

ADF&G HABITAT LIBRARY



32345000056599

ANNUAL MANAGEMENT REPORT
1988
NORTON SOUND - PORT CLARENCE - KOTZEBUE

By
Susan E. Merkouris
and
Charles F. Lean

Regional Information Report¹ No. 3N89-10

Alaska Department of Fish and Game
Division of Commercial Fisheries, AYK Region
333 Raspberry Road
Anchorage, Alaska 99518 - 1599

May 1989

1 The Regional Information Report Series was established in 1987 to provide an informational access system for all unpublished divisional reports. These reports frequently serve diverse ad hoc informational purposes or archive basic uninterpreted data. To accommodate needs for up-to-date information, reports in this series may contain preliminary data.

AUTHORS

Susan E. Merkouris is Region 3, Norton Sound Assistant Area Management Biologist for the Alaska Department of Fish and Game, Division of Commercial Fisheries, P.O. Box 1148, Nome, AK 99762.

Charles F. Lean is Region 3, Area Management Biologist for the Alaska Department of Fish and Game, Division of Commercial Fisheries, P.O. Box 1148, Nome, AK 99762.

ACKNOWLEDGEMENTS

Many people contributed toward the collection and processing of the data contained herein. Alaska Department of Fish and Game seasonal employees work long and hard hours in providing the management staff with timely and useful fishery catch, abundance, and escapement information. In particular, we would like to thank Fred Bue, for his exhaustive efforts in running the Unalakleet test fish projects and seasonal field office in Norton Sound; and Gary Knuepfer, for his leadership role in the Norton Sound herring and Noatak River test fisheries. We wish also to thank Jim Gephard for his collection and analysis of Norton Sound red king crab data. In addition, we wish to thank the regional biologist staff for their assistance in the aerial surveillance programs and with technical assistance. We wish also to acknowledge the data collection of many seasonal technicians and volunteers this past season.

TABLE OF CONTENTS

	<u>Page</u>
LIST OF TABLES.....	vi
LIST OF FIGURES.....	viii
LIST OF APPENDICES.....	x
INTRODUCTION.....	xiv
LITERATURE CITED.....	186

SECTION 1: SALMON

Introduction.....	1
Boundaries.....	1
Salmon Resources.....	1
Commercial Fishery.....	1
Subsistence Fishery.....	2
Management.....	2
Norton Sound District.....	4
District Boundaries.....	4
Commercial Fishery.....	4
District Summary 1988.....	5
Commercial Fishery.....	5
Subsistence Fishery.....	7
Escapement.....	7
Nome - Subdistrict 1.....	9
Commercial Fishery.....	9
Regulatory Actions.....	9
Subsistence Fishery.....	11
Escapement.....	12
Golovin - Subdistrict 2.....	12
Commercial Fishery.....	12
Subsistence Fishery.....	14
Escapement.....	14
Moses Point - Subdistrict 3.....	15
Commercial Fishery.....	15
Subsistence Fishery.....	15
Escapement.....	16
Norton Bay - Subdistrict 4.....	16
Commercial Fishery.....	16
Subsistence Fishery.....	17
Escapement.....	17
Shaktoolik - Subdistrict 5.....	17
Commercial Fishery.....	17
Subsistence Fishery.....	18
Escapement.....	18
Unalakleet - Subdistrict 6.....	19
Commercial Fishery.....	19
Regulatory Actions.....	20
Subsistence Fishery.....	20
Escapement.....	21
Outlook for 1989.....	21
Port Clarence District.....	53
District Boundaries.....	53

TABLE OF CONTENTS (continued)

	<u>Page</u>
Commercial Fishery.....	53
Subsistence Fishery.....	53
Escapement.....	54
Kotzebue District.....	58
District Boundaries.....	58
Commercial Fishery.....	58
Fisheries Management 1988.....	60
Commercial Fishery 1988.....	60
Hatchery Contribution.....	62
Subsistence Fishery.....	62
Escapement.....	64
Outlook for 1989.....	65
 SECTION 2: PACIFIC HERRING	
Introduction.....	87
Boundaries.....	87
Spawning Areas and Timing.....	87
Norton Sound District.....	87
Fishing History.....	87
Food Herring.....	88
Sac Roe.....	88
Spawn on Kelp.....	89
Management Strategies.....	89
Commercial Fishery.....	89
Sac Roe Fishery Summary 1988.....	89
Sac Roe Fishery Management.....	91
Herring Abundance.....	94
Other Research.....	96
Catch Reporting and Enforcement.....	98
Outlook for 1989.....	98
Port Clarence/Kotzebue Districts.....	114
Introduction.....	114
Resource Investigations.....	114
Fall Food/Bait Fishery.....	115
Sac Roe Fishery Summary 1988.....	116
Herring Abundance and Research.....	118
 SECTION 3: KING CRAB	
Introduction.....	121
Norton Sound Red King Crab.....	121
Commercial Fishery.....	121
Subsistence Fishery.....	125
Stock Status/Research.....	126
Future Investigations.....	129
Outlook for 1989.....	130
Management Strategy.....	130

TABLE OF CONTENTS (continued)

	<u>Page</u>
SECTION 4: MISCELLANEOUS SPECIES	
Introduction.....	147
Inconnu (Sheefish).....	147
Commercial Fishery.....	148
Subsistence Fishery.....	148
Escapement.....	149
Char.....	154
Introduction.....	154
Commercial Fishery.....	154
Subsistence Fishery.....	155
Sport Fishery.....	155
Overwintering Counts.....	156
Whitefish.....	161
Introduction.....	161
Commercial Fishery.....	161
Subsistence Fishery.....	161
Escapement.....	161
Saffron Cod.....	164
Miscellaneous Finfish Species.....	165

LIST OF TABLES

<u>Table</u>	<u>Page</u>
1. Norton Sound commercial salmon catch by subdistrict, 1988.....	23
2. Nome (subdistrict 1) subsistence salmon catches, 1988.....	24
3. Aerial survey counts of Norton Sound streams, and associated chum salmon escapement goals, 1988.....	25
4. Commercial salmon catches from Nome, subdistrict 1, Norton Sound, set gill nets, 1988.....	26
5. Commercial salmon catches from Golovin, subdistrict 2, Norton Sound, set gill nets, 1988.....	27
6. Commercial salmon catches from Moses Point, sub-district 3, Norton Sound, set gill nets, 1988.....	28
7. Commercial salmon catches from Norton Bay, sub-district 4, Norton Sound, set gill nets, 1988.....	29
8. Commercial salmon catches from Shaktoolik, sub-district 5, Norton Sound, set gill nets, 1988.....	30
9. Commercial salmon catches from Unalakleet, sub-district 6, Norton Sound, set gill nets, 1988.....	31
10. Commercial catches of chum and chinook salmon and char in the Kotzebue District by fishing period, 1988.....	66
11. Commercial chum and chinook salmon catch by statistical area, Kotzebue District, 1988.....	67
12. Estimated subsistence effort and catch of chum salmon by village, Kotzebue District, 1988.....	68
13. Herring harvest and effort by date and subdistrict, Norton Sound District, all gear types combined, 1988..	100
14. Norton Sound herring harvest by subdistrict by gear type, 1988.....	101
15. Daily observed peak biomass estimates of Pacific herring, Norton Sound District, 1988.....	102
16. Norton Sound herring spawn estimates by subdistrict	

LIST OF TABLES (continued)

<u>Table</u>	<u>Page</u>
(s.d.), 1988.....	103
17. Daily observed herring biomass estimates of Pacific herring, Port Clarence District, 1988.....	119
18. Commercial harvest of red king crab from Norton Sound, Alaska by statistical area, 1988 (summer fishery only).....	131
19. Percent recruit size crab for the Norton Sound male red king crab population from commercial catch samples.....	132
20. Norton Sound section red king crab statistical area conversion chart.....	133
21. Winter 1987-88 subsistence red king crab catches and effort by gear type, Norton Sound, Nome area.....	134
22. Catch of Norton Sound king crab from winter research, percent by size categories.....	135
23. Incidental char catches in the Kotzebue District commercial salmon fishery by fishing period, 1988.....	157

LIST OF FIGURES

1.	Norton Sound commercial salmon fishing subdistricts...	32
2.	Statistical areas of the Moses Point commercial salmon fishing subdistrict, Norton Sound.....	33
3.	Port Clarence district.....	55
4.	Kotzebue district.....	69
5.	Kotzebue district commercial salmon fishing statistical areas.....	70
6.	Kotzebue Sound commercial chum salmon harvests, 1962-1988.....	71
7.	Comparison of 1988 and seven year average (1981-1987) commercial chum salmon period catches, Kotzebue district.....	72
8.	Comparison of 1988 and seven year average (1981-1987) commercial chum salmon period catch per unit effort (CPUE), Kotzebue district.....	73
9.	Comparison of 1988 and seven year average (1981-1987) commercial chum salmon cumulative CPUE, Kotzebue District.....	74
10.	Statistical areas of the Norton Sound, Port Clarence and Kotzebue commercial herring fishery districts.....	104
11.	Norton Sound commercial herring district (333) and statistical boundaries.....	105
12.	Herring age class composition of the commercial catch as depicted by percentage of total catch, Norton Sound District, 1981-1988.....	106
13.	Herring age class composition as depicted by percentage of total catch, variable mesh test gill nets, Norton Sound District, 1981-1988 (% by number)..	107
14.	A comparison of Pacific herring age composition data by gear type of capture, 1988, and the projected age composition of the 1989 return, Norton Sound District.....	108
15.	Age composition of the commercial purse seine (P/S) and commercial gill net (G/N) catch samples, Port Clarence District, 1988.....	120

LIST OF FIGURES (continued)

<u>Figure</u>	<u>Page</u>
16. King crab fishing districts and sections of Statistical Area Q.....	136
17. Statistical areas for the Norton Sound red king crab fishery.....	137
18. Size distribution of the 1988 Norton Sound male red king crab population from assessment trawl surveys conducted by the National Marine Fisheries Service (NMFS). Portions of the graph labeled A are prerecruit two crab (1990 recruitment); B are prerecruit one crab (1989 recruitment); C are recruit crab; D are postrecruit crab.....	138
19. Size distribution of the 1985 Norton Sound male red king crab population from assessment surveys conducted by ADF&G (Top) and NMFS (Bottom). Portions of the graph labeled A are prerecruit two crab (1987 recruitment); B are prerecruit one crab (1986 recruitment); C are recruit crab; D are postrecruit crab.....	139
20. Size structure of the male red king crab population, Norton Sound, Alaska as determined by research fishing, NMFS. Dotted line represents present minimum legal size.....	140
21. Size structure of the male red king crab population, Norton Sound, Alaska as determined by research fishing, ADF&G, 1980-1982. Dotted line represents present minimum legal size.....	141
22. Red king crab catch samples for the Norton Sound summer fishery, 1981-1988. Crab to the left of dotted lines are recruits.....	142
23. Kotzebue and Kobuk River Valley villages and their spatial relationship with Inconnu spawning and overwintering areas.....	150

LIST OF APPENDICES

Appendix A	<u>Page</u>
A1. Number of commercial salmon fishermen fishing in Norton Sound, 1970-1988.....	34
A2. Commercial and subsistence salmon catches by species by subdistrict, Norton Sound District, 1964-1988, Nome (subdistrict 1).....	35
A3. Commercial and subsistence salmon catches by species by subdistrict, Norton Sound District, 1962-1988, Golovin Bay (subdistrict 2).....	36
A4. Commercial and subsistence salmon catches by species by subdistrict, Norton Sound District, 1962-1988, Moses Point (subdistrict 3).....	37
A5. Commercial and subsistence salmon catches by species by subdistrict, Norton Sound District, 1962-1988, Norton Bay (subdistrict 4).....	38
A6. Commercial and subsistence salmon catches by species by subdistrict, Norton Sound District, 1961-1988, Shaktoolik (subdistrict 5).....	39
A7. Commercial and subsistence salmon catches by species by subdistrict, Norton Sound District, 1961-1988, Unalakleet (subdistrict 6).....	40
A8. Commercial and subsistence salmon catches by species, all subdistricts, Norton Sound District, 1961-1988....	41
A9. Mean salmon weights, Norton Sound District, 1962 - 1988.....	42
A10. Estimated mean prices paid to commercial salmon fishermen, Norton Sound District, 1962-1988.....	43
A11. Dollar estimates of Norton Sound District commercial salmon fishery, 1961-1988.....	44
A12. Round weight of commercially caught salmon by species, Norton Sound District, 1961-1988.....	45
A13. Comparative salmon escapement estimates of Norton Sound streams, 1961-1988.....	46

LIST OF APPENDICES (continued)

Appendix B	<u>Page</u>
B1. Subsistence salmon catches for Port Clarence District, 1963-1988.....	56
B2. Comparative sockeye salmon aerial survey estimates, Port Clarence District, 1963-1988.....	57

Appendix C	<u>Page</u>
C1. Comparative commercial chum salmon catch statistics, Kotzebue District, 1962-1988.....	75
C2. Salmon pack by species and type of processing, Kotzebue District, 1962-1988.....	76
C3. Dollar value estimates of Kotzebue District commercial fishery, 1962-1988.....	77
C4. Estimated mean prices paid to salmon fishermen by species, Kotzebue District, 1962-1988.....	78
C5. Commercial and subsistence salmon catches, Kotzebue, 1914-1988.....	79
C6. Kotzebue District subsistence chum salmon catches by village, 1962-1988.....	80
C7. Mean subsistence chum salmon catch per fisherman by village, Kotzebue District, 1962-1988.....	81
C8. Chum salmon aerial survey escapement estimates, Kotzebue District, 1962-1988.....	82
C9. Percent age and sex composition of chum salmon taken in the Kotzebue commercial fishery, 1962-1988.....	86

Appendix D	<u>Page</u>
D1. Norton Sound herring and spawn-on-kelp harvest (in st) by U.S. commercial fishermen, 1909-1988.....	109
D2. Japanese gill net herring catches in Norton Sound, 1968-1977. (North of 63° N. Latitude and East of 167° W. Longitude).....	110
D3. Herring biomass estimates and commercial fisheries data for the Norton Sound District, 1979-1987.....	111

LIST OF APPENDICES (continued)

Appendix D (continued)	<u>Page</u>
D4. Norton Sound commercial herring harvest (st) by subdistrict by year, 1979-1988.....	112
D5. Norton Sound commercial spawn-on-kelp (Fucus) harvest, 1978-1984.....	113

Appendix E	<u>Page</u>
E1. Comparison of annual commercial harvest of red king crab from Norton Sound, Alaska by statistical areas, 1977-1988 (summer fishery only) (catch in pounds).....	143
E2. Commercial harvest of red king crab in Norton Sound, summer fishery, 1977-1988.....	144
E3. Winter commercial and subsistence red king crab harvests, Norton Sound, 1978-1988.....	145
E4. Results of the population assessment surveys conducted for red king crab in Norton Sound since 1976.....	146

Appendix F	<u>Page</u>
F1. Winter commercial inconnu harvest statistics, Kotzebue, 1966-1988.....	151
F2. Reported subsistence inconnu catches, Kotzebue District, 1966-1988.....	152
F3. Annual aerial survey counts of inconnu in the Kobuk and Selawik Rivers, 1966-1988.....	153
F4. Char harvested incidentally during the commercial salmon fishery, Kotzebue District, 1966-1988.....	158
F5. Fall subsistence catches of char documented in Kivalina and Noatak, 1959-1988.....	159
F6. Aerial survey counts of overwintering char in the Kotzebue District watershed, 1968-1988.....	160
F7. Subsistence whitefish catch and effort data, Kotzebue District, 1970-1988.....	163

LIST OF APPENDICES (continued)

Appendix G	<u>Page</u>
G1. List of common and scientific names of finfish species of the Norton Sound-Port Clarence-Kotzebue Districts.....	167
G2. Studies conducted within the Norton Sound-Port Clarence-Kotzebue Districts, 1988.....	168
G3. Emergency orders issued during 1988.....	172
G4. Norton Sound-Port Clarence-Kotzebue Sound processors and associated data, 1988.....	182

INTRODUCTION

This report presents current and historical information concerning management of the commercial and subsistence fisheries of the Norton Sound, Port Clarence and Kotzebue Sound districts. Data from special management and research projects are included in this report, but complete documentation of project results will be presented in separate reports.

Data presented in this report supercedes information found in previous management reports. An attempt has been made to correct errors presented in earlier reports. Previously unreported data has been included and is indicated by appropriate footnotes. Current year catch data presented has been derived from preliminary field data.

This report is organized into the following major sections:

- (1) Salmon
- (2) Herring
- (3) King Crab
- (4) Miscellaneous species

In order to facilitate use of this report, tabular data has been separated into two categories: 1) tables presenting current year data; 2) appendix tables which present annual comparisons. The text for each major section is followed by tables, figures, and appendices.

SECTION 1: SALMON
(Includes Norton Sound, Port Clarence
and Kotzebue Districts)

SECTION 1 - SALMON

Introduction

Boundaries

The Norton Sound-Port Clarence-Kotzebue management districts include all waters from Canal Point Light in southern Norton Sound to Point Hope and includes St. Lawrence Island. These management districts comprise over 65,000 square miles, with a coastline exceeding that of California, Oregon, and Washington combined.

Salmon Resources

Five species of Pacific salmon are indigenous to the area with chum (Oncorhynchus keta) and pink salmon (O. gorbuscha) historically being the most abundant. Chum, pink, and chinook (king) salmon (O. tshawytscha) have been found as far north as Barrow; however, these species are uncommon north of the Kotzebue Sound drainages. The northernmost large concentrations of chum salmon are found within the Kotzebue Sound drainages, while large numbers of pink, chinook and coho (O. kisutch) salmon are not found north of Norton Sound. Very small sockeye (red) salmon (O. nerka) populations exist within a few Seward Peninsula drainages and in Kelly Lake on the Noatak River near Kotzebue.

Commercial Fishery

In 1959 and 1960, Department biologists conducted resource inventories which indicated harvestable surpluses of salmon available in several areas. The Department liberalized various regulations and encouraged processors to explore and develop new fishing grounds. As a result, commercial salmon fishing activity has grown significantly since statehood, enabling many local residents to obtain a cash income.

The majority of commercial fishermen and processing plant workers are resident Eskimos. Commercial fishermen operate set gill nets from outboard powered skiffs to capture salmon. All commercial salmon fishing is done in coastal marine waters.

Salmon effort and catch per unit effort data (CPUE) presented throughout this section have been derived as follows. Boat (or fisherman) hours have been computed after assuming that if a fishing boat delivers during a fishing period, it fished the entire period. The total number of individual boats delivering in any period is multiplied by the number of hours

open to commercial fishing. Catch per fisherman (or boat) hour is obtained by dividing the total fishermen hours into the catch for the corresponding period of time. Total fishermen (or boats) is the total number of fishermen making deliveries, regardless of how many deliveries were made or days fished during a particular period or season. There are a number of fishermen who deliver only once or twice during the entire season. Total days fished is the total number of hours open to commercial fishing during the season divided by 24 hours.

Subsistence Fishery

There are approximately 13,000 people in the area, the majority of whom are Eskimos, residing in more than 26 small villages scattered along the coast and the major river systems. Nearly all of the local people are dependent to varying degrees on the fish and game resources for their livelihood.

Subsistence fishermen operate gill nets or seines in the main rivers and, to a lesser extent, in the coastal marine waters capturing primarily salmon, whitefish, arctic char and inconnu (sheefish). Beach seines are used near the spawning grounds to catch schooling or spawning salmon and other species of fish. The major portion of fish taken during the summer months is sun dried or smoked for later consumption by villagers or their dogs.

Subsistence catch information has been derived from interviews of fishermen, actual counts of fish, and subsistence catch calendars returned by fishermen. Subsistence salmon catches in the Nome subdistrict (subdistrict 1) have been determined from the return of catch calendars as required under a permit system.

The Department conducted annual surveys of the important subsistence salmon fisheries from the early 1960's until 1982. The majority of salmon taken are pinks and chums. Subsistence harvest information prior to 1960 is incomplete or entirely lacking for many years. Beginning in 1983 budgetary restrictions have made it impossible to conduct systematic surveys in each village as was done from 1964 to 1982. For the last 5 years that complete surveys were conducted (1978-1982) the average subsistence catch in Norton Sound was 73,000 salmon including all species, while in the Kotzebue area this average was 17,000 salmon. These reported harvests are primarily based on village household surveys. Since not all fishermen are contacted, these harvests should be considered minimum figures.

Management

The Division of Commercial Fisheries of the Alaska Department of Fish and Game is responsible for the management of commercial and subsistence fisheries in this vast area. The permanent full-time staff assigned to this area during 1988 consisted of an area management biologist stationed in Nome and Kotzebue, an assistant area biologist stationed in Nome, and a clerk typist assigned to the Nome office. In addition, summer seasonal assistance in conducting various management and research activities was provided by nine seasonal biologists and technicians in Norton Sound and Kotzebue Sound. Additional assistance was provided by biologists from the regional staff.

