^a	Count		
Nome (1)	Sinuk ^c	5	3,500	4,540	30	230
	Snake	0		267	0	163
	Nome	3	2,000	1,646	1,400 ^d	419
	Flambeau	0	4,500	115	0	
	Eldorado	6	6,000	3,860	130	108
	Bonanza	0		190	0	
	Solomon	0		135	0	
Golovin (2)	Fish	193	16,000	7,886	0	
	Niukluk	10	12,500	4,145	0	257 ^e
	Boston	583	2,500	3,640	0	
Moses Pt. (3)	Kwiniuk ^f	314	25,000	16,134	5,567	819 ^g
	Tubutulik	474	14,000	9,605	580	
Norton Bay (4)	Inglutalik ^c	945		3,962	8,000	
	Ungalik ^c	44		3,918	6,000	20 ^h
Shaktoolik (5)	Shaktoolik ^c	386	11,000	471	0	746
Unalakleet (6)	Unalakleet System ⁱ	476		623	0	1,042
	North River ^c	445	2,500	392	0	680

^a Aerial survey goal is based on the average of historical peak aerial survey counts with a "good" or "fair" rating.

^b Most coho surveys flown under poor conditions.

^c Peak chum salmon counts.

^d Boat survey count.

^e Includes counts from Ophir Creek.

^f Expanded tower counts.

^g Aerial survey count.

^h Unacceptable conditions.

ⁱ Partial survey; includes counts from Old Woman.

Table 10. Age and sex composition percentages of chinook salmon samples from the Unalakleet commercial and test fisheries, 1987.

Fishery & Sample dates		Brood Year and Age Group				Total
		<u>1983</u>	<u>1982</u>	<u>1981</u>	<u>1980</u>	
		1.2	1.3	1.4	1.5	
Unalakleet Commercial ^a (6/26-7/28)	Female	0.0	3.7	44.7	8.1	56.5
	Male	3.7	8.7	26.1	5.0	43.5
	Total	3.7	12.4	70.8	13.1	100.0
	Sample Size	6	20	115	21	162
Unalakleet Test Fish ^b (6/20-7/17)	Female	0.0	2.6	35.9	2.6	41.1
	Male	15.4	23.1	20.5	0.0	59.0
	Total	15.4	25.6	56.4	2.6	100.0
	Sample Size	6	10	22	1	39

^a Most fishermen target chinook salmon with 216 mm (8-1/2 in) mesh gill nets during chinook salmon migration.

^b Test net is 149 mm (5-7/8 in) mesh gill net.

Table 11. Age and sex composition percentages of chum salmon samples taken by set gill net from Norton Sound, 1987.

		Brood Year and Age Group				
		<u>1984</u>	<u>1983</u>	<u>1982</u>	<u>1981</u>	
		0.2	0.3	0.4	0.5	Total
Unalakleet Commercial (7/7-8/19)	Female	0.2	21.2	27.3	1.7	50.4
	Male	0.7	24.2	23.4	1.3	49.6
	Total	0.9	45.4	50.7	3.0	100.0
	Sample Size	5	274	306	18	603
Unalakleet Test Fish (6/16-9/07)	Female	0.0	15.8	16.3	2.5	34.6
	Male	0.8	34.8	27.7	2.1	65.4
	Total	0.8	50.6	44.0	4.6	100.0
	Sample Size	5	307	267	28	607
Moses Point Commercial (6/27-7/15)	Female	0.0	23.5	31.0	1.0	55.5
	Male	0.5	21.5	21.0	1.5	44.5
	Total	0.5	45.0	52.0	2.5	100.0
	Sample Size	1	90	104	5	200

Table 12. Age and sex composition percentages of coho salmon samples taken by set gill net from the Unalakleet commercial fishery, 1987.

		Brood Year and Age Group			Total
		<u>1984</u>	<u>1983</u>	<u>1982</u>	
		1.1	2.1	3.1	
Unalakleet Commercial (7/28-8/28)	Female	5.0	29.9	16.2	51.1
	Male	3.2	34.5	11.2	48.9
	Total	8.2	64.4	27.4	100.0
	Sample Size	23	179	76	278
Unalakleet Test Net ^a (7/30-9/7)	Female	11.8	32.8	9.2	53.8
	Male	4.2	31.9	10.1	46.2
	Total	16.0	64.7	19.3	100.0
	Sample Size	19	77	23	119

^a Test net is 149 mm (5-7/8 in) mesh gill net.

Table 13. Commercial effort and catch of chinook and chum salmon in the Kotzebue District by fishing period, 1987.

Period	Period Dates	Hours Fished	No. of Fishermen	Catch (nos.)	
				Chinook	Chum
1	7/13-7/14	24	20	1	697
2	7/16-7/17	24	45	3	2,341
3	7/20-7/21	24	99	2	5,610
4	7/23-7/24	24	119	4	9,357
5	8/03-8/04	36	132	9	27,084
6	8/06-8/07	36	140	11	25,019
7	8/13-8/14	36	132	4	22,909
8	8/17-8/18	36	103	7	8,898
9	8/20-8/21	36	78	3	7,552
Season Total		276	160 ^a	44	109,467

^a Total fishermen is total number of fishing permits fished during the 1987 fishing season.

Table 14. Estimated subsistence effort and catch of chum salmon by village, Kotzebue District, 1987.

Village	Number of Fishermen	Chum Salmon Harvest	Average Catch per Fisherman
Noatak ^a	13	2,921	225
Noorvik	35	6,604	189
Shungnak	13	4,279	329
District total	61	13,804	226

^a Most fishermen still fishing at time of survey.

Table 15. Chum salmon aerial survey counts and goals for Kotzebue Sound streams, 1987.

River	Aerial Survey Goal ^a	Aerial Survey Count
Noatak	80,000	5,565 ^b
Squirrel	11,500	2,708
Salmon	7,000	3,333
Tutuksuk	2,000	206
Upper Kobuk R. (between Kobuk and the lower canyon)	10,000	8,210 ^b

^a Aerial survey goal based on average historical aerial surveys of "good" or "fair" rating.

^b Surveyed prior to peak spawning.

Table 16. Age composition of chum salmon samples from Kotzebue District catch and escapement, 1987.^a

Source/Project	Dates	Sample Size	Brood Year and Age Group			
			<u>1984</u> 0.2	<u>1983</u> 0.3	<u>1982</u> 0.4	<u>1981</u> 0.5
KOTZEBUE SOUND						
Commercial Catch (actual)	7/14-8/21	1987	14.1	43.5	30.7	11.6
Commercial Catch (expanded)			13.5	41.5	33.4	11.6
Subsistence	7/07-7/11	87	1.1	6.9	66.7	25.3
	7/28-8/01	264	6.1	39.0	41.6	13.3
NOATAK RIVER						
Noatak test fish	7/23-8/27	999	13.7	34.2	40.1	12.0
Lower Noatak esc (seine)	9/17	440	21.0	36.6	33.0	9.4
KOBUK RIVER						
Squirrel R esc (seine & carcass)	8/31-9/02	242	15.3	50.4	22.7	11.6
Salmon R esc (carcass)	9/04-9/05	215	21.0	35.3	30.2	13.5
Lower Kobuk esc (Squirrel & Salmon R combined)	8/31-9/05	457	18.0	43.9	26.3	11.8

^a All samples taken by set gill net unless otherwise indicated.

Table 17. Mean length (mm) of chum salmon samples from Kotzebue District catch and escapement, 1987.

		Brood Year and Age Group			
		<u>1984</u>	<u>1983</u>	<u>1982</u>	<u>1981</u>
Project/Gear		0.2	0.3	0.4	0.5
Commercial Catch (gill net)	Females	552	583	602	611
	Males	562	601	623	636
	Total	559	592	613	622
	Sample Size	232	728	751	275
Salmon R Escapement (carcass)	Females	526	547	579	579
	Males	574	598	617	623
	Total	548	564	597	608
	Sample Size	32	49	37	14
Squirrel R Escapement (beach seine and carcass)	Females	527	549	559	579
	Males	550	592	619	607
	Total	538	563	589	586
	Sample Size	28	99	40	21
Noatak R Escapement (beach seine)	Females	535	568	588	591
	Males	568	603	646	644
	Total	552	586	622	622
	Sample Size	92	155	143	41