The main objective of the Department's program is to manage the commercial salmon fishery on a sustained yield basis. Various field projects are conducted to provide information on salmon abundance, migration and stock composition. Summaries of these projects are presented in Appendix G2.

Management of the salmon fishery is complicated by the difficulty in obtaining valid escapement data in this large area and by insufficient comparative catch and return information. Management problems are compounded by the need to provide not only for adequate escapements, but for the needs of several different user groups. Past Alaska Department of Fish and Game policy has been to provide for subsistence as the primary beneficial use of the fishery resource. This policy is now State law. If the subsistence harvest or demands increase, commercial fishing may be restricted. It should be pointed out that increases in commercial fishing efficiency are expected and may balance any immediate decline in subsistence utilization or increase in run size with the result that present regulations will be maintained or made even more restrictive.

The basic regulation that governs the commercial salmon harvest in all districts is the scheduled weekly fishing period. Commercial fishing regulations provide for a total of two to four days of fishing per week during the open season depending on area and season. The Department attempts to distribute fishing effort throughout the entire return to avoid harvesting only particular segments of the return. Occasionally, fishing time is increased or decreased by emergency order, depending upon fishing conditions and the strength of the returns or spawning escapements, as determined by special studies conducted by the Department. Emergency orders issued during 1988 are presented in Appendix G3.

Weekly fishery reports, which give information on fishery status and fishing schedules, are broadcast during the fishing season over radio KICY and KNOM in Nome, and KOTZ in Kotzebue. In addition, fishery news articles are published in the Nome

Nugget and the Arctic Sounder.

Norton-Sound-District

District Boundaries

The Norton Sound district includes all waters from Canal Point Light north to Cape Douglas. This district is subdivided into six subdistricts: Nome (subdistrict 1), from Penny River to Topkok Head; Golovin Bay (subdistrict 2), from Rocky Point to Cape Darby; Moses Point (subdistrict 3), from Elim Point to Kwik River; Norton Bay (subdistrict 4), from Kuiuktulik River to Island Point; Shaktoolik (subdistrict 5), from Cape Denbigh to Junction Creek; and Unalakleet (subdistrict 6), from Junction Creek to Black Point (Figure 1).

Each of these subdistricts contain at least one major salmon spawning stream. All commercial fishing is conducted in marine waters and usually concentrated near stream mouths. Subdistrict boundaries were established around the major salmon producing local streams to minimize interception of stocks bound for other areas.

Commercial Fishery

Commercial salmon fishing in this district first began in the Unalakleet and Shaktoolik subdistricts in 1961. Most of the early interest involved chinook and coho salmon which were flown in dressed condition to Anchorage for further processing. A single U.S. freezer ship also purchased and processed chum and pink salmon during 1961. In 1962, two floating cannery ships operated in the district and the commercial fishery was extended into the Norton Bay, Moses Point and Golovin Bay subdistricts. The peak in salmon canning operations occurred during 1963. Current salmon processing operations freeze or ice their product for later shipment. Until recent years, insufficient tendering and processing facilities resulted in sporadic fishing efforts; however, gradual improvements in processing facilities have promoted a more consistent and intensive fishery in most subdistricts.

The commercial salmon fishing season opens by emergency order between June 8 and July 1, depending on run timing and subdistrict. The season closes by regulation on August 31 in subdistricts 1, 2, and 3, and on September 7 in subdistricts 4, 5, and 6, but processors often terminate their operations prior to the regulatory closure dates. Two 48 hour fishing periods normally occur each week unless changed by emergency order with the exception of the Nome subdistrict, where two 24 hour fishing periods normally occur each week.

Commercial fishing gear is restricted to set gill nets, with a maximum aggregate length of 100 fathoms allowed for each fisherman. There are no mesh size or depth restrictions during the normally scheduled periods. The majority of the gill nets fished are approximately 5 3/4 inch stretched measure. In the Unalakleet and Shaktoolik subdistricts, 8 1/4 inch stretched mesh gill nets are commonly used during the chinook salmon run in June through early July. During years when large pink salmon runs occur, the Department provides fishing periods when only 4 1/2 inch mesh nets or less may be set or drifted. These special small mesh periods are an attempt to target pink salmon without overharvesting the larger sized salmon species.

Most fishermen do not tend their nets continuously once they are set, leaving them unattended overnight. Fish quality suffers due to the length of time fish may be left in the nets and is especially poor when storms prevent fishermen from checking their gear for extended periods of time.

The Norton Sound district is managed on the basis of comparative commercial catch data, escapements and weather conditions. A single factor or combination of factors may result in issuance of emergency orders affecting seasons, fishing periods, allowable mesh size, and areas.

Aerial surveys are used to monitor escapements in the majority of the Norton Sound streams. Weather conditions, time of day, type of aircraft, water conditions, bottom conditions, date of survey, and efficiency of the surveyor and pilot must be taken into account when making inter-annual aerial survey comparisons. A counting tower on the Kwiniuk River has been operated since 1965. A second counting tower was also operated on the North River, a major tributary of the Unalakleet River, from 1972-1974 and 1984-1986.

District Summary 1988

Commercial Fishery

The commercial salmon fishing regulations state that the Norton Sound season opens on a date established by emergency order between June 8 and June 20 in subdistricts 2, 3, 4, 5, and 6, and on July 1 in subdistrict 1 (Figure 1). For the first time in five years, the season openings occurred within these regulatory dates. The Golovin, Moses Point, and Norton Bay subdistricts opened June 20 for 48 hours; the Shaktoolik and Unalakleet subdistricts opened June 20 for 24 hours; the Nome subdistrict opened July 1 for 24 hours. The season, which closes on August 31 by regulation in subdistricts 1, 2, and 3,

closed on August 30 in subdistrict 1 and on August 31 in subdistricts 2 and 3. The season, which closes on September 7 by regulation in subdistricts 4, 5, and 6, closed on August 31 in subdistrict 4 and on September 7 in subdistricts 5 and 6 (Figure 1).

The 1988 Norton Sound commercial salmon harvest totaled 225,165 fish, which was comprised of 4,096 chinook, 1,252 sockeye, 37,247 coho, 74,604 pink, and 107,966 chum salmon (Table 1).

The chinook harvest was 60% and 56% below the recent 5 and 10 year averages, (1983-1987 and 1978-1987), respectively. The sockeye harvest was the highest on record. The coho harvest was the fourth highest on record, however was 7% and 5% below the recent 5 and 10 year averages, (1983-1987 and 1978-1987), respectively. The pink harvest was 53% above and 48% below the recent 5 and 10 year averages, (1983-1987 and 1978-1987), respectively. The chum harvest was 37% below both the recent 5 year (1983-1987) and 10 year (1978-1987) averages, respectively. Historical catch data for the Norton Sound district is presented in Appendix Table A8.

The average weight, in pounds for chinook, sockeye, coho, pink, and chum salmon was 16.4, 6.9, 7.5, 3.0, and 7.1 pounds, respectively (Appendix Table A9).

Although a total of 204 CFEC permits were renewed for the 1988 season, only 152 permit holders actually fished. The number of participating fishermen this season was slightly below the recent five year (1983-1987) average of 159 fishermen (Appendix Table A1).

Two domestic processors operated in Norton Sound during 1988. In addition, a joint venture between KEG (Koyuk-Elim-Golovin), and NPL Alaska, Inc., operated during the 1988 season. Under a permit issued by the Governor, two Japanese freezer ships were authorized to buy Norton Sound salmon directly from domestic fishermen. Their operations were limited to internal waters of Golovin and Norton Bay for processing of all salmon species caught in the aforementioned internal waters. Additionally, the joint venture ships were permitted to process pink salmon (only) purchased directly from domestic fishermen fishing the newly designated internal waters (1987) of the Shaktoolik and Unalakleet subdistricts. In 1988, two freezer ships operated in Norton Sound and as in past years, were located in Golovin Bay, and in Norton Bay, near Moses Point. Although the pink salmon return to the Shaktoolik and Unalakleet subdistricts was relatively strong, no deliveries were made by these fishermen to the joint venture vessels. Some fishermen in both villages expressed interest in marketing their pink salmon catches to the Japanese processors, but were discouraged by high costs of tendering this relatively low value species over

the large distance to the ship location. A few fishermen from the Nome, Moses Point, and Unalakleet subdistricts also sold coho salmon locally as permitted under catcher-seller status. A list of processors which operated in Norton Sound during 1988 is found in Appendix G4.

Commercial fishermen received approximately \$754,751.00 for their catch. These earnings rank as the seventh highest since the commercial fishery was initiated in 1961, and was 4% above the 1983-1987 average (Appendix Table A11). Prices paid to the fishermen averaged \$1.26 per pound for chinook, \$1.16 per pound for sockeye, \$1.13 per pound for coho, \$0.19 per pound for pink, and \$0.39 per pound for chum salmon (Appendix Table A10). Both the chinook and coho salmon prices paid were the highest on record; the chum salmon price was the second highest on record (Appendix Table A10).

Subsistence Fishery

The last year that systematic household surveys were conducted in Norton Sound was 1982. Since 1983, house-to-house subsistence salmon surveys have not been conducted in the fishing villages of Norton Sound due to budgetary restrictions. In the Nome subdistrict, subsistence harvests were tabulated from the return of permits which are required in this subdistrict. Table 2 lists salmon harvests by stream from the Nome subdistrict during 1988.

Escapement

Table 3 lists aerial survey and tower escapement counts in the major index streams of Norton Sound. In general, weather conditions were fairly cooperative during 1988. Lower levels of rainfall than normal kept stream water levels comparatively low throughout June and July. Peak surveys were obtained in many subdistrict 1, 2, and 4 streams. Several surveys flown in an attempt for peak counts in subdistricts 3, 5, and 6 were found to be past peak for chum salmon. Many streams also experienced the strongest pink salmon returns since 1984. Surveys were flown on select streams in all six subdistricts for coho salmon in late August and early September. In general, weather conditions were fairly good for these surveys.

Pink salmon escapements were fair to excellent in Norton Sound. Although pink salmon escapement goals are not established for most streams, many pink counts were higher than average. Counts for subdistrict 2, 3, 4, 5, and 6 streams greatly exceeded escapements observed since 1985, but were generally below the even year escapements which occurred from 1978-1984. Escapements in subdistrict 1 streams were lower than most even year return escapement counts since 1980, but were similar to recent odd year returns (1983, 1985) (Appendix Table A13).

Chum salmon escapements in the Nome subdistrict streams appeared to be below average; none of the primary index streams of this subdistrict achieved average escapement goals. Chum salmon escapements in three Golovin subdistrict streams (Fish, Niukluk, Boston) appeared to be below average, although a peak survey was attained only on the Niukluk River. Chum escapements in the Moses Point subdistrict streams (Kwiniuk and Tubutulik) were also at below average levels. Although subdistricts 2 and 3 were allowed to fish with only "pink gear" from July 13-31, it appeared that chum escapement goals were not attained. Numerous pink salmon in both subdistricts also complicated documentation of chum salmon counts.

Chum salmon escapement counts in the Norton Bay subdistrict approached average levels; since pink salmon were numerous in both the Ungalik and Inglutalik Rivers, it is likely average chum salmon escapements were achieved but could not be documented because of species identification problems.

The Shaktoolik River appeared to have above average chum salmon escapements. Conversely, the Unalakleet system appeared to have below average chum counts, however, pink salmon were very abundant. For this reason, the chum counts documented should be considered very minimal due to species identification problems.

The Unalakleet and Shaktoolik subdistricts contain the major chinook salmon returns. Both the Norton Bay and Moses Point subdistrict drainages have gradually produced more chinook in recent years, however their numbers are small relative to the Unalakleet and Shaktoolik returns. Chinook escapements were above average overall in the Unalakleet system, although low water levels appeared to have affected chinook migration. More chinook were observed in the main Unalakleet River and in the Old Woman River than usual; conversely, fewer were observed in the North River. Chinook escapements appeared below average in the Shaktoolik River (subdistrict 5) and the Ungalik River (subdistrict 4), but were above average in the Inglutalik River (subdistrict 4). Chinook salmon escapements in the Moses Point subdistrict were average to above average, with a record aerial survey count of chinook documented on the Tubutulik River. In the Golovin subdistrict, the chinook producing Boston Creek had average escapement, with below average escapement observed on the Fish River (Appendix Table A13).

The major coho producing streams in Norton Sound are also in the Shaktoolik and Unalakleet subdistricts, although coho salmon are found in nearly all of the chum producing streams throughout the district. Because of the inclement weather normally experienced in this area during August and September, escapement data for all subdistricts is incomplete. This

year, however, coho salmon counts were documented in more streams than usual. Most counts were obtained under fair to good aerial viewing conditions, and were flown at or near peak spawning activity. Overall, coho salmon escapements appeared to be very good. However, without an historical data base, escapement goals or averages have not been derived. Specific counts documented this season will be discussed in each subdistrict summary (Table 3 and Appendix Table A13).

Nome -- Subdistrict 1

Commercial Fishery

The commercial salmon season opened July 1 by emergency order. Five fishermen harvested 2 chinook, 54 coho, 182 pink, and 1,628 chum salmon for a combined total of 1,866 fish (Table 4, Appendix Table A2). The chum harvest was 77% below the recent five year average (1983-1987). Fishing effort was well below the recent five year average of 12 fishermen. One buyer operated in the Nome subdistrict for four periods, from July 1-12; however, just three of these periods were actually fished. A few salmon were sold by fishermen operating under catcher-seller permits during the July 28-29 and August 18-19 periods. Inclement weather conditions prevented fishing from August 1-16, and August 22-30 (rough seas due to high winds). This subdistrict was closed to commercial fishing on August 30 (Table 4).

Regulatory Actions

Generally, chum salmon have been less abundant than pink salmon in subdistrict 1 streams, but the commercial fishery has targeted this species. The relatively large chum salmon catches in this subdistrict in conjunction with weak local stock abundance implies that the fishery intercepts non-local stocks. A 1978-79 Norton Sound stock separation study tends to confirm this view. Salmon tagged near Nome were re-captured in fisheries from Golovin (subdistrict 2) to Kotzebue. In an attempt to provide for spawning requirements in addition to an important subsistence fishery that targets local stocks, a commercial harvest guideline of 5,000-15,000 chum salmon was adopted as a regulation.

Due to poor chum salmon escapement during the 1982 and 1983 seasons, the Board of Fisheries, in response to an advisory committee petition, directed the Department to manage the commercial fishery so that chum salmon escapement could be optimized. During the 1984 fall Board of Fisheries meetings, these directives became regulation. In response to public and advisory board proposals, the following commercial fishery

restrictions were adopted as regulations:

- 1) Salmon may be taken commercially only from July 1 through August 31.
- 2) Fishing periods were restricted to two 24 hour periods per week.
- 3) Waters west of Cape Nome were closed to commercial salmon fishing.

The Department was also directed to allow a harvest at the lower end of the guideline harvest range of 5,000 to 15,000 chum salmon, as stipulated in 5AAC 04.360.

In addition to these commercial fishing restrictions, a proposal to restrict the sport fishery in the Nome and Snake Rivers was adopted in 1984:

- 1) With a bag and possession limit of 15 salmon, other than king salmon, only 5 could be chum and coho, in combination.

Subsistence permit limits in the Nome and Snake Rivers were restricted to 20 chum and 20 coho salmon. The remainder of the permit limit could be filled with salmon other than chum or coho.

However, even with these restrictive regulations in place, chum escapement goals were difficult to attain. The 1987 fishing season experienced poor returns of both chum and pink salmon to Nome subdistrict streams. Numerous management actions were made which curtailed commercial fishing activities, and later, sport, personal use, and subsistence efforts as well. Even with such drastic fishery restrictions, escapement goals for chum salmon were not attained during 1987 in the Nome, Eldorado, Flambeau, Bonanza, Snake, and Solomon Rivers. In response to this continuing trend of decreasing chum and pink salmon returns to the Nome subdistrict, several new regulations were adopted during the 1987 Alaska Board of Fisheries meetings.

With the commercial fishery all but eliminated in recent years, proposals affecting the sport, personal use, and subsistence fisheries were considered. The following new sport fish regulations was adopted for all Nome area road system streams (Seward Peninsula drainages from Cape Prince of Wales to Cape Darby):

- 1) For salmon other than chinook, 10 per day, 10 in possession, only 3 which may be chum salmon and coho

salmon, in combination.

- 2) For chinook salmon, 1 per day, 1 in possession.

These new regulations superceded those adopted during 1984. Additional new regulations affecting personal use and subsistence fishermen which were adopted in 1987 were:

- 1) In the Nome River, no person may operate more than 50 feet of gill net in the aggregate.
- 2) The Nome River was added to the regulation 5AAC 01.170 (e) which states that small mesh gill nets (less than 4 1/2 inch mesh) and beach seines may not be used in specific Nome subdistrict streams.

Although these new regulations were in effect for the 1988 season, the chum salmon escapement goals were not achieved in Nome subdistrict streams (Table 3).

Subsistence Fishery

Due to increased access and effort and limited chum and coho salmon stocks in local streams, subsistence fishing has been conducted in this subdistrict on a permit system since 1974. Subsistence fishermen are required to record the number of fish taken by permit and return it at the end of the season, thereby documenting the harvest. The permit system also attempts to distribute fishing effort by limiting the number of fish that each family can harvest from each river. There is no catch limit in ocean waters. Fishing is restricted by regulation to 4 days per week from June 15 through August 31.

In the Nome subdistrict, regulations adopted during the 1984 and 1987 Board of Fisheries meetings were in effect during the 1988 season. These regulations, as explained above, severely restricted Nome commercial fishermen and to a lesser degree, sport fishermen and subsistence fishermen. However, even with reduced quotas and bag limits and gear type and size restrictions, chum salmon escapements goals were not met. Fishing effort was lower than in recent years, as is evidenced by the fewer number of subsistence permits issued during 1988.

One hundred and seventy-seven subsistence permits were issued for the Nome subdistrict in 1988 compared to a recent 5-year average of 229. The reported harvests from the 159 permits returned was 63 chinook, 169 sockeye, 1,076 coho, 2,159 pink, and 5,592 chum salmon for a total of 9,419 fish (Table 2). The total subsistence salmon harvest was 60% of the recent 5 year average (1983-1987) of 15,795 salmon (Appendix Table A2).

This below average reported subsistence catch was due to below average returns of both chum and pink salmon to the Nome area.

Escapement

Due to the restrictive measures used in the management of the commercial, sport, and subsistence fisheries, the Nome subdistrict of Norton Sound received the most intensive survey efforts, with multiple aerial stream surveys conducted on six index streams, as well as several boat surveys of the Nome River.

Chum salmon escapements in the Nome subdistrict appeared to be below average. In the Nome River, the highest chum count (973) was obtained during a July 20 aerial survey. In the remaining Nome area streams, below average chum escapements were also documented in the Sinuk, Flambeau, Eldorado, Bonanza, Snake and Solomon Rivers (Table 3, Appendix Table A13).

Aerial surveys documented poor to fair pink salmon escapements, however counts were higher than the recent record low return in 1987. The highest counts observed in this subdistrict were 2,490 and 4,652 documented on the Nome and Sinuk Rivers, respectively, during July aerial surveys (Appendix Table A13).

A peak coho salmon count of 1,280 was obtained on the Nome River by adding the September 1 upper river boat survey count to the September 2 lower river aerial survey. This is higher than any documented escapement (aerial or boat survey) on record for coho salmon in the Nome River. Aerial counts were also obtained on the Sinuk and Eldorado Rivers. The Eldorado River count of 78 fish was lower than three of four other data points; the Sinuk River count of 563 was the second highest for the six years that this river has been surveyed for coho salmon (Table 3, Appendix Table A13).

Golovin - Subdistrict-2

Commercial Fishery

Commercial landings began on June 20. Twenty-one fishermen harvested 108 chinook, 921 sockeye, 2,149 coho, 31,559 pink, and 33,348 chum salmon for a combined total of 68,085 fish (Tables 1 and 5). The fishing effort has been very stable, averaging 21 fishermen the past six years (Appendix Table A1). The chum salmon harvest was 39% and 34% below recent 5 and 10 year averages (1983-1987 and 1978-1987), respectively. This catch comprised 31% of the Norton Sound district chum salmon harvest in 1988. The pink salmon harvest was 16% above but 11% below the recent 5 and 10 averages, respectively. The chinook salmon harvest was the third highest on record. The

coho salmon harvest was the fourth highest on record, and above both the recent 5 and 10 year averages (Appendix Table A3). The sockeye harvest of 921 fish was by far the largest reported incidental capture of this species in the history of the commercial fishery.

The Golovin Co-op freezer plant did not operate in 1988. On June 20, a Japanese freezer ship affiliated with the joint venture began buying operations in Golovin Bay. The freezer ship ceased buying operations and departed Norton Sound on August 5.