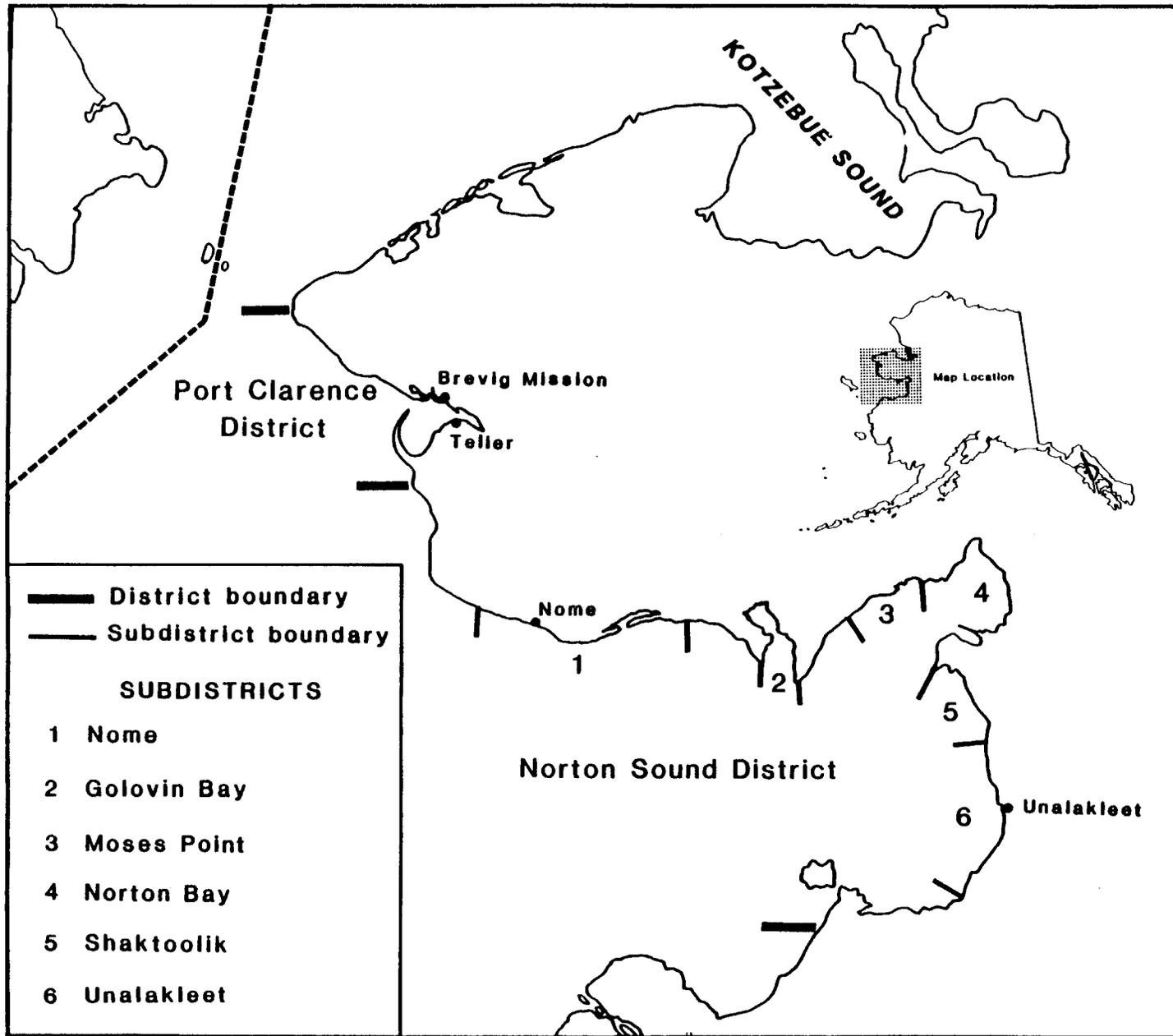


Figure 1. Norton Sound commercial salmon fishing subdistricts.

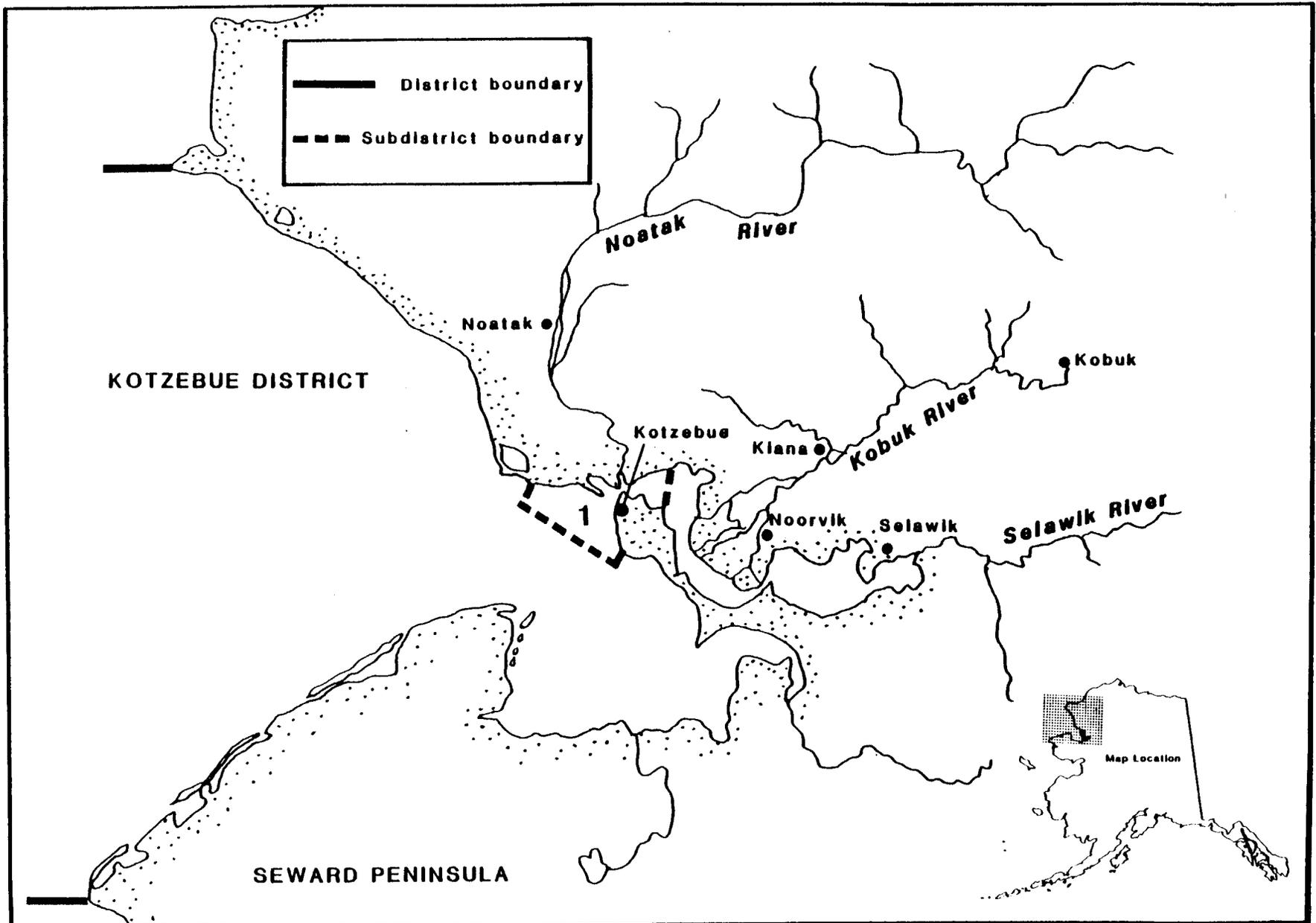


Figure 2. Kotzebue Sound Subdistrict 1.

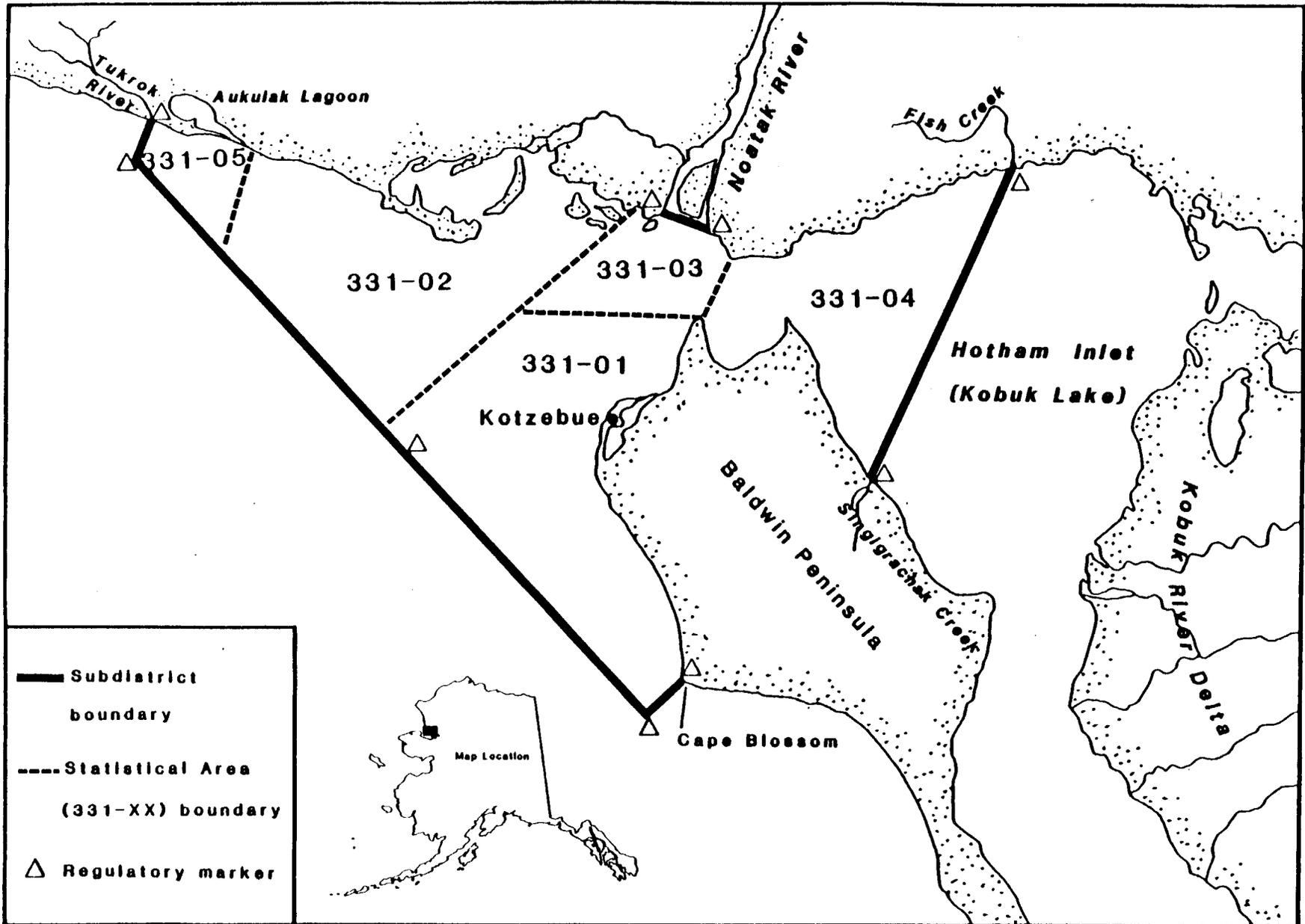


Figure 3. Kotzebue Sound commercial salmon fishing statistical areas.

APPENDICES

Appendix A.1. Age and sex of chinook salmon sample taken by set gill net from the Unalakleet commercial fishery, 1987.

		Brood Year and Age Group				
		<u>1983</u>	<u>1982</u>	<u>1981</u>	<u>1980</u>	
		1.2	1.3	1.4	1.5	Total
Stratum Dates:	6/22-9/04					
Sample Dates:	6/26-7/28					
Sample Size:	162					
Female	Percent	0.0	3.7	44.7	8.1	56.5
	Sample Size	0	6	73	13	92
Male	Percent	3.7	8.7	26.1	5.0	43.5
	Sample Size	6	14	42	8	70
Total	Percent	3.7	12.4	70.8	13.1	100.0
	Sample Size	6	20	115	21	162
	Std. Error	1.5	2.6	3.6	2.7	

Appendix A.2. Length (mm) by age and sex of chinook salmon sample taken by set gill net from the Unalakleet commercial fishery, 1987.

	Brood Year and Age Group			
	<u>1983</u>	<u>1982</u>	<u>1981</u>	<u>1980</u>
	1.2	1.3	1.4	1.5
Females				
Mean Length		766	871	889
Std. Error		26	6	14
Sample Size	0	6	72	13
Males				
Mean Length	494	699	847	958
Std. Error	26	16	13	19
Sample Size	6	14	42	8
Sexes Combined				
Mean Length	494	719	862	916
Std. Error	26	15	6	13
Sample Size	6	20	115	21

Appendix A.3. Age and sex of chinook salmon sample taken with 149 mm (5-7/8 in) mesh gill net from the Unalakleet test fishery, 1987.