The Golovin subdistrict fished a normal schedule of two 48 hour periods a week from June 20-July 13 (Table 5). In addition to this schedule, additional small mesh openings were allowed from July 3-July 14; gill nets with a mesh size of 4 1/2" or less could be set or drifted. The purpose of these additional openings was to target the pink salmon return without overexploiting chum salmon. By July 13 it was apparent the chum salmon return to this subdistrict was weaker than normal. On July 14, an emergency order went into effect which placed this subdistrict on a fishing schedule of two 48 hour periods a week with a small mesh restriction (4 1/2" or less) to allow further harvest of pink salmon without adversely affecting chum salmon escapements. This mesh restriction was in effect until July 31. Larger mesh periods (6" or less) were re-instated from August 1 until the season closure on August 31.

On August 6, a domestic processor began buying operations in subdistricts 2 and 3. This buyer did not contact department employees in Nome nor Unalakleet prior to commencing operations. Department employees in Unalakleet relayed the following information to the Nome office on August 10: the domestic buyer operating in Shaktoolik had transported equipment for buying salmon to Moses Point. This buyer had made arrangements with the local fishermen to purchase salmon during the August coho return, and was also registered with the Department to operate a buying station in Moses Point. On August 10, he flew over the Moses Point landing and observed his equipment being used, without his permission or knowledge, by an unknown individual, to buy salmon from subdistrict 3 fishermen.

From August 11-15, attempts by Department staff to contact the buyer were unsuccessful. Inclement weather prevented an on-site visit by the local Fish and Wildlife Protection officer. On August 16, the individual operating the Moses Point buying station came into the Nome office since he had heard 'ADF&G personnel were trying to contact him.' At this time, the buyer was cited for failure to register prior to operating in Norton Sound (5AAC 04.365) and failure to meet buyer reporting requirements (5AAC 39.130). Also at this time, it was learned

he had been operating in the Golovin subdistrict, as well as Moses Point, since August 6. Following a meeting with ADF&G and Fish and Wildlife Protection personnel, the buyer was registered and given specific reporting and fish ticket submission requirements. Although it appears the fishermen were paid for their fish, this incident serves to point out monitoring problems associated with an area as large as Norton Sound, which does not attract competitive buying operations in the smaller, more remote fishing subdistricts.

All salmon bought during August were flown out iced, in-the-round, to Anchorage for further processing. All buying operations ceased by August 20, and the season closed on August 31.

Subsistence Fishery

Commercial fishermen in the Golovin Bay often retain a portion of their catch for subsistence purposes. Several Golovin residents maintain subsistence fishing camps along the Kachavik River. Subsistence fishing within the Niukluk and Fish Rivers is done by residents of White Mountain and Council. House-to-house interviews were not conducted in the villages of this subdistrict due to lack of funds. During the last 5 years in which household surveys were conducted annually (1978-1982), an average of 23 households were contacted reporting an average harvest of 9,079 salmon (Appendix Table A3).

Escapement

The major salmon spawning areas in subdistrict 2 are the Fish and Niukluk Rivers. Average escapement for these two drainages is 25,000 chum salmon (Appendix Table 13). A peak aerial survey flown in July on the Niukluk documented an escapement of just 6,501 chum salmon (Table 3). Peak counts were not attained on the Fish River nor Boston Creek. The chum salmon counts of 1,240 and 1,040 for the Fish River and Boston Creek, respectively, were well below goal and average escapements. However, the presence of numerous pink salmon made identification difficult. The observer felt many chum salmon may have been missed for this reason. Chinook salmon escapement counts appeared average, with a count of 163 chinook in Boston Creek comparable to recent year counts (Appendix Table A13). Pink salmon counts were made during the chum salmon surveys, and were found to be significantly higher than in recent years. The only coho salmon survey conducted in subdistrict 2 was made on the Niukluk River; the total count of 1,095 coho salmon included the Ophir Creek counts. With very few data points for comparison, it is uncertain whether 'adequate' escapement was attained; however, this count was the

second highest in four years of observations.

Moses Point - Subdistrict 3

Commercial Fishery

Thirty-six commercial fishermen harvested 663 chinook, 93 sockeye, 3,974 coho, 13,703 pink, and 18,585 chum salmon for a combined total of 37,018 fish (Table 6). Fishing effort was slightly above the 1983-1987 average of 33 fishermen. The chinook harvest was 29% above the 1983-1987 average. The chum harvest was 32% and 39% below the recent 5 and 10 year averages (1983-1987 and 1978-1987), respectively. The pink harvest was 10% above but 24% below the recent 5 and 10 year averages, respectively. The coho harvest was 45% above the recent five year (1983-1987) average catch in this subdistrict which has historically experienced sporadic buying operations during August (Appendix Table A4).

The Elim Fishermen's Co-op plant at Moses Point did not operate during the 1988 season. A Japanese freezer ship affiliated with the joint venture began operations on June 20. The vessel was located inside of the line which designates the internal waters of Norton Bay, as defined by the federal government.

As in subdistrict 2, a below average chum salmon return to subdistrict 3 precipitated an emergency order on July 13; this placed the Moses Point fishermen on a fishing schedule of two 48 hour periods per week, with a 4 1/2" mesh restriction, from July 14-31. Additional small mesh openings had been allowed, as in the Golovin subdistrict, from July 3 -14; larger mesh openings (6" or less) were also re-instated from August 1 until the season closure on August 31.

As explained in the Golovin subdistrict summary, a domestic buyer operated in the Moses Point subdistrict from August 6-20. In addition, a second domestic processor operated during the August 11-13 period. All salmon purchased by the domestic operators were flown out, iced, in-the-round, to Anchorage via Nome or Unalakleet for further processing. One commercial fisherman, as permitted by catcher-seller status, sold fresh coho salmon to a Nome restaurant during August. All commercial salmon ventures ceased by August 24, and the season closed on August 31.

Subsistence Fishery

Household subsistence surveys were not conducted in Elim this year. During the last 6 years in which surveys were conducted (1978-1982, 1985), the average harvest was 7,705 salmon

(Appendix Table A4).

Escapement

Chum salmon escapements were below average in the Kwiniuk and Tubutulik Rivers, the main spawning areas of this subdistrict. Aerial surveys flown on the Tubutulik River in July documented 4,660 chum salmon and 114,150 pink salmon (Table 3). With the large numbers of pink salmon present, species identification was a problem. Applying the Kwiniuk River tower count ratio at that time, the chum count may have been as high as 9,500 salmon.

Expanded count totals on the Kwiniuk River indicated an escapement of 13,301 chum salmon (Table 3). The expanded pink salmon count of 187,904 on the Kwiniuk River was much higher than recent odd year returns (1985, 1987), but below even year returns from 1980-1986 (Appendix Table A13).

The chinook salmon escapements on these rivers were average overall: the Tubutulik River aerial count of 561 chinook was the highest ever recorded; the Kwiniuk River expanded tower count of 321 chinook was near the 10 year average (1978-1987) of 311 fish. Coho salmon escapements were not documented on the Tubutulik River, however, a count of 444 (aerial) on the Kwiniuk River was below the 1984-1987 average of 724 fish (Appendix Table A13).

Norton Bay -- Subdistrict 4

Commercial Fishery

Thirteen fishermen harvested 434 chinook, 2 sockeye, 709 coho, 1,749 pink, and 7,521 chum salmon for a combined total of 10,415 fish (Table 7, Appendix Table A5). Fishing effort was slightly above the recent 5 year average (1983-1987) of 11 fishermen (Appendix Table A1). The chinook harvest was 52% and 33% above the five and ten year averages (1983-1987 and 1978-1987), respectively. The pink salmon catch was 67% above but 33% below recent five and ten year averages (1983-1987 and 1978-1987), respectively. The coho harvest was 58% above the 1983-1987 average, but slightly below the 1978-1987 average of 727 fish. The chum catch was 4% above but 18% below the 1983-1987 and 1978-1987 averages, respectively (Appendix Table A5).

The Norton Bay fishermen delivered to a Japanese freezer ship anchored near Moses Point from the season opening date of June 20 through departure of the freezer ship on August 5. This subdistrict was on a regular fishing schedule of two 48 hour periods per week during the entire season. The only regulatory action taken during the 1988 season which affected subdistrict

4 was a district-wide emergency order issued July 14 which restricted commercial salmon fishing openings to mesh sizes of 6" or less, to cease targeting of chinook salmon. Also, small mesh "pink gear" openings provided an additional 36 hours of fishing time per week to target pink salmon. No one fished these small mesh openings in the Norton Bay subdistrict. No buyer was present during the open periods from August 8-31; the season was closed on August 31.

Subsistence Fishery

Most subsistence fishing activities occur near Ungalik River, although limited fishing takes place near the Inglutalik and Koyuk Rivers.

From 1978-1982 an average of 15 subsistence fishermen per year were contacted during village surveys. An annual harvest of 5,137 salmon was reported. Village surveys were not conducted in this subdistrict in 1988 (Appendix Table A5).

Escapement

Chum salmon escapements in the Norton Bay subdistrict appeared average overall. Although there are no set escapement goals for the Ungalik and Inglutalik Rivers, a peak count of 1,770 chum salmon obtained on the Ungalik River was considered below average, however, large numbers of pink salmon present made species identification difficult. Conversely, a near average chum count of 5,100 was documented for the Inglutalik River, with pink salmon counts higher than most other years of observations. Chinook counts of 788 and 53 on the Inglutalik and on the Ungalik Rivers, respectively, were near average overall. A coho survey flown on the Ungalik River counted 358 fish; this was much higher than the only other data point of 20 coho salmon observed in 1987 under poor conditions.

Shaktoolik -- Subdistrict 5

Commercial Fishery

Twenty-one fishermen harvested 671 chinook, 79 sockeye, 6,096 coho, 3,681 pink, and 21,521 chum salmon for a combined total of 32,048 fish (Table 8). The chinook harvest was 74% and 68% below the 1983-1987 and 1978-1987 average catches of 2,591 and 2,092, respectively. The coho salmon harvest was 22% and 19% below the 1983-1987 and 1978-1987 average catches of 7,847 and 7,516 fish, respectively. The chum catch was 25% and 22% below the 1983-1987 and 1978-1987 average catches of 28,647 and

27,544 fish, respectively (Appendix Table A6).

The Shaktoolik subdistrict opened by emergency order on June 20 for a 24 hour period. Initial periods were set at 24 hours in length from June 20-28 (periods 1, 2, and 3). On June 30, fishing time was increased to two 48 hour periods per week. On June 30, an emergency order was issued which also allowed additional "pink gear" periods from July 3-14, however, no one fished these additional small mesh openings. On July 14, an emergency order went into effect which placed a maximum mesh size restriction of six inches district-wide. The intent of this regulation was to prevent further targeting of chinook salmon due to an apparent below average return. The Shaktoolik subdistrict fished on the regular schedule of two 48 hour periods a week throughout the season. The domestic buyer based in Shaktoolik elected to cease operations following the August 31 period closure. This subdistrict was without a buyer for the remaining two periods; the season closed by regulation on September 7 (Table 8).

One domestic buyer operated in Shaktoolik during 1988. In addition, the joint venture freezer ship located in Norton Bay had been permitted to buy pink salmon directly from fishermen of this subdistrict since no domestic market existed for this salmon species. However, no pink salmon deliveries were made to the freezer ship by Shaktoolik fishermen. The domestic buyer operated during 21 of 23 open periods. All fish were iced and flown out in-the-round to Anchorage via Unalakleet for processing. The domestic buyer bought pink salmon caught incidentally during the first four periods of the season.

Subsistence Fishery

Most of the catch is made from the Shaktoolik River, although some fish camps have historically been maintained near Cape Denbigh.

From 1978-1982 an average of 17 subsistence fishermen per year were contacted during village subsistence surveys, reporting an average annual harvest of 5,961 salmon. Village surveys were not conducted in Shaktoolik during 1988 (Appendix Table A6).

Escapement

Chum salmon counts of the Shaktoolik River appeared to be above average. An aerial survey flown on July 19 found both the chum and pink salmon returns to be past peak as evidenced by good numbers of carcasses observed. High numbers of pink salmon made species identification difficult; both the number of fish and carcasses were derived by applying a ratio of 15 pink to 1 chum (15:1 ratio of pink to chum taken from Kwiniuk

Tower counts) to unidentified salmon counts, and adding to the number of each species actually counted. The estimated escapement of 13,242 chum was above the goal of 11,000 for this stream; the estimated pink salmon escapement of 192,135 was the highest since a 1978 survey which documented 203,303 pink salmon.

Chinook salmon counts of the Shaktoolik River were below average. The July 19 survey documented just 410 chinook salmon. An aerial survey flown on September 3 documented 1,124 coho salmon, which was higher than the only other data point of 746 coho salmon observed in 1987.

Unalakleet - Subdistrict 6

Commercial Fishery

The Unalakleet subdistrict receives the most fishing effort in Norton Sound, and has historically not had problems obtaining buyers for their salmon, with the exception of pink salmon. This season, the joint venture was authorized to buy pink salmon directly from Unalakleet fishermen. Although interest was expressed, the high costs associated with tendering this relatively low value salmon species discouraged attempts to market pink salmon to the Japanese freezer ship located in Norton Bay, near Moses Point. The domestic buyer operating in Unalakleet purchased some pink salmon from June 20-July 7 (Table 9).

The commercial fishing periods, openings, and closures in the Unalakleet subdistrict were the same as those in the Shaktoolik subdistrict. Because of their close proximity to each other (shared boundary) and the difficulty in obtaining timely escapement information, the Unalakleet inriver test net was used frequently as an index of salmon abundance and escapement in the Shaktoolik and Unalakleet subdistricts. Table 9 summarizes catch and effort data by period for the Unalakleet subdistrict.

A total of 69 fishermen landed 2,218 chinook, 157 sockeye, 24,265 coho, 23,730 pink, and 25,363 chum salmon for a combined total of 75,733 fish (Table 9). The chinook salmon harvest was the lowest on record since 1976, and was 68% and 64% below the 1983-1987 and 1978-1987 average catches of 6,837 and 6,233 fish, respectively. The coho harvest was 10% and 13% below the 1983-1987 and 1978-1987 average catches of 27,020 and 27,723 fish, respectively. The pink salmon harvest was well above the 1983-1987 average harvest of 5,259 fish, but 65% below the 1978-1987 average harvest of 68,137 fish. The chum salmon catch was 44% and 42% below the 1983-1987 and 1978-1987 average catches of 45,082 and 44,084 fish, respectively (Appendix Table A7).

One domestic buyer operated in the Unalakleet subdistrict throughout the entire season, including two of the four additional "pink gear" periods. A second domestic buyer operated from August 1-20. All salmon were flown out iced, in-the-round, to fresh food markets or for further processing. The Norton Sound Fishermen's Co-op plant did not operate, however; the facility was leased to receive and ice the salmon delivered dockside.

Regulatory Actions

Four regulatory changes in effect for the first time during the 1988 season were adopted during the 1987 fall Alaska Board of Fisheries meetings. One regulation change affected all Norton Sound District commercial fishermen; one regulation change affected Unalakleet river sport fishermen; and two regulation changes affected Unalakleet River subsistence fishers. All regulatory changes addressed concerns over chinook salmon escapements to the Unalakleet River System.

The new sport fish regulation changed the bag and possession limit for chinook salmon as follows:

- 1) Chinook salmon: one per day, one in possession, no size limit.

The new subsistence regulations changed the open fishing periods and gear specifications in the Unalakleet River, as follows:

- 1) In the Unalakleet River from June 1 through July 15, salmon may be taken from 8:00 a.m. monday until 8:00 p.m. saturday.
- 2) In the Unalakleet River from June 1 through July 15, no person may operate more than 25 fathoms of gill net in the aggregate.

Also, as discussed in previous sections, a district-wide regulation was in place for the first time in 1988 which gave the Department the authority to restrict the mesh size of the commercial gill nets as follows:

- 1) In the Norton Sound District, no person may take salmon with a gill net that has a mesh size larger than six inches after a date specified by an emergency order issued between July 1 and July 15.

Subsistence Fishery

Subsistence fishermen interviews which have historically been conducted (1964-1985) in Unalakleet were not conducted in 1986, 1987, nor 1988 due to budget restrictions. For the last five years during which fishermen were interviewed (1981-1985), an average harvest of 1,339 chinook, 5,730 coho, 11,415 pink and 3,729 chum salmon were reported (Appendix Table A7).

During the chinook salmon run, Department personnel noted large concentrations of gill nets in the lower Unalakleet River for the sixth consecutive year. Although river subsistence chinook harvests were used as an inseason index of return strength and timing, total harvests were not documented. Known river subsistence fishers were contacted daily, on a rotating basis, to gauge chinook salmon return strength. This information was valuable in managing for sufficient escapement of chinook salmon through the fisheries.

Escapement

Aerial surveys in the Unalakleet subdistrict have historically been hampered by turbid stream conditions. In an attempt to index escapement, the Department has operated test nets in the lower Unalakleet River since 1981. A counting tower on the North River, a major tributary of the Unalakleet River, was operated in 1972-1974 and 1984-1986, but was not operated during 1987 and 1988 due to lack of funds.

The Department test net on the Unalakleet River proved to be very useful during 1988. Although this type of sampling does not give a quantitative measure of escapement magnitudes, it did provide an important relative measure of abundance and return timing when compared to previous years' test net catches.

Outlook for 1989

Insufficient data are available to enable reliable forecasting methods to be employed in Norton Sound. The 1989 "outlook" is based upon analysis of comparative escapement and commercial catch information, age data, and "subjective determinations". This outlook is presented only as an indicator of possible 1989 return strength.

The chinook salmon return will be determined by the 1983 and 1984 brood years. The 1983 commercial harvest was above average, while the 1984 catch was below average. Escapement for both years was similar. The chinook salmon return during 1989 is expected to be near average, providing a commercial harvest of 8,000 to 11,000 fish.

The 1989 pink salmon return will be the progeny of the 1987 brood year. Pink salmon have developed a cycle of weak returns during odd years in Norton Sound. Harsh climatic conditions, poor returns and corresponding low escapements are responsible for this cycle. The 1989 pink salmon return is expected to be poor, and commercial catches are not expected to exceed 5,000 fish.

The chum salmon return will be primarily produced by the 1985 return, with a small contribution from the 1984 return. Both the 1984 and 1985 brood year returns were below average. Escapements during the 1985 season generally met the goals the Department feels are needed to maintain the population. Therefore, the chum salmon return is expected to be slightly below average, and may yield a commercial harvest of 120,000 to 180,000 fish.

The 1989 coho salmon return will be produced by the 1985 brood year. The 1985 brood year was characterized by below average returns and escapements of coho salmon. A below average return of coho salmon is expected, and the commercial harvest is expected to fall between 15,000 and 30,000 fish.

Table 1. Norton Sound commercial salmon catch by subdistrict, 1988.

Subdistrict	Chi- nook	Sock- eye	Coho	Pink	Chum	Total
Nome	2	0	54	182	1628	1866
Golovin	108	921	2149	31559	33348	68085
Moses Point	663	93	3974	13703	18585	37018
Norton Bay	434	2	709	1749	7521	10415
Shaktoolik	671	79	6096	3681	21521	32048
Unalakleet	2218	157	24265	23730	25363	75733
District Totals	4096	1252	37247	74604	107966	225165

Table 2. Nome (subdistrict 1) subsistence salmon catches, 1988.

Location	Permits Issued	Permits Returned	Permits Fished	Chinook	Sockeye	Coho	Pink	Chum	Total
Nome River	21	21	10	0	4	150	90	46	290
Marine Waters	93	84	60	60	159	491	1043	4395	6148
Sinuk River	4	4	1	0	4	0	11	57	72
Eldorado River	23	18	15	3	0	175	544	1227	1949
Flambeau River	8	8	2	0	0	71	4	81	156
Snake River	13	12	7	0	2	110	158	43	313
Penny River	0	0	0	0	0	0	0	0	0
Solomon River	6	5	3	0	0	9	74	17	100
Feather River	0	0	0	0	0	0	0	0	0
Bonanza River	7	5	4	0	0	4	223	67	294
Cripple River	2	2	1	0	0	66	12	19	97
Safety Sound	0	0	0	0	0	0	0	0	0
Eld/Flam Rivers	0	0	0	0	0	0	0	0	0
Totals	177	159	103	63	169	1076	2159	5952	9419

Table 3. Aerial survey counts of Norton Sound streams and associated chum salmon escapement goals, 1988.