		Brood Year and Age Group				
		<u>1983</u>	<u>1982</u>	<u>1981</u>	<u>1980</u>	
		1.2	1.3	1.4	1.5	Total
Sample Dates:	6/20-7/17					
Sample Size:	39					
Female	Percent	0.0	2.6	35.9	2.6	41.1
	Sample Size	0	1	14	1	16
Male	Percent	15.4	23.1	20.5	0.0	59.0
	Sample Size	6	9	8	0	23
Total	Percent	15.4	25.6	56.4	2.6	100.0
	Sample Size	6	10	22	1	39
	Std. Error	5.9	7.1	8.0	2.6	

Appendix A.4. Length (mm) by age and sex for chinook salmon sample taken by 149 mm (5-7/8 in) mesh set gill net from the Unalakleet test fishery, 1987.

	Brood Year and Age Group			
	<u>1983</u>	<u>1982</u>	<u>1981</u>	<u>1980</u>
	1.2	1.3	1.4	1.5
Females				
Mean Length		913	874	888
Std. Error		0	12	0
Sample Size	0	1	14	1
Males				
Mean Length	496	690	805	
Std. Error	40	23	25	
Sample Size	6	9	8	0
Sexes Combined				
Mean Length	496	712	849	888
Std. Error	40	30	14	0
Sample Size	6	10	22	1

Appendix A.5. Age and sex of chum salmon sample taken by set gill net from the Moses Point commercial fishery, 1987.

		Brood Year and Age Group				
		<u>1984</u>	<u>1983</u>	<u>1982</u>	<u>1981</u>	
		0.2	0.3	0.4	0.5	Total
Stratum Dates:	6/22-7/17					
Sample Dates:	6/27-7/15					
Sample Size:	200					
Female	Percent	0.0	23.5	31.0	1.0	55.5
	Sample Size	0	47	62	2	111
Male	Percent	0.5	21.5	21.0	1.5	44.5
	Sample Size	1	43	42	3	89
Total	Percent	0.5	45.0	52.0	2.5	100.0
	Sample Size	1	90	104	5	200
	Std. Error	0.0	0.4	0.4	0.1	

Appendix A.6. Length (mm) by age and sex of chum salmon sample taken by set gill net from the Moses Point commercial fishery, 1987.

	Brood Year and Age Group			
	<u>1984</u>	<u>1983</u>	<u>1982</u>	<u>1981</u>
	0.2	0.3	0.4	0.5
Females				
Mean Length		542	563	570
Std. Error		6	5	15
Sample Size	0	47	62	2
Males				
Mean Length	504	572	603	582
Std. Error	0	6	7	38
Sample Size	1	43	40	3
Sexes Combined				
Mean Length	504	556	579	577
Std. Error	0	4	5	22
Sample Size	1	90	102	5

Appendix A.7. Catch, age and sex of chum salmon taken by set gill net from the Unalakleet commercial fishery, 1987.

		Brood Year and Age Group				
		<u>1984</u>	<u>1983</u>	<u>1982</u>	<u>1981</u>	
		0.2	0.3	0.4	0.5	Total
Stratum Dates:	6/22-9/04					
Sample Dates:	7/7-8/19					
Sample Size:	603					
Female	Percent	0.2	21.2	27.3	1.7	50.4
	Catch	35	3,715	4,784	298	8,832
Male	Percent	0.7	24.2	23.4	1.3	49.6
	Catch	123	4,241	4,101	228	8,693
Total	Percent	0.9	45.4	50.7	3.0	100.0
	Catch	158	7,956	8,885	526	17,525
	Std. Error	67	356	357	122	

Appendix A.8 Length (mm) by age and sex of chum salmon sample taken by set gill net from the Unalakleet commercial fishery, 1987.

	Brood Year and Age Group			
	<u>1984</u>	<u>1983</u>	<u>1982</u>	<u>1981</u>
	0.2	0.3	0.4	0.5
Females				
Mean Length	563	568	587	590
Std. Error		2	2	7
Sample Size	1	128	165	10
Males				
Mean Length	554	581	609	612
Std. Error	13	2	2	8
Sample Size	4	146	141	8
Sexes Combined				
Mean Length	556	575	597	600
Std. Error	11	1	2	6
Sample Size	5	274	306	18

Appendix A.9. Age and sex of chum salmon sample taken by 149 mm (5-7/8 in) mesh gill net from the Unalakleet test fishery, 1987.

		Brood Year and Age Group				
		<u>1984</u>	<u>1983</u>	<u>1982</u>	<u>1981</u>	
		0.2	0.3	0.4	0.5	Total
Sample Dates:	6/16-9/07					
Sample Size:	607					
Female	Percent	0.0	15.8	16.3	2.5	34.6
	Sample Size	0	96	99	15	210
Male	Percent	0.8	34.8	27.7	2.1	65.4
	Sample Size	5	211	168	13	397
Total	Percent	0.8	50.6	44.0	4.6	100.0
	Sample Size	5	307	267	28	607
	Std. Error	0.4	2.0	2.0	0.8	

Appendix A.10. Length (mm) by age and sex for chum salmon sample taken by 149 mm (5-7/8 in) mesh gill net from the Unalakleet test fishery, 1987.

	Brood Year and Age Group			
	<u>1984</u>	<u>1983</u>	<u>1982</u>	<u>1981</u>
	0.2	0.3	0.4	0.5
Females				
Mean Length		579	596	612
Std. Error		2	2	6
Sample Size	0	96	99	15
Males				
Mean Length	544	589	615	644
Std. Error	14	2	2	7
Sample Size	5	210	168	13
Sexes Combined				
Mean Length	544	586	608	627
Std. Error	14	1	2	6
Sample Size	5	306	267	28

Appendix A.11. Age and sex of coho salmon sample taken by set gill net from the Unalakleet commercial fishery, 1987.

		Brood Year and Age Group			
		<u>1984</u>	<u>1983</u>	<u>1982</u>	Total
		1.1	2.1	3.1	
Stratum Dates:	7/13-9/04				
Sample Dates:	7/28-8/28				
Sample Size:	278				
Female	Percent	5.0	29.9	16.2	51.1
	Sample Size	14	83	45	142
Male	Percent	3.2	34.5	11.2	48.9
	Sample Size	9	96	31	136
Total	Percent	8.2	64.4	27.4	100.0
	Sample Size	23	179	76	278
	Std. Error	1.6	2.9	2.9	

Appendix A.12. Length (mm) by age and sex for coho salmon sample taken by set gill net from the Unalakleet commercial fishery, 1987.

	Brood Year and Age Group		
	<u>1984</u>	<u>1983</u>	<u>1982</u>
	1.1	2.1	3.1
Females			
Mean Length	582	569	578
Std. Error	10	4	3
Sample Size	14	83	45
Males			
Mean Length	571	569	557
Std. Error	13	5	9
Sample Size	9	96	31
Sexes Combined			
Mean Length	578	569	569
Std. Error	8	3	4
Sample Size	23	179	76

Appendix A.13. Age and sex of coho salmon taken by 149 mm (5-7/8 in) mesh gill net from the Unalakleet test fishery, 1987.

		Brood Year and Age Group			
		<u>1984</u>	<u>1983</u>	<u>1982</u>	Total
		1.1	2.1	3.1	
Sample Dates:	7/30-9/7				
Sample Size:	119				
Female	Percent	11.8	32.8	9.2	53.8
	Sample Size	14	39	11	64
Male	Percent	4.2	31.9	10.1	46.2
	Sample Size	5	38	12	55
Total	Percent	16.0	64.7	19.3	100.0
	Sample Size	19	77	23	119
	Std. Error	3.4	4.4	3.6	

Appendix A.14. Length (mm) by age and sex for coho salmon sample taken by 149 mm (5-7/8 in) mesh set gill net from the Unalakleet test fishery, 1987.

	Brood Year and Age Group		
	<u>1984</u>	<u>1983</u>	<u>1982</u>
	1.1	2.1	3.1
Females			
Mean Length	607	595	603
Std. Error	5	4	10
Sample Size	14	39	11
Males			
Mean Length	600	586	608
Std. Error	10	6	8
Sample Size	5	38	12
Sexes Combined			
Mean Length	605	590	605
Std. Error	5	3	6
Sample Size	19	77	23

Appendix B.1. Thousands of chum salmon in the Kotzebue commercial fishery by age group, 1962-1987.

Year	Sample Size ^a	Age Class			Total ^b
		0.2	0.3	0.4	
1962	69	9.5	82.2	36.4	128.1
1963	255	16.4	27.7	10.1	54.2
1964	463	40.8	34.5	1.3	76.6
1965	480	0.9	36.4	2.7	40.0
1966	430	3.1	20.7	7.0	30.8
1967	1,865	2.6	21.3	5.4	29.3
1968	1,989	6.4	17.5	6.0	29.9
1969	1,125	21.8	34.6	2.9	59.3
1970	267	6.2	145.3	8.1	159.6
1971	1,105	11.0	104.3	40.8	156.1
1972	980	26.8	100.8	40.9	168.5
1973	598	62.7	260.9	51.8	375.4
1974	350	179.0	398.7	49.0	626.7
1975	340	14.1	489.5	60.3	563.9
1976	566	17.9	82.5	59.4	159.8
1977	446	13.1	143.0	36.4	192.5
1978	579	11.7	64.1	35.5	111.3
1979	658	43.3	75.3	21.5	140.1
1980	710	55.5	286.9	24.2	366.6
1981	1,167	16.3	454.4	207.2	677.9
1982	983	24.7	201.8	168.4	394.9
1983	1,979	10.2	101.6	60.1	171.9
1984	2,933	46.7	205.9	63.1	315.7
1985	3,293	2.3	436.6	80.6	521.4
1986	3,095	0.8	48.6	206.3	261.4
1987	1,987	15.5	47.7	33.6	109.5
1987 ^c	expanded	24.8	76.5	61.6	184.2
10 yr avg (1977-1986)		22.5	201.8	90.3	315.4

^a Sample size in numbers of fish.

^b Totals do not include age 0.5 fish which generally contribute less than 1% towards the commercial fishery.

^c Expanded numbers include estimates of numbers of fish in each age class that would have been caught during closed fishing periods.

Appendix B.2. Percent age and sex composition of chum salmon samples taken in the Kotzebue commercial fishery, 1962-1987.