Stream name	Chum	Chum Goal	Pink	Chinook	Coho
Nome R. 1/2/	973	2,000	2,490	3	1,280 3/
Flambeau R. 2/	765	3,300	10	3	-
Eldorado R. 2/	2,645	5,300	1,045	17	78
Sinuk R. 1/2/	2,070	-	4,652	3	563
Solomon R.	25	-	570	0	-
Fish R. 1/	1,240	17,500	29,950	36	-
Niukluk R. 2/	6,501	8,000	8,160	18	1,095 4/
Boston Cr. 1/	1,040	2,500	7,400	163	-
Tubutulik R.1/5/	4,660	12,000	114,150	561	-
Kwiniuk R. 6/	12,686	25,000	174,541	232	444 7/
Ungalik R. 1/2/	1,770	-	99,600	53	358
Inglutalik R.	5,100	-	10,740	788	-
Shaktoolik R. 1/	13,242	11,000	192,135	410	1,124
North R. 1/	30	4,500	112,770	202	240
Unalakleet System 1/8/	1,620	-	148,170	1,234	1,129

- 1/ Species identification problem due to numerous pink salmon; pink count may include some chum salmon.
- 2/ Peak chum salmon counts.
- 3/ Peak coho salmon count obtained by adding upper river boat survey count on 9/01 to lower river aerial count on 9/02.
- 4/ Includes 474 coho salmon counted in Ophir Creek.
- 5/ Numerous pink salmon masked some chum salmon; applying the Kwiniuk River tower count ratio to date of 12:1 pink to chum, the chum escapement on this survey may have been as high as 9,500 salmon.
- 6/ Preliminary expanded tower counts.
- 7/ Aerial survey count.
- 8/ Includes Old Woman aerial survey counts.

Table 4. Commercial salmon catches from Nome, subdistrict 1, Norton Sound, set gill nets, 1988.

Period Dates	Hours Fished	No. of Fishermen	Period Catch and Catch Per Unit Effort						Cumulative Catch and Catch Per Unit Effort									
			CHINOOK	CPUE	COHO	CPUE	PINK	CPUE	CHINOOK	CPUE	COHO	CPUE	PINK	CPUE	CHUM	CPUE		
1 7/01-7/02	24	2	0	0.00	0	0.00	39	0.81	352	7.33	0	0.00	0	0.00	39	0.81	352	7.33
2 7/04-7/05	24	2	1	0.02	0	0.00	54	1.13	849	17.69	1	0.01	0	0.00	93	0.97	1,201	12.51
3 7/07-7/08	24	0	NO ONE FISHED								1	0.01	0	0.00	93	0.97	1,201	12.51
4 7/11-7/12	24	3	0	0.00	0	0.00	77	1.07	333	4.63	1	0.01	0	0.00	170	1.01	1,534	9.13
5 7/14-7/15	24	0	NO BUYER								1	0.01	0	0.00	170	1.01	1,534	9.13
6 7/18-7/19	24	0	NO BUYER								1	0.01	0	0.00	170	1.01	1,534	9.13
7 7/21-7/22	24	0	NO BUYER								1	0.01	0	0.00	170	1.01	1,534	9.13
8 7/25-7/26	24	0	NO BUYER								1	0.01	0	0.00	170	1.01	1,534	9.13
9 7/28-7/29	24	2	1	0.02	5	0.10	12	0.25	94	1.96	2	0.01	5	0.02	182	0.84	1,628	7.54
10 8/01-8/02	24	0	STORMY								2	0.01	5	0.02	182	0.84	1,628	7.54
11 8/04-8/05	24	0	STORMY								2	0.01	5	0.02	182	0.84	1,628	7.54
12 8/08-8/09	24	0	STORMY								2	0.01	5	0.02	182	0.84	1,628	7.54
13 8/11-8/12	24	0	STORMY								2	0.01	5	0.02	182	0.84	1,628	7.54
14 8/15-8/16	24	0	STORMY								2	0.01	5	0.02	182	0.84	1,628	7.54
15 8/18-8/19	24	1	0	0.00	49	2.04	0	0.00	0	0.00	2	0.01	54	1.10	182	0.76	1,628	6.78
16 8/22-8/23	24	0	STORMY								2	0.01	54	1.10	182	0.76	1,628	6.78
17 8/25-8/26	24	0	STORMY								2	0.01	54	1.10	182	0.76	1,628	6.78
18 8/29-8/30	24	0	STORMY								2	0.01	54	1.10	182	0.76	1,628	6.78
Season Total	120 1/	5	2		54		182		1,628		2		54		182		1,628	

1/ Total hours actually fished.

Table 5. Commercial salmon catches from Golovin, subdistrict 2, Norton Sound, set gill nets, 1988.

1/ Period Dates	Hours Fished	No. of Fishermen	Period Catch and Catch Per Unit Effort												Cumulative Catch and Catch Per Unit Effort											
			CHINOOK	CPUE	SOCKEYE	CPUE	COHO	CPUE	PINK	CPUE	CHUM	CPUE	CHINOOK	CPUE	SOCKEYE	CPUE	COHO	CPUE	PINK	CPUE	CHUM	CPUE				
1	6/20-6/22	48	14	24	0.04	5	0.01	0	0.00	303	0.45	3,877	5.77	24	0.04	5	0.01	0	0.00	303	0.45	3,877	5.77			
2	6/23-6/25	48	15	12	0.02	13	0.02	0	0.00	489	0.68	4,209	5.85	36	0.03	18	0.01	0	0.00	792	0.57	8,086	5.81			
3	6/27-6/29	48	18	10	0.01	232	0.27	0	0.00	2,560	2.96	5,071	5.87	46	0.02	250	0.11	0	0.00	3,352	1.49	13,157	5.83			
4	6/30-7/02	48	20	15	0.02	201	0.21	0	0.00	2,320	2.42	5,601	5.83	61	0.02	451	0.14	0	0.00	5,672	1.76	18,758	5.83			
P1	7/03-7/04	24	10	1	0.00	15	0.06	0	0.00	2,486	10.36	665	2.77	1	0.00	15	0.06	0	0.00	2,486	10.36	665	2.77			
5	7/04-7/06	48	19	7	0.01	156	0.17	0	0.00	2,157	2.37	4,599	5.04	68	0.02	607	0.15	0	0.00	7,829	1.90	23,357	5.66			
P2	7/06-7/07	12	7	0	0.00	4	0.05	0	0.00	624	7.43	194	2.31	1	0.00	19	0.06	0	0.00	3,110	9.60	859	2.65			
6	7/07-7/09	48	18	4	0.00	140	0.16	0	0.00	3,826	4.43	4,251	4.92	72	0.01	747	0.15	0	0.00	11,655	2.33	27,608	5.53			
P3	7/10-7/11	24	7	0	0.00	16	0.10	0	0.00	1,497	8.91	345	2.05	1	0.00	35	0.07	0	0.00	4,607	9.36	1,204	2.45			
7	7/11-7/13	48	17	3	0.00	75	0.09	0	0.00	2,692	3.30	1,974	2.42	75	0.01	822	0.14	0	0.00	14,347	2.47	29,582	5.09			
P4	7/13-7/14	12	4	0	0.00	4	0.08	0	0.00	1,040	21.67	124	2.58	1	0.00	39	0.07	0	0.00	5,647	10.46	1,328	2.46			
P5	7/15-7/16	48	9	0	0.00	2	0.00	0	0.00	4,563	10.56	371	0.86	1	0.00	41	0.04	0	0.00	10,210	10.50	1,699	1.75			
P6	7/18-7/20	48	9	0	0.00	13	0.03	0	0.00	3,192	7.39	613	1.42	1	0.00	54	0.04	0	0.00	13,402	9.55	2,312	1.65			
P7	7/21-7/23	48	8	0	0.00	9	0.02	3	0.01	1,069	2.78	352	0.92	1	0.00	63	0.04	3	0.00	14,471	8.09	2,664	1.49			
P8	7/25-7/27	48	5	4	0.02	2	0.01	12	0.05	1,226	5.11	166	0.69	5	0.00	65	0.03	15	0.01	15,697	7.74	2,830	1.40			
P9	7/28-7/30	48	7	4	0.01	9	0.03	30	0.09	1,192	3.55	190	0.57	9	0.00	74	0.03	45	0.02	16,889	7.14	3,020	1.28			
8	8/01-8/03	48	10	2	0.00	7	0.01	257	0.54	240	0.50	313	0.65	77	0.01	829	0.13	257	0.54	14,587	2.32	29,895	4.75			
9	8/04-8/06	48	8	8	0.02	6	0.02	334	0.87	83	0.22	159	0.41	85	0.01	835	0.13	591	0.68	14,670	2.20	30,054	4.50			
10	8/08-8/10	48	10	7	0.01	4	0.01	600	1.25	0	0.00	119	0.25	92	0.01	839	0.12	1,191	0.89	14,670	2.05	30,173	4.22			
11	8/11-8/13	48	7	4	0.01	3	0.01	361	1.07	0	0.00	90	0.27	96	0.01	842	0.11	1,552	0.92	14,670	1.96	30,263	4.04			
12	8/15-8/17	48	5	1	0.00	0	0.00	225	0.94	0	0.00	13	0.05	97	0.01	842	0.11	1,777	0.92	14,670	1.90	30,276	3.92			
13	8/18-8/20	48	8	2	0.01	5	0.01	327	0.85	0	0.00	52	0.14	99	0.01	847	0.10	2,104	0.91	14,670	1.81	30,328	3.74			
14	8/22-8/24	48	0	0	NO BUYER																					
15	8/25-8/27	48	0	0	NO BUYER																					
16	8/29-8/31	48	0	0	NO BUYER																					
Season Total			936	4/ 21	108	921	2,149	31,559	33,348	108	921	2,149	31,559	33,348												

1/ Special "pink gear" periods designated by "P".

2/ Cumulative figures calculated by mesh size restriction in effect for respective period.

3/ Cumulative coho boat hours began when 100 coho were caught.

4/ Total hours fished, all mesh sizes.

Table 6. Commercial salmon catches from Moses Point, subdistrict 3, Norton Sound, set gill nets, 1988.

1/ Period Dates	Hours Fished	No. of Fishermen	Period Catch and Catch Per Unit Effort									2/ 3/ Cumulative Catch and Catch Per Unit Effort											
			CHINOOK	CPUE	SOCKEYE	CPUE	COHO	CPUE	PINK	CPUE	CHUM	CPUE	CHINOOK	CPUE	SOCKEYE	CPUE	COHO	CPUE	PINK	CPUE	CHUM	CPUE	
			1	6/20-6/22	48	21	165	0.16	0	0.00	0	0.00	163	0.16	3,086	3.06	165	0.16	0	0.00	0	0.00	163
2	6/23-6/25	48	24	218	0.19	0	0.00	0	0.00	482	0.42	3,282	2.85	383	0.18	0	0.00	0	0.00	645	0.30	6,368	2.95
3	6/27-6/29	48	27	156	0.12	0	0.00	0	0.00	1,660	1.28	3,955	3.05	539	0.16	0	0.00	0	0.00	2,305	0.67	10,323	2.99
4	6/30-7/02	48	23	47	0.04	15	0.01	0	0.00	1,286	1.16	1,708	1.55	586	0.13	15	0.00	0	0.00	3,591	0.79	12,031	2.64
P1	7/03-7/04	24	8	9	0.05	1	0.01	0	0.00	998	5.20	201	1.05	9	0.05	1	0.01	0	0.00	998	5.20	201	1.05
5	7/04-7/06	48	21	24	0.02	46	0.05	0	0.00	2,513	2.49	2,678	2.66	610	0.11	61	0.01	0	0.00	6,104	1.10	14,709	2.64
P2	7/06-7/07	12	9	1	0.01	0	0.00	0	0.00	965	8.94	132	1.22	10	0.03	1	0.00	0	0.00	1,963	6.54	333	1.11
6	7/07-7/09	48	22	18	0.02	14	0.01	0	0.00	2,184	2.07	1,598	1.51	628	0.09	75	0.01	0	0.00	8,288	1.25	16,307	2.46
P3	7/10-7/11	24	5	1	0.01	0	0.00	0	0.00	455	3.79	56	0.47	11	0.03	1	0.00	0	0.00	2,418	5.76	389	0.93
7	7/11-7/13	48	14	10	0.01	8	0.01	0	0.00	673	1.00	746	1.11	638	0.09	83	0.01	0	0.00	8,961	1.23	17,053	2.34
P4	7/13-7/14	12	1	0	0.00	0	0.00	0	0.00	40	3.33	9	0.75	11	0.03	1	0.00	0	0.00	2,458	5.69	398	0.92
P5	7/15-7/16	48	7	1	0.00	2	0.01	0	0.00	1,717	5.11	20	0.06	12	0.02	3	0.00	0	0.00	4,175	5.44	418	0.54
P6	7/18-7/20	48	7	0	0.00	1	0.00	0	0.00	364	1.08	168	0.50	12	0.01	4	0.00	0	0.00	4,539	4.11	586	0.53
P7	7/21-7/23	48	6	4	0.01	1	0.00	2	0.01	156	0.54	96	0.33	16	0.01	5	0.00	2	0.00	4,695	3.37	682	0.49
P8	7/25-7/27	48	0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	16	0.01	5	0.00	2	0.00	4,695	3.37	682	0.49
P9	7/28-7/30	48	3	2	0.01	3	0.02	14	0.10	37	0.26	108	0.75	18	0.01	8	0.01	16	0.01	4,732	3.08	790	0.51
8	8/01-8/03	48	9	2	0.00	2	0.00	133	0.31	9	0.02	175	0.41	640	0.08	85	0.01	133	0.31	8,970	1.16	17,228	2.23
9	8/04-8/06	48	15	3	0.00	0	0.00	276	0.38	1	0.00	116	0.16	643	0.08	85	0.01	409	0.35	8,971	1.06	17,344	2.05
10	8/08-8/10	48	21	1	0.00	0	0.00	748	0.74	0	0.00	270	0.27	644	0.07	85	0.01	1,157	0.53	8,971	0.95	17,614	1.86
11	8/11-8/13	48	17	0	0.00	0	0.00	972	1.19	0	0.00	14	0.02	644	0.06	85	0.01	2,129	0.71	8,971	0.87	17,628	1.72
12	8/15-8/17	48	19	0	0.00	0	0.00	978	1.07	0	0.00	50	0.05	644	0.06	85	0.01	3,107	0.80	8,971	0.80	17,678	1.58
13	8/18-8/20	48	19	1	0.00	0	0.00	774	0.85	0	0.00	117	0.13	645	0.05	85	0.01	3,881	0.81	8,971	0.74	17,795	1.47
14	8/22-8/24	48	1	0	0.00	0	0.00	77	1.60	0	0.00	0	0.00	645	0.05	85	0.01	3,958	0.81	8,971	0.74	17,795	1.47
15	8/25-8/27	48	0	NO BUYER																			
16	8/29-8/31	48	0	NO BUYER																			
Season Total			936 4/ 36	663	93	3,974	13,703	18,585	663	93	3,974	13,703	18,585										

1/ Special "pink gear" periods designated by "P".

2/ Cumulative figures calculated by mesh size restriction in effect for respective period.

3/ Cumulative coho boat hours began when 100 coho were caught.

4/ Total hours fished, all mesh sizes.

Table 7. Commercial salmon catches from Norton Bay, subdistrict 4, Norton Sound, set gill nets, 1988.

1/ Period Dates	Hours Fished	No. of Fishermen	Period Catch and Catch Per Unit Effort										Cumulative Catch and Catch Per Unit Effort 2/										
			CHINOOK	CPUE	SOCKEYE	CPUE	COHO	CPUE	PINK	CPUE	CHUM	CPUE	CHINOOK	CPUE	SOCKEYE	CPUE	COHO	CPUE	PINK	CPUE	CHUM	CPUE	
1	6/20-6/22	48	4	54	0.28	0	0.00	0	0.00	0	0.00	272	1.42	54	0.28	0	0.00	0	0.00	0	0.00	272	1.42
2	6/23-6/25	48	8	235	0.61	0	0.00	0	0.00	9	0.02	681	1.77	289	0.50	0	0.00	0	0.00	9	0.02	953	1.65
3	6/27-6/29	48	9	73	0.17	0	0.00	0	0.00	98	0.23	793	1.84	362	0.36	0	0.00	0	0.00	107	0.11	1,746	1.73
4	6/30-7/02	48	6	26	0.09	0	0.00	0	0.00	101	0.35	339	1.18	388	0.30	0	0.00	0	0.00	208	0.16	2,085	1.61
P1	7/03-7/04	24	0	NO ONE FISHED																			
5	7/04-7/06	48	9	14	0.03	0	0.00	0	0.00	170	0.39	1,079	2.50	402	0.23	0	0.00	0	0.00	378	0.22	3,164	1.83
P2	7/06-7/07	12	0	NO ONE FISHED																			
6	7/07-7/09	48	7	4	0.01	0	0.00	0	0.00	369	1.10	962	2.86	406	0.20	0	0.00	0	0.00	747	0.36	4,126	2.00
P3	7/10-7/11	24	0	NO ONE FISHED																			
7	7/11-7/13	48	4	1	0.01	0	0.00	0	0.00	93	0.48	185	0.96	407	0.18	0	0.00	0	0.00	840	0.37	4,311	1.91
P4	7/13-7/14	12	0	NO ONE FISHED																			
8	7/14-7/16	48	6	1	0.00	0	0.00	0	0.00	71	0.25	1,091	3.79	408	0.16	0	0.00	0	0.00	911	0.36	5,402	2.12
9	7/18-7/20	48	9	9	0.02	1	0.00	1	0.00	639	1.48	668	1.55	417	0.14	1	0.00	1	0.00	1,550	0.52	6,070	2.04
10	7/21-7/23	48	5	0	0.00	0	0.00	4	0.02	83	0.35	223	0.93	417	0.13	1	0.00	5	0.00	1,633	0.51	6,293	1.96
11	7/25-7/27	48	7	7	0.02	0	0.00	23	0.07	37	0.11	399	1.19	424	0.12	1	0.00	28	0.01	1,670	0.47	6,692	1.88
12	7/28-7/30	48	8	7	0.02	1	0.00	148	0.39	71	0.18	568	1.48	431	0.11	2	0.00	176	0.46	1,741	0.44	7,260	1.84
13	8/01-8/03	48	7	3	0.01	0	0.00	428	1.27	8	0.02	241	0.72	434	0.10	2	0.00	604	0.83	1,749	0.41	7,501	1.76
14	8/04-8/06	48	6	0	0.00	0	0.00	105	0.36	0	0.00	20	0.07	434	0.10	2	0.00	709	0.70	1,749	0.38	7,521	1.65
15	8/08-8/10	48	0	NO BUYER																			
16	8/11-8/13	48	0	NO BUYER																			
17	8/15-8/17	48	0	NO BUYER																			
18	8/18-8/20	48	0	NO BUYER																			
19	8/22-8/24	48	0	NO BUYER																			
20	8/25-8/27	48	0	NO BUYER																			
21	8/29-8/31 3/	48	0	NO BUYER																			
Season Total			672 4/ 13	434		2	709		1,749		7,521		434		2	709		1,749		7,521			

1/ Special "pink gear" periods designated by "P".

2/ Cumulative coho boat hours began when 100 coho were caught.

3/ Commercial fishing season closed by emergency order on August 31.

4/ Total hours actually fished.

Table 8. Commercial salmon catches from Shaktoolik, subdistrict 5, Norton Sound, set gill nets, 1988.