Year	Sample Size ^a	Males	Females	Age Class			
				0.2	0.3	0.4	0.5
1962	69	26.1	73.9	7.3	63.3	28.0	1.4
1963	255	35.0	65.0	30.1	50.9	18.6	0.4
1964	463	43.6	56.4	53.3	45.1	1.7	0.0
1965	480	42.1	57.9	2.3	91.0	6.7	0.0
1966	430	40.2	59.8	10.1	67.1	22.8	0.0
1967	1,865	37.3	62.7	8.8	72.3	18.5	0.5
1968	1,989	48.2	51.8	21.2	58.0	19.8	0.9
1969	1,125	53.7	46.3	36.8	58.3	4.9	0.0
1970	267	45.3	54.7	3.9	91.0	5.1	0.0
1971	1,105	54.6	45.4	7.1	67.3	26.3	0.0
1972	980	50.9	49.1	15.8	59.4	24.1	0.6
1973	598	46.0	54.0	16.7	69.5	13.8	0.0
1974	350	47.1	52.9	28.5	63.5	7.8	0.2
1975	340	46.4	53.6	2.5	86.9	10.7	0.0
1976	566	47.9	52.1	11.2	51.6	37.2	0.1
1977	446	49.3	50.7	6.7	73.0	18.6	1.7
1978	579	49.9	50.1	10.5	57.5	31.8	0.2
1979	658	53.3	46.7	30.6	53.2	15.2	1.0
1980	710	56.4	43.6	15.1	78.1	6.6	0.2
1981	1,167	52.4	47.6	2.4	67.1	30.6	0.0
1982	983	48.8	51.2	5.9	48.3	40.3	5.5
1983	1,979	43.4	56.6	5.8	57.8	34.2	2.3
1984	1,933	50.2	49.8	14.6	64.3	19.7	1.3
1985	3,293	47.8	52.2	0.4	83.7	15.5	0.4
1986	3,095	46.0	54.0	0.3	18.6	78.9	2.2
1987	1,987	50.6	49.4	14.2	43.5	30.7	11.2
1987 ^b	e x p a n d e d			13.5	41.5	33.4	11.6
Mean		49.8	50.2	9.2	60.2	29.1	1.5
1977-1986							

^a Sample size in numbers of fish.

^b Expanded percentages includes estimates of age composition for closed fishing periods.

Appendix B.3. Catch, age and sex of chum salmon taken by set gill net from the Kotzebue Sound commercial fishery by sample period, 1987.

		Brood Year and Age Group				
		<u>1984</u>	<u>1983</u>	<u>1982</u>	<u>1981</u>	
		0.2	0.3	0.4	0.5	Total
Stratum Dates: 7/13-7/17						
Sample Size: 439						
Female	Percent	0.5	6.4	24.6	12.1	43.6
	Catch	15	194	748	368	1,325
Male	Percent	1.1	13.0	32.0	10.3	56.4
	Catch	33	395	972	313	1,713
Total	Percent	1.6	19.4	56.6	22.4	100.0
	Catch	48	589	1,720	681	3,038
	Std. Error	18	57	72	61	
Stratum Dates: 7/20-7/24						
Sample Size: 430						
Female	Percent	0.0	11.7	21.0	10.3	43.0
	Catch	0	1,751	3,143	1,542	6,436
Male	Percent	3.3	18.6	26.7	8.4	57.0
	Catch	494	2,784	3,996	1,257	8,531
Total	Percent	3.3	30.3	47.7	18.7	100.0
	Catch	494	4,535	7,139	2,799	14,967
	Std. Error	129	332	361	282	
Stratum Dates: 8/3-8/7						
Sample Size: 221						
Female	Percent	8.3	22.0	12.4	6.9	49.6
	Catch	4,325	11,463	6,461	3,595	25,844
Male	Percent	5.5	25.6	14.7	4.6	50.4
	Catch	2,866	13,337	7,659	2,397	26,259
Total	Percent	13.8	47.6	27.1	11.5	100.0
	Catch	7,191	24,800	14,120	5,992	52,103
	Std. Error	1,212	1,754	1,561	1,121	
Sample Dates: 8/13-8/14						
Sample Size: 451						
Female	Percent	6.0	24.1	17.5	6.9	54.5
	Catch	1,375	5,520	4,009	1,581	12,485
Male	Percent	11.5	19.5	11.8	2.7	45.5
	Catch	2,635	4,467	2,703	619	10,424
Total	Percent	17.5	43.6	29.3	9.6	100.0
	Catch	4,010	9,987	6,712	2,200	22,909
	Std. Error	410	536	492	318	
Sample Dates: 8/17-8/21						
Sample Size: 446						
Female	Percent	7.0	26.0	12.9	2.9	48.8
	Catch	1,152	4,277	2,122	477	8,028
Male	Percent	15.6	21.1	10.9	3.6	51.2
	Catch	2,566	3,471	1,793	592	8,422
Total	Percent	22.6	47.1	23.8	6.5	100.0
	Catch	3,718	7,748	3,915	1,069	16,450
	Std. Error	326	389	332	192	

Appendix B.4. Catch, age and sex of chum salmon taken by set gill net from the Kotzebue Sound commercial fishery, all periods combined, 1987.