1/ Period Dates	Hours Fished	No. of Fishermen	Period Catch and Catch Per Unit Effort								Cumulative Catches and Catch Per Unit Effort 2/												
			CHINOOK CPUE	SOCKEYE CPUE	COHO CPUE	PINK CPUE	CHUM CPUE	CHINOOK CPUE	SOCKEYE CPUE	COHO CPUE	PINK CPUE	CHUM CPUE											
1	6/20-6/21	24	17	137	0.34	0	0.00	0	0.00	44	0.11	544	1.33	137	0.34	0	0.00	0	0.00	44	0.11	544	1.33
2	6/23-6/24	24	15	124	0.34	0	0.00	0	0.00	482	1.34	873	2.43	261	0.34	0	0.00	0	0.00	526	0.68	1,417	1.85
3	6/27-6/28	24	17	123	0.30	0	0.00	0	0.00	2,944	7.22	2,455	6.02	384	0.33	0	0.00	0	0.00	3,470	2.95	3,872	3.29
4	6/30-7/02	48	17	103	0.13	0	0.00	0	0.00	211	0.26	4,349	5.33	487	0.24	0	0.00	0	0.00	3,681	1.85	8,221	4.13
P1	7/03-7/04	24	0	NO ONE FISHED																			
5	7/04-7/06	48	18	37	0.04	1	0.00	0	0.00	0	0.00	2,429	2.81	524	0.18	1	0.00	0	0.00	3,681	1.29	10,650	3.73
P2	7/06-7/07	12	0	NO ONE FISHED																			
6	7/07-7/09	48	20	42	0.04	2	0.00	0	0.00	0	0.00	2,788	2.90	566	0.15	3	0.00	0	0.00	3,681	0.96	13,438	3.52
P3	7/10-7/11	24	0	NO ONE FISHED																			
7	7/11-7/13	48	18	24	0.03	2	0.00	0	0.00	0	0.00	1,901	2.20	590	0.13	5	0.00	0	0.00	3,681	0.79	15,339	3.28
P4	7/13-7/14	12	0	NO ONE FISHED																			
8	7/14-7/16	48	17	25	0.03	6	0.01	3	0.00	0	0.00	1,406	1.72	615	0.11	11	0.00	3	0.00	3,681	0.67	16,745	3.05
9	7/18-7/20	48	2	5	0.05	1	0.01	6	0.06	0	0.00	405	4.22	620	0.11	12	0.00	9	0.00	3,681	0.66	17,150	3.07
10	7/21-7/23	48	13	13	0.02	2	0.00	10	0.02	0	0.00	1,426	2.29	633	0.10	14	0.00	19	0.00	3,681	0.59	18,576	2.99
11	7/25-7/27	48	10	6	0.01	2	0.00	17	0.04	0	0.00	420	0.88	639	0.10	16	0.00	36	0.01	3,681	0.55	18,996	2.84
12	7/28-7/30	48	20	5	0.01	4	0.00	309	0.32	0	0.00	817	0.85	644	0.08	20	0.00	345	0.36	3,681	0.48	19,813	2.59
13	8/01-8/03	48	17	8	0.01	9	0.01	494	0.61	0	0.00	531	0.65	652	0.08	29	0.00	839	0.47	3,681	0.43	20,344	2.40
14	8/04-8/06	48	17	8	0.01	6	0.01	452	0.55	0	0.00	298	0.37	660	0.07	35	0.00	1,291	0.50	3,681	0.40	20,642	2.22
15	8/08-8/10	48	16	1	0.00	8	0.01	872	1.14	0	0.00	406	0.53	661	0.07	43	0.00	2,163	0.64	3,681	0.37	21,048	2.09
16	8/11-8/13	48	11	4	0.01	1	0.00	574	1.09	0	0.00	165	0.31	665	0.06	44	0.00	2,737	0.70	3,681	0.35	21,213	2.00
17	8/15-8/17	48	13	1	0.00	11	0.02	616	0.99	0	0.00	42	0.07	666	0.06	55	0.00	3,353	0.74	3,681	0.33	21,255	1.90
18	8/18-8/20	48	14	1	0.00	2	0.00	744	1.11	0	0.00	79	0.12	667	0.06	57	0.00	4,097	0.79	3,681	0.31	21,334	1.80
19	8/22-8/24	48	10	1	0.00	3	0.01	607	1.26	0	0.00	79	0.16	668	0.05	60	0.00	4,704	0.83	3,681	0.30	21,413	1.73
20	8/25-8/27	48	15	1	0.00	16	0.02	880	1.22	0	0.00	45	0.06	669	0.05	76	0.01	5,584	0.87	3,681	0.28	21,458	1.64
21	8/29-8/31	48	9	2	0.00	3	0.01	504	1.17	0	0.00	62	0.14	671	0.05	79	0.01	6,088	0.89	3,681	0.27	21,520	1.59
22	9/01-9/03	48	0	NO BUYER																			
23	9/05-9/07	48	0	NO BUYER																			
Season Total			1,008 3/ 21	671	79	6,088	3,681	21,520	671	79	6,088	3,681	21,520										

1/ Special "pink gear" periods designated by "P".

2/ Cumulative coho boat hours began when 100 coho were caught.

3/ Total hours actually fished.

Table 9. Commercial salmon catches from Unalakleet, subdistrict 6, Norton Sound, set gill nets, 1988.

1/ Period Dates	Hours Fished	No. of Fishermen	Period Catch and Catch Per Unit Effort									Cumulative Catch and Catch Per Unit Effort 2/ 3/											
			CHINOOK	CPUE	SOCKEYE	CPUE	COHO	CPUE	PINK	CPUE	CHUM	CPUE	CHINOOK	CPUE	SOCKEYE	CPUE	COHO	CPUE	PINK	CPUE	CHUM	CPUE	
1	6/20-6/21	24	45	572	0.53	0	0.00	0	0.00	305	0.28	442	0.41	572	0.53	0	0.00	0	0.00	305	0.28	442	0.41
2	6/23-6/24	24	48	630	0.55	1	0.00	0	0.00	762	0.66	952	0.83	1,202	0.54	1	0.00	0	0.00	1,067	0.48	1,394	0.62
3	6/27-6/28	24	48	361	0.31	0	0.00	0	0.00	7,592	6.59	2,957	2.57	1,563	0.46	1	0.00	0	0.00	8,659	2.56	4,351	1.29
4	6/30-7/02	48	38	216	0.12	2	0.00	0	0.00	6,153	3.37	2,205	1.21	1,779	0.34	3	0.00	0	0.00	14,812	2.84	6,556	1.26
P1	7/03-7/04	24	7	12	0.07	0	0.00	0	0.00	5,840	34.76	330	1.96	1,272	0.07	0	0.00	0	0.00	5,840	34.76	330	1.96
5	7/04-7/06	48	31	78	0.05	6	0.00	0	0.00	33	0.02	2,301	1.55	1,857	0.28	9	0.00	0	0.00	14,845	2.22	8,857	1.32
P2	7/06-7/07	12	8	8	0.08	0	0.00	0	0.00	3,045	31.72	56	0.58	20	0.08	0	0.00	0	0.00	8,885	33.66	386	1.46
6	7/07-7/09	48	31	81	0.05	4	0.00	0	0.00	0	0.00	2,746	1.85	1,938	0.24	13	0.00	0	0.00	14,845	1.81	11,603	1.42
P3	7/10-7/11	24	0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	20	0.08	0	0.00	0	0.00	8,885	33.66	386	1.46
7	7/11-7/13	48	28	30	0.02	2	0.00	3	0.00	0	0.00	1,329	0.99	1,968	0.21	15	0.00	3	0.00	14,845	1.56	12,932	1.36
P4	7/13-7/14	12	0	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	20	0.08	0	0.00	0	0.00	8,885	33.66	386	1.46
8	7/14-7/16	48	32	32	0.02	2	0.00	3	0.00	0	0.00	2,700	1.76	2,000	0.18	17	0.00	6	0.00	14,845	1.34	15,632	1.41
9	7/18-7/20	48	27	42	0.03	1	0.00	18	0.01	0	0.00	1,205	0.93	2,042	0.17	18	0.00	24	0.00	14,845	1.20	16,837	1.36
10	7/21-7/23	48	22	20	0.02	10	0.01	38	0.04	0	0.00	1,510	1.43	2,062	0.15	28	0.00	62	0.00	14,845	1.11	18,347	1.37
11	7/25-7/27	48	12	8	0.01	0	0.00	41	0.07	0	0.00	460	0.80	2,070	0.15	28	0.00	103	0.18	14,845	1.06	18,807	1.34
12	7/28-7/30	48	39	20	0.01	5	0.00	1,230	0.66	0	0.00	1,542	0.82	2,090	0.13	33	0.00	1,333	0.54	14,845	0.94	20,349	1.28
13	8/01-8/03	48	51	24	0.01	12	0.00	2,927	1.20	0	0.00	927	0.38	2,114	0.12	45	0.00	4,260	0.87	14,845	0.81	21,276	1.16
14	8/04-8/06	48	54	15	0.01	4	0.00	1,763	0.68	0	0.00	691	0.27	2,129	0.10	49	0.00	6,023	0.80	14,845	0.71	21,967	1.05
15	8/08-8/10	48	55	16	0.01	17	0.01	4,940	1.87	0	0.00	984	0.37	2,145	0.09	66	0.00	10,963	1.08	14,845	0.63	22,951	0.97
16	8/11-8/13	48	48	6	0.00	3	0.00	2,428	1.05	0	0.00	444	0.19	2,151	0.08	69	0.00	13,391	1.08	14,845	0.57	23,395	0.91
17	8/15-8/17	48	49	9	0.00	12	0.01	2,202	0.94	0	0.00	247	0.11	2,160	0.08	81	0.00	15,593	1.06	14,845	0.53	23,642	0.84
18	8/18-8/20	48	52	6	0.00	14	0.01	1,783	0.71	0	0.00	237	0.09	2,166	0.07	95	0.00	17,376	1.00	14,845	0.48	23,879	0.78
19	8/22-8/24	48	36	11	0.01	14	0.01	2,436	1.41	0	0.00	407	0.24	2,177	0.07	109	0.00	19,812	1.04	14,845	0.46	24,286	0.75
20	8/25-8/27	48	46	1	0.00	14	0.01	2,253	1.02	0	0.00	232	0.11	2,178	0.06	123	0.00	22,065	1.04	14,845	0.43	24,518	0.71
21	8/29-8/31	48	37	9	0.01	14	0.01	883	0.50	0	0.00	184	0.10	2,187	0.06	137	0.00	22,948	1.00	14,845	0.41	24,702	0.68
22	9/01-9/03	48	28	6	0.00	13	0.01	816	0.61	0	0.00	158	0.12	2,193	0.06	150	0.00	23,764	0.97	14,845	0.39	24,860	0.66
23	9/05-9/07	48	24	5	0.00	7	0.01	468	0.41	0	0.00	117	0.10	2,198	0.06	157	0.00	24,265	0.95	14,845	0.38	24,977	0.64
Season Total			1,140 4/	69	2,218	157	24,265	23,730	25,364	2,218	157	24,265	23,730	25,364									

1/ Special "pink gear" periods designated by "P".

2/ Cumulative figures calculated by mesh size restriction in effect for respective period.

3/ Cumulative coho boat hours began when 100 coho were caught.

4/ Total hours fished, all mesh sizes.

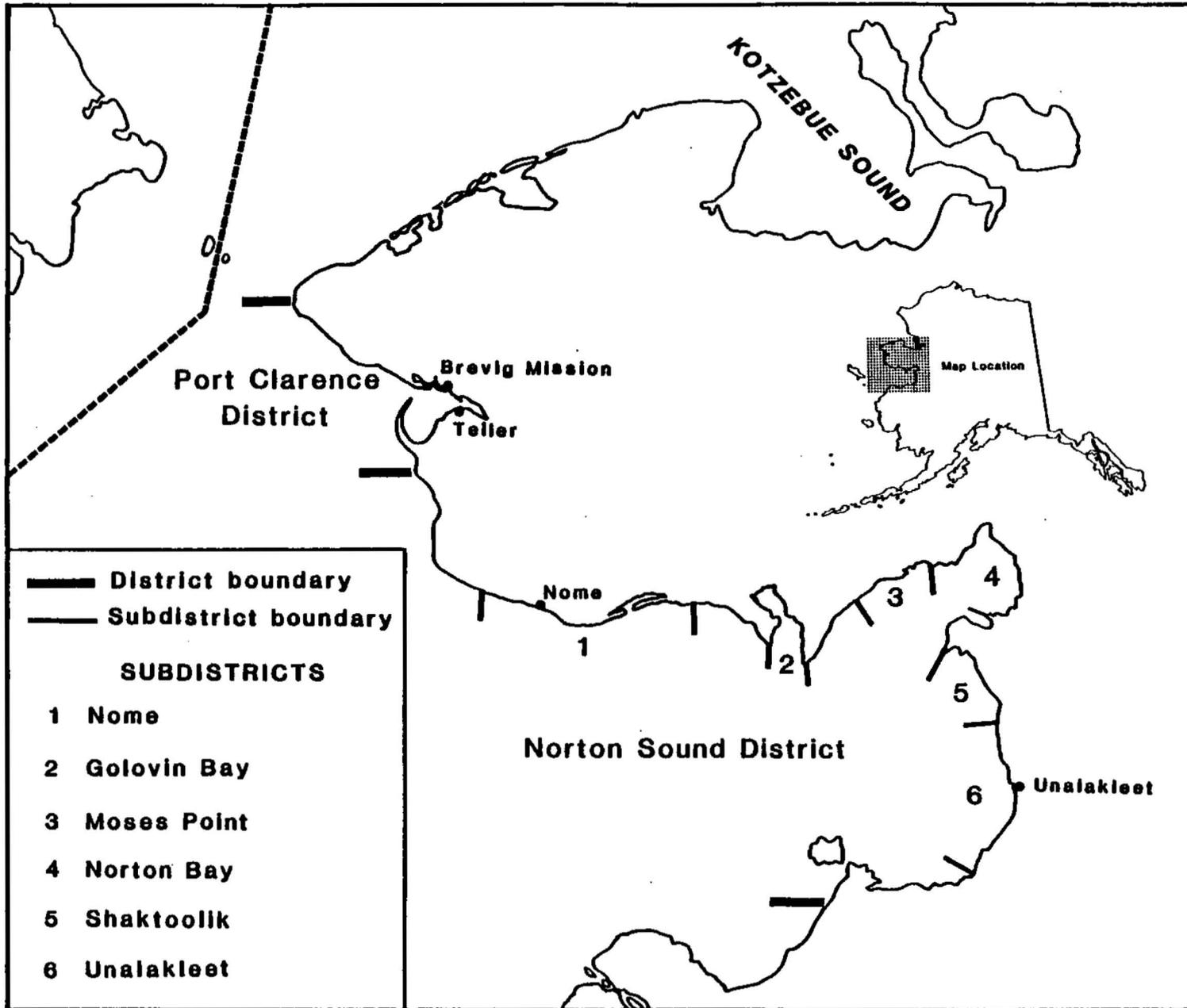


Figure 1. Norton Sound commercial salmon fishing subdistricts.

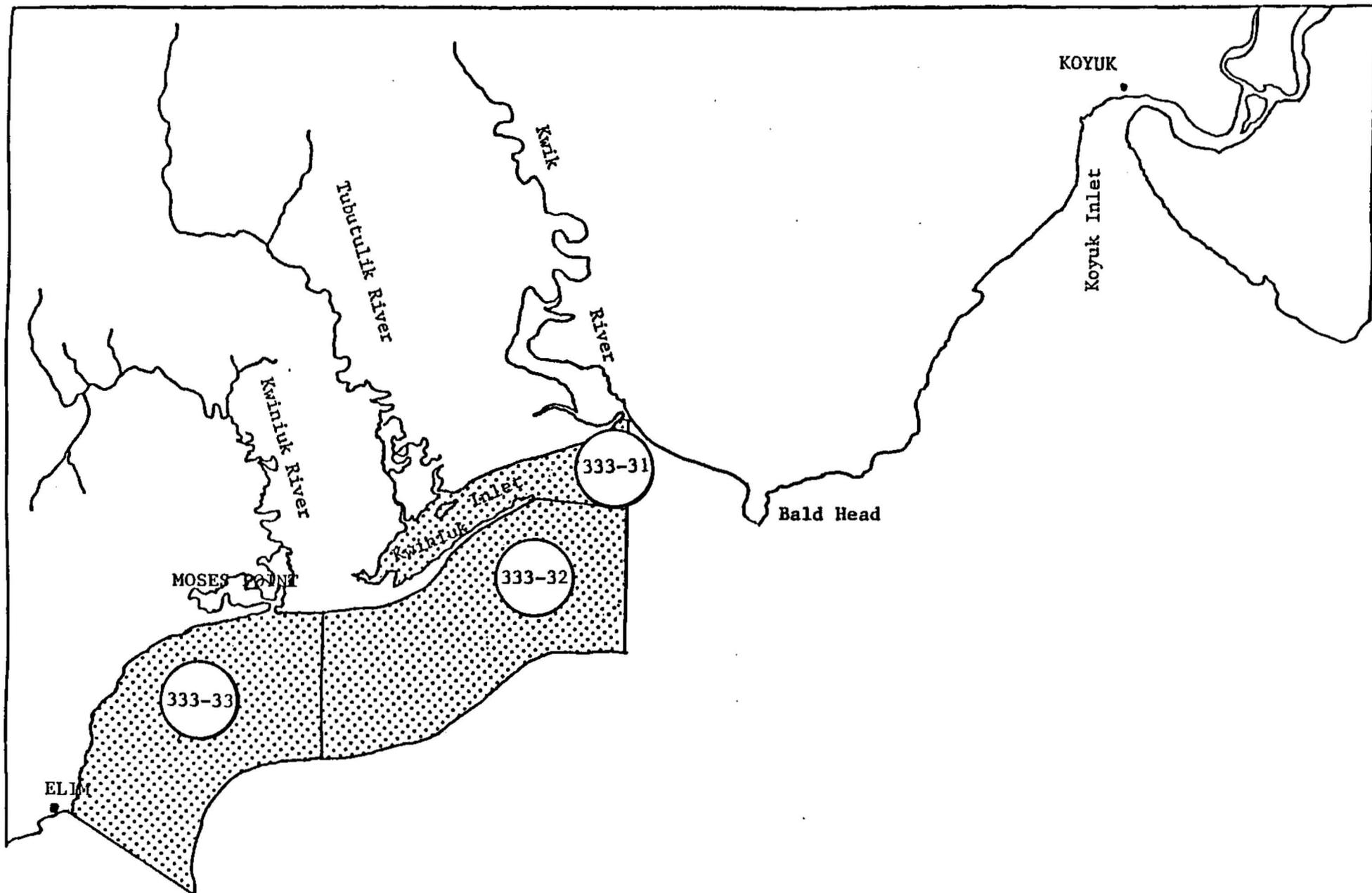


Figure 2 . Statistical areas of the Moses Point commercial salmon fishing subdistrict, Norton Sound.

Appendix Table A1. Number of commercial salmon fishermen fishing in Norton Sound, 1970-1988.

Year	SUBDISTRICT						DISTRICT 1/ Totals
	1	2	3	4	5	6	
1970	6	33	21	0	12	45	2/
1971	7	22	45	6	19	72	2/
1972	20	20	48	32	20	71	2/
1973	21	34	57	30	27	94	2/
1974	25	25	60	8	23	53	2/
1975	24	42	67	42	39	61	2/
1976	21	22	54	27	37	60	2/
1977	14	25	52	24	30	45	164
1978	16	24	44	26	26	51	176
1979	15	21	41	22	29	63	175
1980	14	17	26	13	26	66	159
1981	15	19	33	10	26	73	167
1982	18	17	28	10	32	68	164
1983	19	21	39	15	34	72	170
1984	8	22	25	8	24	74	141
1985	9	21	34	12	21	64	155
1986	13	24	34	9	30	73	163
1987	10	21	34	12	39	65	164
1988	5	21	36	13	21	69	152

1/ District total is the number of fishermen that actually fished in Norton Sound. Subdistrict totals may exceed the District total a fisherman may have fished more than one subdistrict.

2/ Data not available.

Appendix Table A2. Commercial and subsistence salmon catches by species, by subdistrict, Norton Sound District, 1964-1988.

Year	Commercial						Subsistence					Combined					
	Chi-nook	Sock-eye	Coho	Pink	Chum	Total	Chi-nook	Coho	Pink	Chum	Total	Chi-nook	Sock-eye	Coho	Pink	Chum	Total
NOME (SUBDISTRICT 1)																	
1964	5	-	-	1	1194	1200	-	-	-	-	-	5	-	-	1	1194	1200
1965	1	-	-	193	1941	2135	-	-	780	1825	2605	1	-	-	973	3766	4740
1966	1	-	32	1	581	615	12	192	1794	1762	3760	13	-	224	1795	2343	4375
1967	-	-	-	72	406	478	11	36	349	627	1023	11	-	36	421	1033	1501
1968	-	-	-	50	102	152	7	108	6507	621	7243	7	-	108	6557	723	7395
1969	-	-	63	330	601	994	2	27	3649	508	4186	2	-	90	3979	1109	5180
1970	-	-	6	55	960	1019	-	35	5001	458	5494	-	-	41	5056	1418	6513
1971	11	-	-	14	2315	2340	-	122	5457	2900	8479	11	-	122	5471	5215	10819
1972	15	-	-	12	2643	2670	19	52	4684	315	5070	34	-	52	4696	2958	7740
1973	-	-	-	321	1132	1453	14	120	5108	1863	7114	14	-	129	5429	2995	8567
1974	19	-	123	7722	10431	18295	8	5	3818	183	4014	27	-	128	11540	10614	22309
1975	2	-	319	263	8364	10848	2	97	6267	2858	9224	4	-	416	8430	11222	20072
1976	2	10	26	1331	7620	8989	13	189	5492	1705	7399	15	10	215	6823	9325	16388
1977	8	-	58	65	15998	16129	35	498	2773	12192	15498	43	-	556	2838	28190	31627
1978	19	-	-	22869	8782	31670	35	225	13063	4295	17618	54	-	225	35932	13077	49288
1979	9	-	29	5860	5391	11289	11	1120	6353	3273	10757	20	-	1149	12213	8664	22046
1980	8	-	-	10007	13922	23937	129	2157	22246	5983	30515	137	-	2157	32253	19905	54452
1981	4	-	508	3202	18666	22380	35	1726	5584	8579	15938 3/	39	14	2234	8786	27245	38318
1982	20	-	1183	18512	13447	33162	21	1829	19202	4831	25889 4/	41	6	3012	37714	18278	59051
1983	23	-	261	308	11691	12283	74	1911	8086	7091	17215 5/	97	53	2172	8394	18782	29498
1984	7	-	820	-	3744	4571	83	1795	17182	4883	23949 6/	90	16	2615	17182	8627	28520
1985	21	-	356	-	6219	6596	56	1054	2117	5667	9008 7/	77	114	1410	2117	11886	15604
1986	6	-	50	-	8160	8216	150	688	8720	8085	17750 8/	156	107	738	8720	16245	25966
1987	3	-	577	-	5646	6226	200	1100	1251	8394	11052 9/	203	107	1677	1251	14040	17278
1988	2	-	54	182	1628	1866											
5-year avg. 1/	12	-	413	62	7092	7578	113	1310	7471	6824	15795	125	79	1722	7533	13916	23373
10-year avg. 2/	12	-	378	6076	9567	16033	79	1360	10380	6108	17969	91	42	1739	16456	15675	34002
1/ 1983-1987	5/ Total includes 53 sockeye.																
2/ 1978-1987	6/ Total includes 16 sockeye.																
3/ Total includes 14 sockeye	7/ Total includes 114 sockeye.																
4/ Total includes 6 sockeye	8/ Total includes 107 sockeye.																
	9/ Total includes 107 sockeye.																

Appendix Table A3. Commercial and subsistence salmon catches by species, by subdistrict, Norton Sound District, 1962-1988.

Year	Commercial						Subsistence					Combined					
	Chi-nook	Sock-eye	Coho	Pink	Chum	Total	Chi-nook	Coho	Pink	Chum	Total	Chi-nook	Sock-eye	Coho	Pink	Chum	Total
GOLOVIN BAY (SUBDISTRICT 2)																	
1962	45	11	264	10276	68720	79316	-	-	-	-	-	45	11	264	10276	68720	79316
1963	40	40	-	19677	49850	69607	-	118	5702	9319	15139	40	40	118	25379	59169	84746
1964	27	40	3	7236	58301	65607	-	-	-	-	-	27	40	3	7236	58301	65607
1965	-	-	-	-	-	-	2	49	1523	3847	5421	2	-	49	1523	3847	5421
1966	17	14	584	4665	29791	35071	4	176	1573	3520	5273	21	14	760	6238	33311	40344
1967	10	-	747	5790	31193	37740	3	185	2774	4803	7765	13	-	932	8564	35996	45505
1968	12	-	205	18428	10011	28656	4	181	4955	1744	6884	16	-	386	23383	11755	35540
1969	28	-	1224	23208	20949	45409	2	190	2760	2514	5466	30	-	1414	25968	23463	50875
1970	13	-	3	18721	20566	39303	4	353	2046	2614	6017	17	-	356	20767	23180	45320
1971	37	-	197	2735	33824	36793	7	191	1544	1936	3678	44	-	388	4279	35760	40471
1972	36	-	20	6562	27097	33715	4	62	1735	2028	3829	40	-	82	8297	29125	37644
1973	70	-	183	14145	41689	56087	1	48	9	74	132	71	-	231	14154	41763	56219
1974	30	-	3	28340	30173	58546	3	-	967	205	1175	33	-	3	29307	30379	58722
1975	17	-	206	10770	41761	52754	-	1	2011	2025	4037	17	-	207	12781	43786	56791
1976	12	-	1311	24051	30219	55593	-	-	1995	1128	3123	12	-	1311	26046	31347	58716
1977	26	-	426	7928	53912	62292	3	80	703	2915	3701	29	-	506	8631	56827	65993
1978	22	-	94	72033	41462	113611	1	-	2470	1061	3532	23	-	94	74503	42523	117143
1979	75	49	1606	45948	30201	77879	-	845	2546	2840	6231	75	49	2451	48494	33041	84110
1980	36	36	328	10774	52609	63783	12	692	10727	4057	15488	48	36	1020	21501	56666	79271
1981	23	5	13	49755	58323	108119	8	1520	5158	5543	12229	31	5	1533	54913	63866	120348
1982	78	5	4281	39510	51970	95844	7	1289	4752	1868	7916	85	5	5570	44294	53838	103760
1983	52	10	295	17414	48283	66054	-	-	-	-	-	-	-	-	-	-	-
1984	31	-	2462	88588	54153	145234	-	-	-	-	-	-	-	-	-	-	-
1985	193	113	1196	3019	55781	60302	12	430	1904	9577	11925	205	115	1626	4923	65358	72227
1986	81	8	958	25425	69725	96197	-	-	-	-	-	-	-	-	-	-	-
1987	166	51	2203	1579	44334	48333	-	-	-	-	-	-	-	-	-	-	-
1988	108	921	2149	31559	33348	68085	-	-	-	-	-	-	-	-	-	-	-
5-Year avg. 1/	105	36	1423	27205	54455	83224	-	-	-	-	-	-	-	-	-	-	-
10-Year avg. 2/	76	28	1344	35404	50684	87536	-	-	-	-	-	-	-	-	-	-	-

1/ 1983-1987
2/ 1978-1987

3/ Subsistence surveys not conducted.
4/ Total includes 2 sockeye.

Appendix Table A8. Commercial and subsistence salmon catches by species, all subdistricts, Norton Sound District, 1961-1988.

Year	Commercial						Subsistence					Combined					
	Chi-nook	Sock-eye	Coho	Pink	Chum	Total	Chi-nook	Coho	Pink	Chum	Total	Chi-nook	Sock-eye	Coho	Pink	Chum	Total
ALL SUBDISTRICTS																	
1961	5300	35	13807	34327	48332	101801	-	-	-	-	-	5300	35	13807	34327	48332	101801
1962	7286	18	9156	33187	182784	232431	-	-	-	-	-	7286	18	9156	33187	182784	232431
1963	6613	71	16765	55625	154789	233863	5	118	16607	17635	34365	6618	71	16883	72232	172424	268228
1964	2018	126	98	13567	148862	164671	565	2567	9225	12486	24843	2583	126	2665	22792	161348	189514
1965	1449	30	2030	220	36795	40524	574	4812	19131	30772	55289	2023	30	6842	19351	67567	95813
1966	1553	14	5755	12778	80245	100345	269	2210	14335	21873	38687	1822	14	7965	27113	102118	139032
1967	1804	-	2379	28879	41756	74818	817	1222	17516	22724	42279	2621	-	3601	46395	64480	117097
1968	1045	-	6885	71179	45300	124409	237	2391	36912	11661	51201	1282	-	9276	108091	56961	175610
1969	2392	-	6836	86949	82795	178972	436	2191	18562	15615	36804	2828	-	9027	105511	98410	215776
1970	1853	-	4423	64908	107034	178218	561	4675	26127	22763	54126	2414	-	9098	91035	129797	232344
1971	2593	-	3127	4895	131362	141977	1026	4097	10863	21815	1/ 37801	3619	-	7224	15758	153177	179778
1972	2938	-	454	45182	100920	149494	804	2319	14158	13966	2/ 31247	3742	-	2773	59340	114886	180741
1973	1918	-	9282	46499	119098	176797	392	520	14770	7185	22867	2310	-	9802	61269	126283	199664
1974	2951	-	2092	148519	162267	315829	420	1064	16426	3958	21868	3371	-	3156	164945	166225	337697
1975	2393	2	4593	32388	212485	251861	186	192	15803	8124	3/ 24305	2579	2	4785	48191	220609	276166
1976	2243	11	6934	87919	95956	193060	203	1004	18048	7718	26973	2446	11	7938	105964	103674	220033
1977	4500	5	3690	48675	200455	257325	846	2530	14296	26607	44279	5346	5	6220	62971	227062	301604
1978	9819	12	7335	325503	189279	531948	1211	2981	35281	12257	51730	11030	12	10316	360784	201536	583678
1979	10706	57	31438	167411	140789	350401	747	8487	25247	11975	46456	11453	57	39925	192658	152764	396857
1980	6311	40	29842	227352	180792	444337	1397	8625	63778	19622	93422	7708	40	38467	291130	200414	537759
1981	7929	56	31562	232479	169708	441734	2021	13416	28741	32866	77082	6/7/ 9950	94	44978	261220	202574	518816
1982	5892	10	91690	230281	183335	511208	1328	17874	56295	23185	98690	6/8/ 7220	18	109564	286576	206520	609898
1983	10308	27	49735	76913	319437	456420	-	-	-	-	-	9/	-	-	-	-	-
1984	8455	6	67875	119381	146442	342159	-	-	-	-	-	9/	-	-	-	-	-
1985	19491	166	21968	3647	134928	180200	-	-	-	-	-	9/	-	-	-	-	-
1986	6395	233	35600	41260	146912	230400	-	-	-	-	-	9/	-	-	-	-	-
1987	7080	207	24279	2260	102457	136283	-	-	-	-	-	9/	-	-	-	-	-
1988	4096	1252	37247	74604	107966	225165	-	-	-	-	-	9/	-	-	-	-	-
5-Year avg. 4/	10327	128	39891	48692	170035	269074	-	-	-	-	-	-	-	-	-	-	-
10-Year avg. 5/	9229	76	39132	142649	171408	362494	-	-	-	-	-	-	-	-	-	-	-

141

1/ Includes 197 recorded sockeye salmon in all subdistricts
 2/ Includes 93 recorded sockeye salmon in all subdistricts
 3/ Includes 11 recorded sockeye salmon in all subdistricts
 4/ 1983-1987
 5/ 1978-1987
 6/ These figures also include data from Stebbins and St. Michael.
 7/ Includes 38 sockeye salmon.
 8/ Includes 8 sockeye salmon.
 9/ Subsistence surveys not conducted in all subdistricts.

Appendix Table A9. Mean salmon weights, Norton Sound District, 1962-1988. 1/

Year	Mean Round Weight in Pounds 2/			
	Chinook	Coho	Pink	Chum
1962	-	-	-	-
1963	-	-	-	-
1964	-	-	-	7.0
1965	-	-	2.3	7.1
1966	-	-	3.5	7.8
1967	23.7	7.0	3.6	7.2
1968	20.0	7.0	4.0	7.5
1969	19.3	7.5	3.6	6.4
1968	20.0	7.0	3.5	7.8
1967	23.7	7.0	3.6	7.2
1968	20.0	7.3	2.8	6.9
1973	20.3	6.8	3.9	7.1
1974	18.2	6.7	3.4	6.6
1975	10.8	7.4	2.9	6.5
1976	15.2	7.2	3.1	7.0
1977	22.7	7.6	3.3	7.0
1978	22.8	6.9	3.6	7.4
1979	22.9	7.1	3.6	7.2
1980	21.5	6.8	3.2	7.2
1981	20.7	6.7	3.5	7.6
1982	16.5	7.1	2.9	7.3
1983	17.4	7.2	3.6	7.4
1984	20.0	7.7	2.9	7.0
1985	21.5	7.7	3.1	7.0
1986	20.8	6.9	3.2	6.9
1987	20.0	7.3	3.0	7.1
1988	16.4	7.5	3.0	7.1

1/ Information not available for some species.

2/ Based on age-weight-length samples or fish tickets.

Appendix Table A10. Estimated mean prices paid to commercial salmon fishermen, Norton Sound District, 1962-1988.1/

Year	Chinook	Coho	Pink	Chum
Price Per Fish				
1962	\$3.85	\$.60	\$.25	\$.35
1963	3.85	.60	.25	.35
1964	4.50	--	.25	.40
1965	3.75	.45	--	.40
1966	4.80	1.05	.25	.65
Price Per Pound				
1967	.20	.14	.07	.09
1968	.25	.14	.06	.10
1969	.22	.14	.06	.11
1970	.25	.14	.06	.10
1971	.25	.14	.07	.10
1972	.27	.16	.06	.11
1973	.40	.16	.07	.32
1974	.40	.16	.13	.32
1975	.40	.16	.13	.24
1976	.50	.32	.17	.30
1977	.65	.40	.16	.30
1978	.65	.35	.20	.30
1979	.88	.66	.16	.41
1980	.74	.63	.07	.23
1981	\$1.25	.62	.13	.26
1982	\$1.25	.57	.12	.32
1983	\$1.13	.39	.11	.28
1984	\$1.20	.45	.11	.24
1985	\$1.08	.48	.20	.31
1986	.88	.52	.15	.27
1987	\$1.11	.57	.20	.33
1988	\$1.26	\$1.13	.19	.39

1/ Information is not available for some species.

Appendix Table All. Dollar estimates of Norton Sound District commercial salmon fishery, 1961-1988.

Year	Gross Value of Catch to Fishermen	Wages Earned 2/	License and Tax Revenues to State (License Fees Only)
1961	\$ 1/	\$ 1/	\$ 2,010.00
1962	105,800.00	1/	16,341.00
1963	104,000.00	1/	18,009.00
1964	51,000.00	1/	11,305.00
1965	21,483.00	1/	5,084.00
1966	68,000.00	1/	4,680.00
1967	44,038.00	58,000.00	3,500.00
1968	63,700.00	1/	4,000.00
1969	95,297.00	72,145.00	1/
1970	99,019.00	55,100.00	5,595.00
1971	101,000.00	65,500.00	5,730.00
1972	102,225.00	68,700.00	7,000.00
1973	308,740.00	81,000.00	15,400.00
1974	437,127.00	129,600.00	20,028.00
1975	413,255.00	172,800.00	28,230.00
1976	285,283.00	1/	10,133.00
1977	528,610.00	1/	11,386.00
1978	814,221.00	1/	12,002.00
1979	876,547.00	1/	11,780.00
1980	583,388.00	1/	11,640.00 3/
1981	758,471.00	1/	11,940.00
1982	988,588.00	1/	7,155.00 3/4/
1983	1,038,967.00	1/	10,700.00 3/
1984	721,055.00	1/	9,690.00 3/
1985	822,056.00	1/	5,820.00 5/
1986	539,576.00	1/	5,970.00 5/
1987	504,631.00	1/	5,940.00 5/
1988	754,751.00	1/	10,050.00 5/6/

1/ Information not available.

2/ Includes wages paid to tender boat operators, processing plant employees in district.

3/ Includes only permit renewals and vessel license fees.

4/ The Alaska state legislature lowered all resident permit renewal fees and vessel license fees to poverty level fees for 1982.

5/ Includes only permit renewal fees.

6/ The Alaska state legislature raised resident permit renewal fee to \$50.00 in 1988.

Appendix Table A12. Round weight of commercially caught salmon by species, Norton Sound District, 1961-1988.

Year	Pounds Caught (Round Wt. in Lbs)				Salmon Roe (lbs)
	Chinook	Coho	Pink	Chum	
1961	120,405	96,649	102,711	347,990	
1962 1/	157,000	--	10,569	221,645	
1963 1/	89,700	51,750	--	--	
1964 1/	39,169	686	--	249,890	
1965	33,327	14,210	660	264,924	2/
1966	35,259	40,285	38,334	577,764	16,901
1967	41,854	15,944	100,913	289,473	21,429
1968 3/	22,954	50,665	250,044	306,871	20,381
1969 4/	51,441	50,461	312,836	529,235	5,578
1970	38,103	25,000	156,313	610,588	1,345
1971	43,112	22,078	15,377	857,014	1,122
1972	57,675	3,257	133,389	710,853	1,083
1973	38,935	63,812	185,799	845,596	2/
1974	54,433	15,023	511,737	1,082,575	39,876
1975	25,964	32,345	87,586	1,318,111	46,470
1976	34,095	49,822	271,867	669,728	2/
1977	102,341	28,254	162,457	1,415,981	2/
1978	222,974	50,872	1,164,174	1,389,806	2/
1979	231,988	251,129	598,785	1,001,548	2/
1980	135,646	204,498	719,368	1,301,693	2/
1981	164,182	212,065	719,102	1,284,193	2/
1982	97,255	648,212	659,171	1,338,788	95
1983	179,666	360,264	274,568	2,352,104	239
1984	169,104	523,310	343,685	1,020,635	0
1985	419,331	169,413	11,458	939,885	0
1986	133,161	247,333	133,319	1,011,824	0
1987	141,494	177,569	6,691	731,597	0
1988	67,148	280,658	226,966	767,168	0

- 1/ Does not include canned salmon cases (48#)
 1962: 29 chinook, 883 coho, 927 pink, 12,459 chum
 1963: 604 chinook, 808 coho, 1,918 pink, 13,308 chum
 1964: 75 chinook, 452 pink, 9,357 chum
- 2/ Information not available
- 3/ Includes about 48,000 lbs of salted coho, about 150,000 lbs. of salted pink, and 150,000 lbs of salted chum.
- 4/ Includes about 598 lbs. of salted chinook, about 48,092 lbs. of salted pink and about 117,664 lbs. salted chum.

Appendix Table A13. Comparative salmon escapement estimates of Norton Sound streams, 1961-1988. 1/

Year	Chi- nook	Chum	Pink	Pink & Chum 2/	Coho
Eldorado River					
1974	13	2,143	6,185	--	--
1977	--	1,835	125	--	--
1978	--	10,125	12,800	--	--
1980	6	9,900	55,520	--	--
1981	--	15,605	495	--	--
1982	2	1,095	163,300	--	--
1983	11	994	270	--	100
1984	14 9/	4,361 7/9/	1,924,935 7/9/	--	261
1985	8	6,090	150	--	67
1986	9	3,490	18,200	--	--
1987	6	3,860	0	--	108
1988	17	2,645	1,045	--	78
Flambeau River					
1976	--	375	1,994	--	--
1977	--	1,275	10	--	--
1978	--	7,110	--	--	--
1979	--	283	291	--	--
1980	--	--	--	29,190	--
1981	1	12,031	2,710	--	--
1982	1	5,097	25,001	--	--
1983	2	1,195	200	--	--
1984	1	3,150 7/	20,200 7/	--	--
1985	1	3,215	260	--	--
1986	2	3,075	300	--	--
1987	0	115	0	--	--
1988	3	765	10	--	--
Nome River					
1971	--	75	7,765	--	--
1972	--	710	14,960	--	--
1973	6	1,760	14,940	--	--
1974	--	854	17,832	--	--
1975	1	2,161	3,405	--	--
1977	5	3,046	1,726	--	--
1978	2	5,242	34,900	--	--
1980	5	--	--	179,095	920
1981	15	1,195	12,565	--	--
1982	--	700	327,570	--	--
1983	2	198	9,170	--	365
1984	--	2,084 8/	178,870	--	839
1985	7	1,967	2,250	--	242
1986	2	1,150	13,580	--	--
1987	3	1,646	1,400 8/	--	419
1988	3	973	2,490 12/	--	1,280 8/

-Continued-

Appendix Table A13. (page 2 of 7).

Year	Chi- nook	Chum	Pink	Pink & Chum 2/	Coho
Sinuk River					
1975	--	4,662	5,390	--	--
1977	--	5,207	1,302	--	--
1978	--	8,756	22,435	--	--
1980	3	2,022	199,000	--	1,002
1981	--	5,579	350	--	--
1982	--	638	148,800	--	--
1983	48	2,150	10,770	--	96
1984	7 8/	493 8/	284,400 8/	--	192
1985	4	1,910	8,860	--	33
1986	4	1,960	28,690	--	--
1987	5	4,540	30	--	230
1988	3	2,070	4,652 12/	--	563
Boston Creek					
1963	67	1,669	--	--	--
1964	10	3,315	--	--	--
1966	3/ 153	761	--	--	--
1968	7	2,500	2,500	--	--
1969	100	7,000	16,000	--	--
1970	246	8,200	12,900	--	--
1971	42	7,045	80	--	--
1972	57	4,252	3,950	--	--
1973	153	3,014	3,213	--	--
1974	231	2,426	749	--	--
1975	147	1,885	2,556	--	--
1977	76	1,325	385	--	--
1978	136	2,655	74,221	--	--
1979	58	882	271	--	--
1980	16	2,450	1,510	--	--
1982	10	1,730	22,020	--	--
1983	154	704	--	--	--
1984	35	--	--	47,850	--
1985	243	3,450	--	--	--
1986	2	220	0	--	--
1987	583	3,640	0	--	--
1988	163	1,040	7,400 12/	--	--

-Continued-

Appendix Table A13. (Page 3 of 7).

Year	Chi- nook	Chum	Pink	Pink & Chum 2/	Coho
Fish River					
1961	1	--	--	14,100	--
1962	48	--	--	28,918	--
1963	21	--	--	25,728	--
1964	--	18,670	10,935	14,550	--
1966	7	--	--	17,955	--
1967	20	--	--	13,610	--
1968	10	--	--	164,000	--
1969	--	2,080	124,000	--	--
1970	33	76,550	198,000	--	--
1971	1	13,185	1,670	--	--
1972 2/	--	3,616	13,050	--	--
1973	31	6,887	15,564	--	--
1974	7	10,945	15,690	--	--
1975	26	20,114	15,840	--	--
1976	1	8,390	15,850	8,550	--
1977	9	9,664	2,430	--	--
1978	29	26,797	140,640	--	--
1979	11	6,893	9,132	--	--
1980	--	19,100	33,500	--	--
1981	90	24,095	450	--	--
1982	--	--	--	241,700	--
1983	87	20,037	300	--	--
1984	42	--	--	293,245	--
1985	303	21,080	7,365	--	--
1986	200	25,190	140	--	--
1987	193	7,886	0	--	--
1988	36	1,240	29,950 12/	--	--
Kachauik Creek					
1963	--	16,000	16,000	--	--
1964	--	5,284	3,675	--	--
1966	--	758	1,788	--	--
1967 3/	--	--	--	1,780	--
1969	--	600	4,525	--	--
1970	--	500	--	--	--
1971	--	1,000	5,323	--	--
1972	--	3,100	16,950	--	--
1973	--	10,325	22,275	--	--
1974	--	1,645	2,723	--	--
1975	--	1,735	23,360	--	--
1977 4/	--	9,564	30,432	--	--
1978 4/	--	3,481	26,533	--	--
1979	--	2,650	23,850	--	--
1982	--	1,111	72,235	--	--
1988	--	1,440	3,130	--	--

-Continued-

Appendix Table A13. (page 4 of 7).