		Brood Year and Age Group				
		<u>1984</u>	<u>1983</u>	<u>1982</u>	<u>1981</u>	
		0.2	0.3	0.4	0.5	Total
Sample Size:	1,987					
Female	Percent	6.3	21.2	15.1	6.9	49.4
	Catch	6,867	23,205	16,483	7,563	54,118
Male	Percent	7.9	22.3	15.6	4.7	50.6
	Catch	8,594	24,454	17,123	5,178	55,349
Total	Percent	14.1	43.5	30.7	11.6	100.0
	Catch	15,461	47,659	33,606	12,741	109,467
	Std. Error	1,327	1,905	1,710	1,215	

Appendix B.5. Length (mm) by age and sex of chum salmon sample taken by set gill net from the Kotzebue commercial fishery, 1987.

	Brood Year and Age Group			
	<u>1983</u>	<u>1982</u>	<u>1981</u>	<u>1980</u>
	0.2	0.3	0.4	0.5
Females				
Mean Length	552	583	602	611
Std. Error	2	1	1	3
Sample Size	78	349	361	156
Males				
Mean Length	562	601	623	636
Std. Error	2	2	2	3
Sample Size	152	373	389	119
Sexes Combined				
Mean Length	559	592	613	622
Std. Error	2	1	1	2
Sample Size	232	728	751	275

Appendix B.6. Age and sex of chum salmon escapement sample from the Squirrel River, 1987. ^a

		Brood Year and Age Group				
		<u>1984</u>	<u>1983</u>	<u>1982</u>	<u>1981</u>	
		0.2	0.3	0.4	0.5	Total
Sample Dates:	8/31-9/02					
Sample Size:	242					
Female	Percent	8.1	32.5	11.5	7.7	59.8
	Sample Size	20	79	28	19	146
Male	Percent	7.3	19.2	11.1	2.6	40.2
	Sample Size	18	46	27	6	97
Total	Percent	15.3	50.4	22.7	11.6	100.0
	Sample Size	37	122	55	28	242
	Std. Error	2.3	3.2	2.7	2.1	

^a Combined carcass (216) and beach seine (26) sample.

Appendix B.7. Length (mm) by age and sex of chum salmon escapement sample taken from the Squirrel River, 1987.^a

	Brood Year and Age Group			
	<u>1984</u>	<u>1983</u>	<u>1982</u>	<u>1981</u>
	0.2	0.3	0.4	0.5
Females				
Mean Length	527	549	559	579
Std. Error	6	3	7	6
Sample Size	15	68	20	16
Males				
Mean Length	550	592	619	607
Std. Error	7	4	11	10
Sample Size	13	31	20	5
Sexes Combined				
Mean Length	53	563	589	586
Std. Error	5	3	8	6
Sample Size	28	99	40	21

^a Combined carcass (216) and beach seine (26) sample.

Appendix B.8. Age and sex of chum salmon carcass sample from the Salmon River, 1987.

		Brood Year and Age Group				
		<u>1984</u>	<u>1983</u>	<u>1982</u>	<u>1981</u>	
		0.2	0.3	0.4	0.5	Total
Sample Dates:	9/04-9/05					
Sample Size:	215					
Female	Percent	9.8	21.8	14.4	4.2	50.2
	Sample Size	21	47	31	9	108
Male	Percent	11.2	13.5	15.8	9.3	49.8
	Sample Size	24	29	34	20	107
Total	Percent	21.0	35.3	30.2	13.5	100.0
	Sample Size	45	76	65	29	215
	Std. Error	6	7	7	5	

Appendix B.9. Length (mm) by age and sex of chum salmon carcass sample taken from the Salmon River, 1987.

	Brood Year and Age Group			
	<u>1984</u>	<u>1983</u>	<u>1982</u>	<u>1981</u>
	0.2	0.3	0.4	0.5
Females				
Mean Length	526	547	579	579
Std. Error	4	5	8	18
Sample Size	17	33	20	5
Males				
Mean Length	574	598	617	623
Std. Error	4	9	9	6
Sample Size	15	16	17	9
Sexes Combined				
Mean Length	548	564	597	608
Std. Error	5	6	7	9
Sample Size	32	49	37	14

Appendix B.10. Age and sex of chum salmon escapement sample taken by beach seine from the lower Noatak River, 1987.

		Brood Year and Age Group				
		<u>1984</u>	<u>1983</u>	<u>1982</u>	<u>1981</u>	
		0.2	0.3	0.4	0.5	Total
Sample Dates:	9/17					
Sample Size:	440					
Female	Percent	10.5	17.8	13.7	3.9	45.9
	Sample Size	46	78	60	17	201
Male	Percent	10.5	18.8	19.3	5.5	54.1
	Sample Size	46	83	86	24	239
Total	Percent	21.0	36.6	33.0	9.4	100.0
	Sample Size	92	161	146	41	440
	Std. Error	1.9	2.3	2.2	1.4	

Appendix B.11. Length (mm) by age and sex of chum salmon escapement sample taken by beach seine from the Noatak River, 1987.

	Brood Year and Age Group			
	<u>1984</u>	<u>1983</u>	<u>1982</u>	<u>1981</u>
	0.2	0.3	0.4	0.5
Females				
Mean Length	535	568	588	591
Std. Error	5	3	4	9
Sample Size	45	73	59	17
Males				
Mean Length	568	603	646	644
Std. Error	5	4	3	9
Sample Size	46	82	84	24
Sexes Combined				
Mean Length	552	586	622	622
Std. Error	4	3	4	8
Sample Size	92	155	143	41

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