Year	Chi- nook	Chum	Pink	Pink & Chum 2/	Coho
Niukluk River					
1962	11	--	--	27,879	--
1963	1	13,687	4,103	--	--
1964	--	8,395	10,495	--	--
1966	--	21,300	8,600	4,700	--
1967	--	20,546	--	--	--
1968	--	--	--	87,085	--
1969	--	10,240	92,650	--	--
1970	--	7,300	60,350	--	--
1971	--	22,605	8,370	--	--
1972	3/	10,500	22,600	--	--
1973	--	14,365	14,790	--	--
1974	1	8,720	8,915	--	--
1975	--	10,089	16,258	--	--
1976	--	4,130	7,190	--	--
1977	19	10,456	4,150	--	--
1978	2	14,365	208,300	--	--
1979	4/ 8	10,127	30,147	--	--
1980	--	8,915	75,770	--	--
1981	--	7,249	--	--	--
1982	20	2,557	227,540	--	--
1983	54	8,886	50	--	--
1984	10/ 6	--	--	57,208	3,072
1985	25	11,140	--	--	332 11/
1986	2	2,442	0	--	--
1987	10	4,145	0	--	257 11/
1988	18	6,501	8,160 12/	--	1,095 11/

-Continued-

Appendix Table A13. (page 5 of 7).

Year	Chi- nook	Chum	Pink	Pink & Chum	2/ Coho
Kwiniuk River					
1962	3	--	--	23,249	--
1963	2	11,340	3,779	--	--
1964	--	14,533	--	--	--
1965 4/	14	26,634	8,301	--	--
1966 4/	7	32,786	10,629	--	--
1967 4/	13	24,444	3,508	--	--
1968 4/	27	18,813	126,764	--	--
1969 4/	12	19,687	56,683	--	--
1970 4/	--	68,004	235,131	--	--
1971 4/	37	39,046	16,742	--	--
1972 4/	65	30,686	62,461	--	--
1973 4/	57	28,617	38,420	--	--
1974 4/	62	35,899	40,816	--	--
1975 4/	44	14,344	57,317	--	--
1976 4/	12	6,977	29,471	--	--
1977 4/	84	22,757	46,234	--	--
1978 3/4/	74	14,408	72,270	--	--
1979 4/	107	12,355	167,492	--	--
1980 4/	177	19,374	320,389	--	--
1981 4/	136	34,561	566,417	--	--
1982 4/	138	44,036	469,674	--	--
1983 4/	267	56,907	251,965	--	--
1984 4/	736	54,043	736,544	--	983 6/
1985 4/	712	9,912	22,548	--	673 6/
1986 4/	653	24,704	241,446	--	421
1987 4/	314	16,134	5,567	--	819 6/
1988 4/	321	13,301	187,904	--	444 6/

-Continued-

Appendix Table A13. (Page 6 of 7).

Year	Chi- nook	Chum	Pink	Pink & Chum	2/ Coho

Tubutulik River					
1962	3	--	--	16,690	--
1963	9	16,069	4,355	--	--
1964	--	15,469	10,043	3,420	--
1966	--	5,514	26,000	--	--
1967	1	--	--	22,475	--
1969	3	12,040	12,788	3,045	--
1970	--	53,290	136,590	--	--
1971	--	16,820	7,500	5,065	--
1972 3/	--	8,070	21,100	--	--
1973	131	5,383	15,665	--	--
1974	136	9,560	17,940	--	--
1975	7	17,141	38,003	--	--
1976	--	1,095	6,095	2,600	--
1977	--	8,540	4,685	--	--
1978	2	5,865	1,364	--	--
1979	--	812	1,624	--	--
1980 5/	405	21,616	663,937	--	--
1982 3/	49	2,044	53,605	--	--
1983	135	16,345	40,790	--	--
1984	139	56,210	93,600	--	--
1985	472	13,645	8,940	--	--
1986	453	5,975	35,680	--	--
1987	474	9,605	580	--	--
1988	561	4,660	114,150 12/	--	--

-Continued-

Appendix Table A13. (Page 7 of 7).

Year	Chi-nook	Chum	Pink	Pink & Chum	2/ Coho

North River					
1962	162	--	--	16,087	--
1963 3/	287	--	--	73,274	--
1964	23	--	--	5,981	--
1965	153	--	--	16,600	--
1970 3/	1	20,655	12,400	--	--
1971 3/	256	--	--	1,047	--
1972 4/	561	2,332	54,934	--	--
1973 4/	298	4,332	26,542	--	--
1974 4/	220	861	154,285	--	--
1975 3/	60	5,237	17,885	--	--
1976 3/	66	196	10,606	--	--
1977	1,275	8,139	4,565	--	--
1978	321	9,349	21,813	--	--
1979	735	1,130	9,500	--	--
1980	61	2,300	127,900	--	204
1981	68	405	575	--	263
1982	8	599	173,352	--	4,145
1983	347	4,135	4,980	--	--
1984 4/	2,844	2,915	458,387	--	152 6/
1985 4/	1,426	4,567	4,360	--	2,045
1986 4/	1,613	3,738	236,487	--	--
1987	445	392	0	--	680
1988	202	30	112,770 12/	--	240

- 1/ Represents "high count" for season.
- 2/ Surveyor unable to distinguish between the two species.
- 3/ Poor survey conditions or partial survey, poor counting tower conditions.
- 4/ Total counts obtained from counting tower.
- 5/ Combined tower and aerial survey counts below the tower.
- 6/ Aerial survey; not tower count.
- 7/ Helicopter survey.
- 8/ Boat survey.
- 9/ Foot survey.
- 10/ Includes counts from Casadepaga and Ophir Creeks.
- 11/ Includes counts from Ophir Creek.
- 12/ Numerous pink salmon made enumerating of chum salmon difficult; pink count may include some chum.

Port Clarence District

District Boundaries

The Port Clarence district encompasses all waters from Cape Douglas north to Cape Prince of Wales including the Salmon Lake and Pilgrim River drainages (Figure 3). Salmon, saffron cod, whitefish and herring are the major subsistence species; however, other fishery resources are also utilized.

Commercial Fishery

Commercial salmon fishing in this district has been prohibited since 1967. In 1966 a total of 1,216 salmon consisting of 93 sockeyes, 131 pinks and 922 chums was taken commercially in the Grantley Harbor/Tuksuk Channel area. This was the only bona fide commercial fishery, but a few salmon are sold or bartered each year in Teller and Nome. Due to the relatively small runs in this area and the existence of an important subsistence fishery, commercial salmon fishing has not been reopened.

Subsistence Fishery

A traditional subsistence salmon fishery has probably occurred within this district for centuries; however, subsistence fishing has only been known to occur within Salmon Lake since the 1930's and upper Pilgrim River since 1962. Data collected by Department personnel has indicated a majority of the fishermen of Brevig Mission fish the northern and northeastern sections of Port Clarence, while Teller fishermen utilize Grantley Harbor and Tuksuk Channel. Interviews with local residents have also indicated substantial fishing effort within the Agiapuk River. Salmon Lake and Pilgrim River stocks have been utilized primarily by Nome residents. However, the Alaska Board of Fisheries in 1972 adopted a regulation which closed Salmon Lake and its tributaries to subsistence salmon fishing from July 15 through August 31 to conserve declining sockeye salmon stocks.

Three subsistence permits were issued to Nome residents in 1987 for the Pilgrim River. One permit reported a harvest (gill net) of 20 chum salmon; one permit (beach seine) reported no catch; one permit was not fished.

Personal interviews with fishermen seem to indicate a decline in subsistence fishing effort, due primarily to the absence of younger fishermen entering the fishery. A majority of the subsistence fishing effort appears to be conducted by elder residents who gather fish for an entire family.

Village surveys of subsistence fishermen have not been conducted in this district since 1983 (Appendix Table B1).

Escapement

Aerial surveys were not flown in this district, with the exception of Salmon Lake, due to the low priority assigned to districts which do not support commercial fisheries. An escapement of 4,570 sockeye salmon was documented in Salmon Lake and the Grand Central River in 1987 (Appendix Table B2). This was the highest escapement documented since 1963. The aerial count of 1,201 obtained in 1988 was lower than recent years, but was considered average escapement for Salmon Lake.

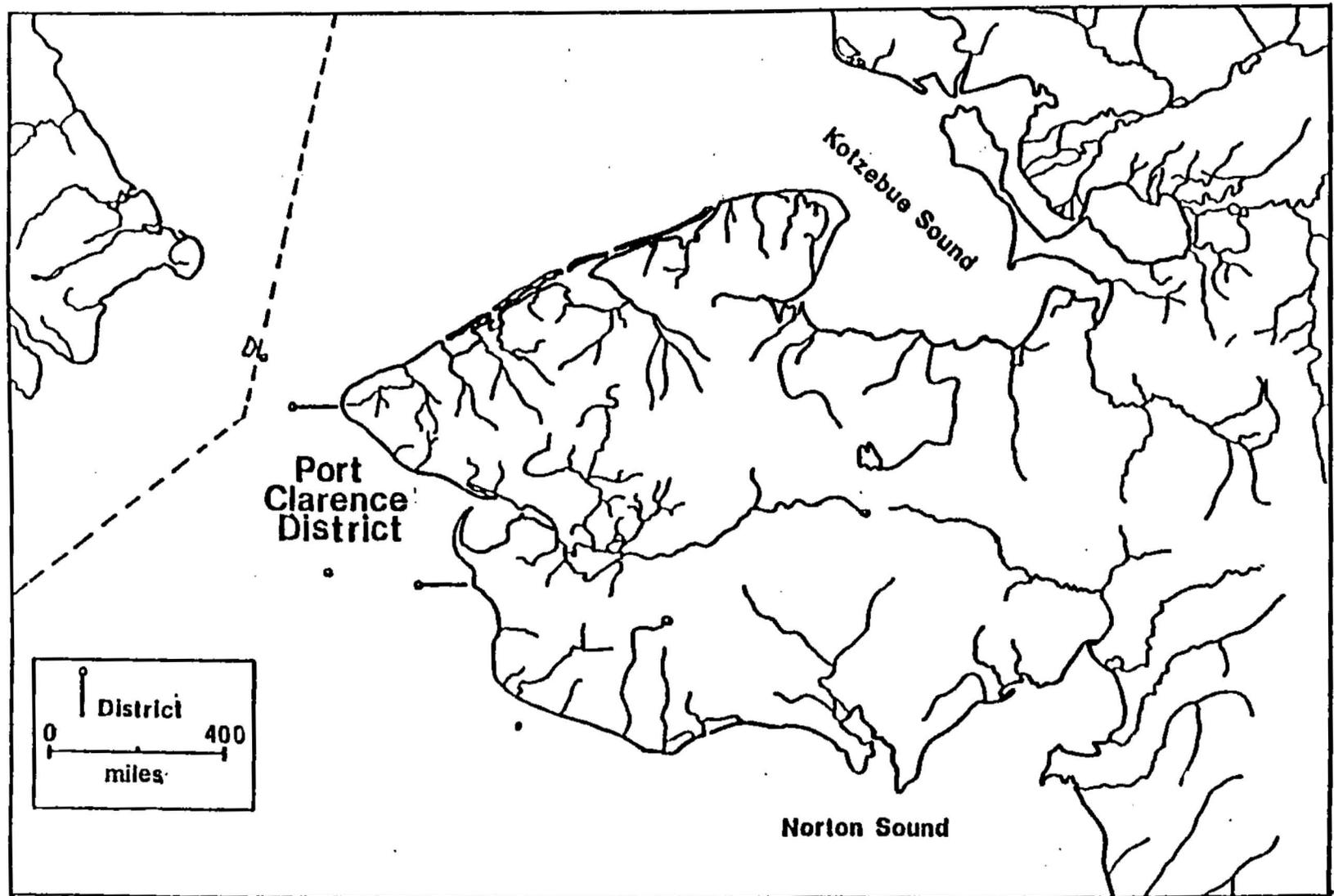


Figure 3. Port Clarence district

Appendix Table B1. Subsistence salmon catches for Port Clarence District, 1963-1988.

Year	Number of Fishing Families Interviewed	Chi-nook	Sock-eye	Coho	Pink	Chum	Total
1963	19	9	4866	25	1061	1279	7440
1964	22	17	1475	227	371	1049	3139
1965	29	36	1804	639	1854	1602	5935
1966	26	10	1000	896	859	2875	5640
1967	19	12	2068	232	767	1073	4152
1968	24	40	688	133	1906	904	3671
1969	13	2	180	27	548	932	1582
1970	18	4	588	1071	1308	4231	7202
1971	22	31	850	959	1171	3769	6780
1972	8	4	68	388	75	2806	3341
1973	4	22	46	280	424	1562	2334
1974	13	0	28	62	14	2663	2767
1975	17	0	244	5	743	1589	2581
1976	15	7	291	20	436	6026	6780
1977 1/	13	-	-	-	-	-	5910
1978	26	1	392	0	7783	705	8881
1979	26	0	320	35	741	1658	2720
1980	22	7	3195	5	3170	1715	8092
1981	10	8	255	110	765	5845	6983
1982	27	23	405	100	4345	684	5557
1983 2/	3	17	261	--	615	299	1192
1984 3/							
1985 3/							
1986 3/							
1987 3/							
1988 3/							

1/ Species composition estimated at 75% chum, 10% pink, 10% sock-eye and 5% chinook and coho combined.

2/ Data collected from returned catch calendars. Due to low return of calendars and absence of household surveys, the resultant catches are incomplete and not comparable to past years.

3/ Surveys not conducted.

Appendix Table B2. Comparative sockeye salmon aerial survey estimates, Port Clarence District, 1963-1988.

Year	Salmon Lake	Grand Central River	Total
1963	866	620	1486
1964 3/	76	590	666
1965	250	160	410
1966	1120	370	1490
1967	129	280	409
1968 3/	830	645	1475
1969	24	171	195
1970 1/	-	-	-
1971	538	512	1050
1972 3/	680	300 2/	980
1973	1747	607	2354
1974	820	0	820
1975	537	123	660
1976	132	22	154
1977	317	235	552
1978	822	280	1102
1979	1250	261	1511
1980 3/	512	175	687
1983	970	-	970
1984	445	30	475
1985	730	250	980
1986	2,125	160	2,285
1987	4,040	530	4,570
1988	1,195	6	1,201

1/ No survey made.

2/ Boat survey.

3/ Poor survey.

Kotzebue District

District Boundaries

The Kotzebue District includes all waters of Alaska between the latitude of the westernmost tip of Point Hope and west of 141° W. longitude, including those waters draining into the Arctic Ocean and Chukchi Sea.

Commercial salmon fishing is allowed in Subdistrict 1, which includes all waters east of a line from the terminus of Tukrok River to an ADF&G regulatory marker located approximately one mile offshore to an ADF&G regulatory marker located on a sandbar at 66°49' N. latitude, 162°55' W. longitude to an ADF&G marker located approximately two miles off Riley Wreck to an ADF&G marker located on the west bank of Riley Creek at 66°43' N. latitude, 162°19' W. longitude. Commercial salmon fishing may be allowed (by emergency order) in Subdistrict 2, which includes all waters at the mouth of the Noatak River inside a triangle defined by three points: the first point is located at the outlet of a small slough on the east side of the Noatak River at 66°59' N. lat., 162°29' W. long. The west side of the triangle is located on a mud bar on the west side of the Noatak River extending between 66°88' N. lat., 162°34' W. long. and 66°57' N. lat., 162°32' W. longitude. Subdistrict 3 is all remaining waters in the Kotzebue District, and is closed to commercial fishing.

Commercial Fishery

Commercial salmon fishing in the Kotzebue District dates back to the 1914-1918 period when the Midnight Sun Packing Company processed 10,130 cases (48 one-pound cans) and 300 barrels of hard salt salmon in the vicinity of Kotzebue (Appendix Table C5). It is assumed that these fish were chum salmon.

The next documented commercial fishery occurred in 1962 when a harvest of 129,948 chum salmon was recorded. Commercial catches from 1962-1988 are presented in Appendix Table C1 and Figure 6.

Commercial fishing effort is restricted to ocean waters near the town of Kotzebue (Figure 4) in order to minimize the interception of salmon bound for other areas. Fishermen can legally operate set gill nets of up to 150 fathoms in length. Primarily, open skiffs powered by outboard motors are used to operate fishing gear and deliver fish to buyers.

Department tagging studies indicate that the majority of fish returning to this district are bound for the Kobuk and Noatak Rivers. Lower Kobuk River chum salmon arrive first in the

commercial fishery and peak in mid to late July. Noatak River chum salmon, which are more abundant than Kobuk River chum salmon, peak in the commercial fishery during early to mid-August. There is evidence that chum salmon bound for the upper Kobuk River pass through the commercial fishery during middle to late August and are intermixed with Noatak River fish.

The Kotzebue District commercial fishery is regulated on the assumption that a harvestable surplus exists after providing for spawning and subsistence requirements. Information on salmon abundance, distribution and timing is obtained from the analysis of catch, catch per unit of effort, and escapement (aerial survey and test fish) data. These data are collected and evaluated continuously throughout the fishing season and are the basis for actions resulting in the issuance of emergency orders affecting fishing time.

In the first 10 years of the fishery, 1962-1971, annual commercial catches averaged 77,000 chum salmon while an average of 60 fishermen participated each year. Due to apparent excellent brood years survival rates, returns during the 1973-1975 period increased; the average commercial harvest increased to 522,000 chums and effort increased to an average of 200 fishermen per year. During 1976-1979, returns were more similar to pre-1973 levels, but effort remained high. In 1978, the chum salmon run decreased to one of the lowest levels recorded (Appendix Table C1 and Figure 6).

The 1979 Alaska Board of Fisheries, in an effort to protect the smaller Kobuk River chum salmon stocks and ensure adequate salmon for subsistence needs, established: 1) July 10 as the opening date of the commercial salmon season to reduce harvest of Kobuk River salmon, and 2) emergency order commercial fishing periods during July, and two 36-hour fishing periods per week in August.

Although the harvest was below average again in 1979, the total catch was well above average during the next 3 years (1980, 1981, and 1982) with a record catch of 677,239 chum salmon taken in 1981 (Appendix Table C1 and Figure 6). This catch was attributed primarily to Noatak River stocks; Kobuk River escapements remained average during these years. In 1983, the harvest decreased to a level similar to harvest levels in the late 1970's. In light of increased commercial fishing effort, management restrictions designed and adopted in 1979 to protect Kobuk River stocks are still necessary.

Additional changes in commercial fishing regulations were made by the 1984 Alaska Board of Fisheries. Subdistrict boundaries were redefined (see 1984 Norton Sound-Port Clarence-Kotzebue Annual Management Report). Permit holders could reserve a set gill net fishing site by remaining on the site, and a 300 foot

minimum distance between units of gear was established.

Further fishing regulatory changes made during the Fall 1987 Alaska Board of Fisheries meetings. Subdistrict boundaries were once again changed; a new subdistrict was defined (Subdistrict 2) at the Noatak River mouth (Figure 5). This subdistrict was to remain closed during the commercial fishery unless opened by emergency order, during years of better than average returns. Formerly, this same area was open during the entire commercial fishery. The closure of the new Subdistrict 2 was intended to enhance wild stock escapement by dispersing fishing effort into offshore waters. To compensate for the loss of these highly productive fishing sites, more set gill net sites were created by a southward extension of the former Cape Blossom boundary; this statistical area (331-01) now has Riley Creek as its southern boundary. Open waters extend to an ADF&G marker (buoy) located approximately two miles offshore (perpendicular to the shore) from Riley Creek rather than from the old boundary of Cape Blossom. All remaining waters in the Kotzebue District outside of the aforementioned Subdistricts 1 and 2 were designated as Subdistrict 3, and remain closed to commercial fishing.

Fisheries Management 1988

The primary fishery management objectives were to provide adequate chum salmon escapement through the commercial fishery to ensure (1) sustained runs in future years and, (2) required subsistence harvest levels. Fisheries management in the Kotzebue district in 1988 was dependent on comparing period catch, catch per unit of effort (CPUE), and cumulative CPUE to historical averages (Figures 7, 8, and 9). An absence of established inseason escapement programs combined with staff reductions and a changing fishery (increasing efficiency) necessitated a conservative approach to management of the Kotzebue salmon fishery. Run strength was assessed after each period by comparing catch data (catch and catch per unit of effort) to historic average values for approximately the same date. A seven year average was used for comparison so as to include a range of weak and strong runs, thus providing a good comparative base.

The management staff considered first-hand knowledge of run strength and fishing conditions by local fishermen in decision-making processes. Subsistence fishermen in the lower Kobuk River villages were contacted twice a week to give their assessment of salmon abundance, timing, and fishing conditions. In addition, frequent meetings were held with members of the local commercial fishermen's association to exchange ideas and information.

Commercial Fishery 1988

The 1988 commercial harvest of salmon in the Kotzebue district

totaled 352,915 chum salmon and 152 chinook salmon (Table 10 and Figure 6). The harvest was the very close to the recent seven year average (1981-1987) catch of 354,730 chum salmon.

One hundred ninety-three permit holders fished at least one fishing period during the 1988 commercial salmon season which extended from July 11 to August 30 (Table 10). Due to an apparently early run, fishing time was extended to 36 hours per period on July 25, a week earlier than normal. On August 4, fishing time was again extended, to 48 hours per period, due to the continued trend of strong catches. By August 10, the fishery had peaked and chum salmon catches were declining. Escapements were near the historical averages, and the season catch was projected to be near the recent seven year average. On this basis, fishing time was reduced to the normal August fishing schedule of two 36 hours periods a week for the remainder of the season.

Total fishing time allowed was 516 hours, which was less than the recent seven year average (1981-1987) of 550 hours. The shorter than normal fishing time was in contrast to the relatively large number of active permits which was exceeded only once in the past nine years (Appendix Table C1).

Both catch and CPUE indicate the commercial fishery was one period earlier than normal. The first four periods showed this trend well, as did period six (Table 10). The fifth period was affected by poor weather. Catch and cumulative CPUE both peaked during period eight when 66,886 chum salmon were sold. The number of permit holders fishing ranged from 36 fishermen during the fifteenth period to 175 fishermen during the eighth period.

Commercial fishermen received approximately 2,581,333 dollars for their catch in 1988 (Appendix Table C3). This is the second highest value of the fishery in history. Only the 1981 fishery exceeded this value when a record catch of the fishery occurred, and was valued at 3,246,793 dollars. The 1988 chum salmon prices ranged from 72 cents to 90 cents per pound, while chinook salmon sold for two dollars per pound during each period, except period one when the price paid for chinook was \$1.62 per pound. The average prices paid were 85 cents per pound for chum salmon and \$1.98 per pound for chinook salmon (Appendix Table C4).

The average fisherman earned \$13,500 during the 1988 commercial salmon fishery. This amount was augmented by cash bonuses based on the number of pounds sold to a particular buyer. Five buyers operated, and all fish were flown out iced, in-the-round, to other areas (Anchorage and Sterling) for further processing (Appendix G4). Average weights were 8.7 and 13.9 pounds for chum and chinook salmon respectively (Appendix Table C4).

Three-quarters of the catch was taken in statistical area 331-01,

adjacent to the Baldwin Peninsula (Table 11 and Figure 5). Ninety-nine percent of the fishermen participated in this stat area during at least one period of the fishing season. The new fishing area created this season by the extension of the southwestern boundary, from Cape Blossom to Riley Creek (approximately 5 miles), was included in statistical area 331-01. The elimination of fishing at the Noatak River mouth (Subdistrict 2), and unusual weather conditions and salmon migration patterns all contributed to the increased effort in this area. Slightly more than half of the fishermen fished in stat area 331-02 (Sisaulik), 25% fished in stat area 331-03 (near Noatak River mouth), 35% fished in stat area 331-04 (Kobuk Lake), and 15% fished in stat area 331-05 (northwest boundary). Sea conditions in stat area 331-05 can be such that only large boats fish this area on a regular basis. Catch and effort by statistical area is summarized in Table 11.

The age composition of the commercial catch (weighted by period catch) was 7.6% age 3, 72.1% age 4, 18.3% age 5 and 1.9% age 6 (Appendix Table C9). Four seven-year-old chum salmon, (progeny of the record year return 1981) which rarely occur, were observed in the commercial catch.

Hatchery Contribution

A total of 93 marked (adipose and ventral clips) chum salmon were found in the commercial fishery out of 49,778 (14% of commercial harvest of 352,915 chum) checked. The estimated hatchery contribution to the fishery was approximately 7,543 chum salmon. The estimated age composition of the hatchery contribution (7,543 chum) to the commercial fishery was 3.4% age 3, 29.0% age 4, 50.6% age 5, and 17.0% age 6 fish (Raymond 1988).

Subsistence Fishery

Subsistence salmon fishing has long been an important food gathering activity for the Eskimo people of the Kotzebue district. Remnants of salmon spears and nets have been found in old village sites on the Kobuk River that date back to 1250 A.D. At present, subsistence fishermen use set gill nets and beach seines to catch salmon in the bays and rivers. Nearly all of the catch is dried for later consumption.

It is difficult to calculate the monetary value of the subsistence fishery in terms of dollars to the residents of this area. However, if subsistence fishermen had to purchase a protein food in the place of their subsistence salmon catch, the dollar value of this fishery would be considerable.

Raleigh (1957) documented estimates of average annual

subsistence catches for several years prior to 1957. The methods and completeness of this survey were not fully documented. The catch estimates were obtained from interviews of a percentage of each village population. The interview data were then expanded to include the entire village. Large errors in estimating total catches could have occurred.

The Alaska Department of Fish and Game has documented subsistence catches from annually conducted subsistence surveys since 1962 (ADFG Annual Management Report Series) (Appendix Table C6). Since 1984, decreased funding levels in this area has prevented systematic surveying of all Noatak and Kobuk River villages. The average harvest for the most recent five years in which subsistence salmon catches were documented (1982-1986) was 27,570 chum salmon. These surveys estimated catches by direct counts, interviews of fishermen, or the return of catch forms that were distributed to fishermen. Since not all fishermen were interviewed or responded to questionnaires, these catch figures should be considered minimum estimates only for years prior to 1981. Beginning in 1981, a mean catch per fishing family was calculated for each village surveyed. This mean was applied to those families known to have fished but were not available for interview.

Subsistence Division of the Alaska Department of Fish and Game conducted a subsistence resource utilization survey in 1986. The survey design used a stratified sampling technique based on the number of household exhibiting low, medium, and high use of the subsistence resources. Preliminary results of the 56 households surveyed in 1986 indicated an average subsistence chum salmon harvest of 47 fish per household. The preliminary (expanded) total subsistence chum salmon harvest for Kotzebue in 1986 was 36,311 fish (Appendix Tables C5 and C6). These results are still considered preliminary since final totals are not yet available. The town of Kotzebue was not surveyed in 1987 nor 1988.

Door-to-door subsistence fishermen interviews were conducted in two Kobuk River villages, Shungnak and Noorvik, during the last two weeks of September. Fishermen in the lower Kobuk village of Noorvik reported better than average catches. Fishing was best in August, when water conditions were better than in July, and the peak of salmon migration occurred. Shungnak fishermen also reported good salmon fishing, with better than average catches. Moderately high water levels during August presented some fishing difficulties, but most fishermen interviewed said they were able to get what they needed. Whitefish seemed to be very abundant. A survey of the village of Noatak was prevented due to three days of fog and cancelled flights. However, some Noatak residents had reported good salmon fishing earlier in the season. Unlike the past several years, river conditions were good for seining during the entire month of September.

A catch of 6,591 chum salmon was estimated from interviews of 22 fishing families in Noorvik. However, at least 3 major fishermen were not contacted, so another 900 (average catch of 300 chum per fisherman) were added; the total estimated chum salmon harvest was thus 7,500 fish. The average catch of 300 chum salmon was higher than the recent (1983-1987) five year average catch of 234 chum salmon per fishing family in Noorvik. Approximately 4,000 whitefish was estimated to have been caught as of September 15.

A catch of 5,723 chum salmon was reported from interviews of 15 (out of 16 known) fishers residing in the village of Shungnak. Added to this figure was 500 fish for one known fisher who could not be contacted (owner of a large dog team), for a total estimated chum catch of 6,223. The average catch for the 16 known fishing families was 389 chum salmon. This estimate was considerably above the recent five year (1983-1987) average catch of 255 chum salmon. Although many people of Shungnak were still fishing for whitefish, it was estimated that 10,000 had been caught at the time of the survey (September 26). These data are summarized in Appendix Tables C6 and C7.

Escapement

A test fishery was initiated during the 1987 season to evaluate the feasibility of indexing chum salmon escapement in the Noatak River using systematic drift gill net catches. The project continued in 1988, from July 19 through August 24, with peak catches occurring on August 12. The data collected was of limited use in the management of the commercial fishery this year since only one year of data exists for comparison. If the project is continued it will provide the management staff with an index of chum salmon timing and escapement to the Noatak River, the largest salmon system in the area. Results are presented in a separate project report (Knuepfer 1988).

Aerial surveys of index spawning streams were conducted before and after peak spawning on the lower Kobuk streams, after peak spawning on the upper Kobuk, and during peak spawning on the Noatak River. Poor weather and high water during most of August precluded surveys at that time. Completed surveys indicate chum salmon escapements to have been near average in all streams, with the exception of the Squirrel River, which was estimated to be below the historic average (Appendix Table C8). The number of chum counted on the lower and upper Kobuk River was 14,178 and 11,895 fish, respectively. Approximately 45,930 salmon were counted on the Noatak River, however, turbid water prevented a complete survey.

Escapements appeared to be adequate based on the number of fish observed in the index areas in which survey conditions were good.

A total of 8,639 chum salmon were counted in the Eli River, with 1,460 documented in the Kelly River and Lake. These surveys were conducted prior to peak spawning.

Ground surveys were conducted on the lower Noatak and Kobuk Rivers to collect information on the age, sex and length of fish escaping to these areas. This information will be available in the annually published Norton Sound/Kotzebue Sound Catch and Escapement report series (In press).

Outlook for 1989

The outlook for the 1989 Kotzebue chum salmon return and harvest is unclear. The cycle that has developed over the past eight years, or, two generations of chum salmon, would indicate a strong return, with a harvest approaching 500,000 chum salmon. However, the apparently poor return of the 1988 three-year-old class (brood year 1985), which was roughly one-half normal strength, would indicate a below average return. Since a reliable forecast method has not yet been developed for the Kotzebue fishery, only a very broad range of possible harvests will be stated. The 1989 Kotzebue chum harvest is expected to fall between 200,000 and 500,000 chum salmon.

Table 10. Commercial catches of chum and chinook salmon and char in the Kotzebue District by fishing period, 1988.

	Period Dates	Hours Fished	Nb. of Fishermen	Nb. of Chinook	Nb. of Pounds	CPUE	Nb. of Chum	Nb. of Pounds	CPUE	Char	Nb. of Pounds	CPUE
1	7/11-7/12	24	76	11	162	0.1	5,630	49,217	3.1	0	0	0.0
2	7/14-7/15	24	118	28	387	0.1	13,146	117,675	4.6	0	0	0.0
3	7/20-7/21	24	141	15	204	0.0	19,914	181,699	5.9	0	0	0.0
4	7/21-7/22	24	146	14	239	0.0	30,284	270,340	8.6	0	0	0.0
5	7/25-7/26	36	147	10	165	0.0	27,214	242,214	5.1	0	0	0.0
6	7/28-7/29	36	160	18	227	0.0	43,464	399,181	7.5	0	0	0.0
7	8/01-8/02	36	166	6	70	0.0	30,794	267,387	5.1	0	0	0.0
8	8/04-8/06	48	175	18	309	0.0	66,886	584,337	8.0	0	0	0.0
9	8/08-8/10	48	165	10	119	0.0	32,989	276,040	4.2	3	20	0.0
10	8/12-8/13	36	150	9	111	0.0	44,506	366,357	8.2	0	0	0.0
11	8/15-8/16	36	134	6	61	0.0	15,007	120,893	3.1	4	11	0.0
12	8/18-8/19	36	124	5	52	0.0	12,174	98,789	2.7	284	1,808	0.6
13	8/22-8/23	36	92	1	11	0.0	6,223	49,112	1.9	310	2,017	0.9
14	8/25-8/26	36	58	1	3	0.0	2,886	22,574	1.4	131	975	0.6
15	8/29-8/30	36	36	0	0	0.0	1,798	14,279	1.4	20	136	0.2
Season Totals		516	193	152	2,120		352,915	3,060,292		752	4,967	

Table 11. Commercial chum and chinook salmon catch by statistical area, Kotzebue District, 1988.

Stat Area	No. of Fishermen	CHUM SALMON					CHINOOK SALMON				
		No. of Chum	Percent	Pounds	Ave. Weight	CPUE	No. of Chinook	Percent	Pounds	Ave. Weight	CPUE
331-01	191	266,039	75.4	2,300,459	8.6	2.70	98	64.5	1,401	14.3	0.0
331-02	104	34,073	9.7	294,525	8.6	0.63	46	30.3	608	13.2	0.0
331-03	49	11,880	3.4	105,045	8.8	0.47	2	1.3	36	18.0	0.0
331-04	66	31,384	8.9	276,886	8.8	0.97	3	2.0	35	11.7	0.0
331-05	29	9,539	2.7	83,377	8.7	0.64	3	2.0	40	13.3	0.0
Totals	193	352,915	100.0	3,060,292	8.7	3.54	152	100.0	2,120	14.0	0.0

Table 12. Estimated subsistence effort and catch of chum salmon by village, Kotzebue District, 1988.

Village	Number of Fishermen	Chum Salmon Harvest	Average Catch per Fisherman
Noatak 1/			
Noorvik	25	7,500	300
Shungnak	16	6,223	389
District total			

1/ Not surveyed due to poor weather hindering aircraft travel.

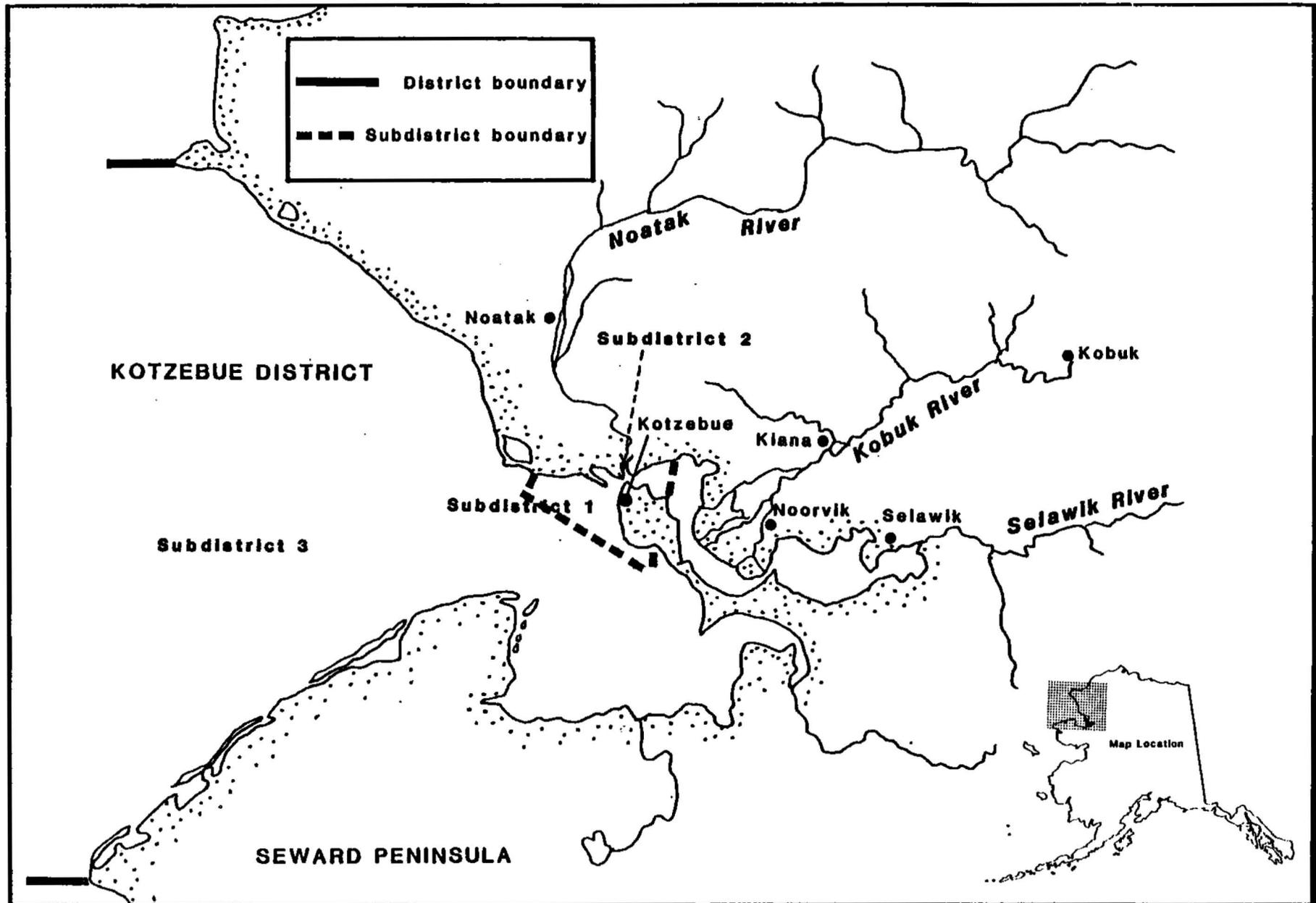


Figure 4. Kotzebue District.

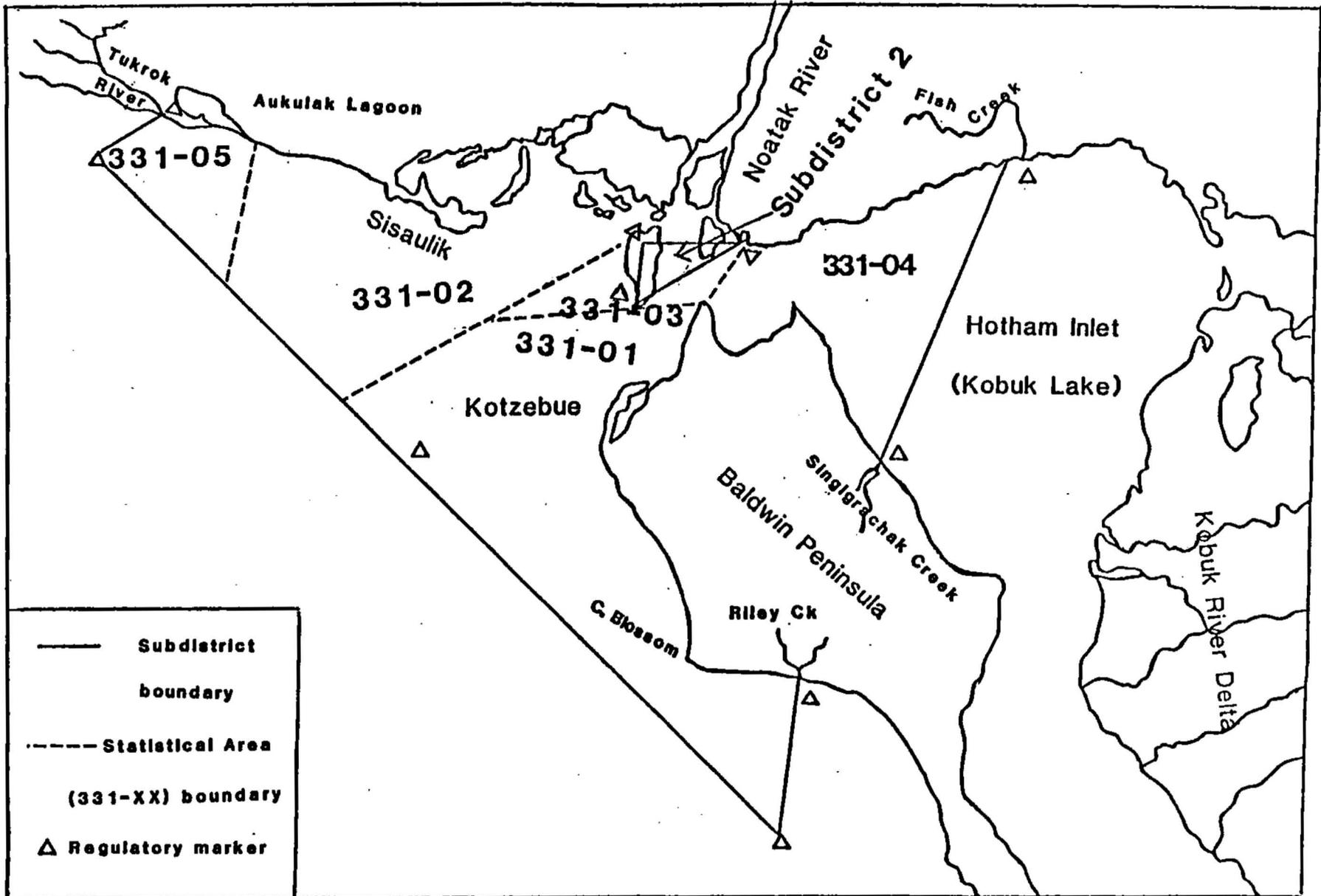


Figure 5. Kotzebue Sound commercial salmon fishing subdistricts.

Kotzebue District Chum Salmon

Commercial Catch, 1962-1988

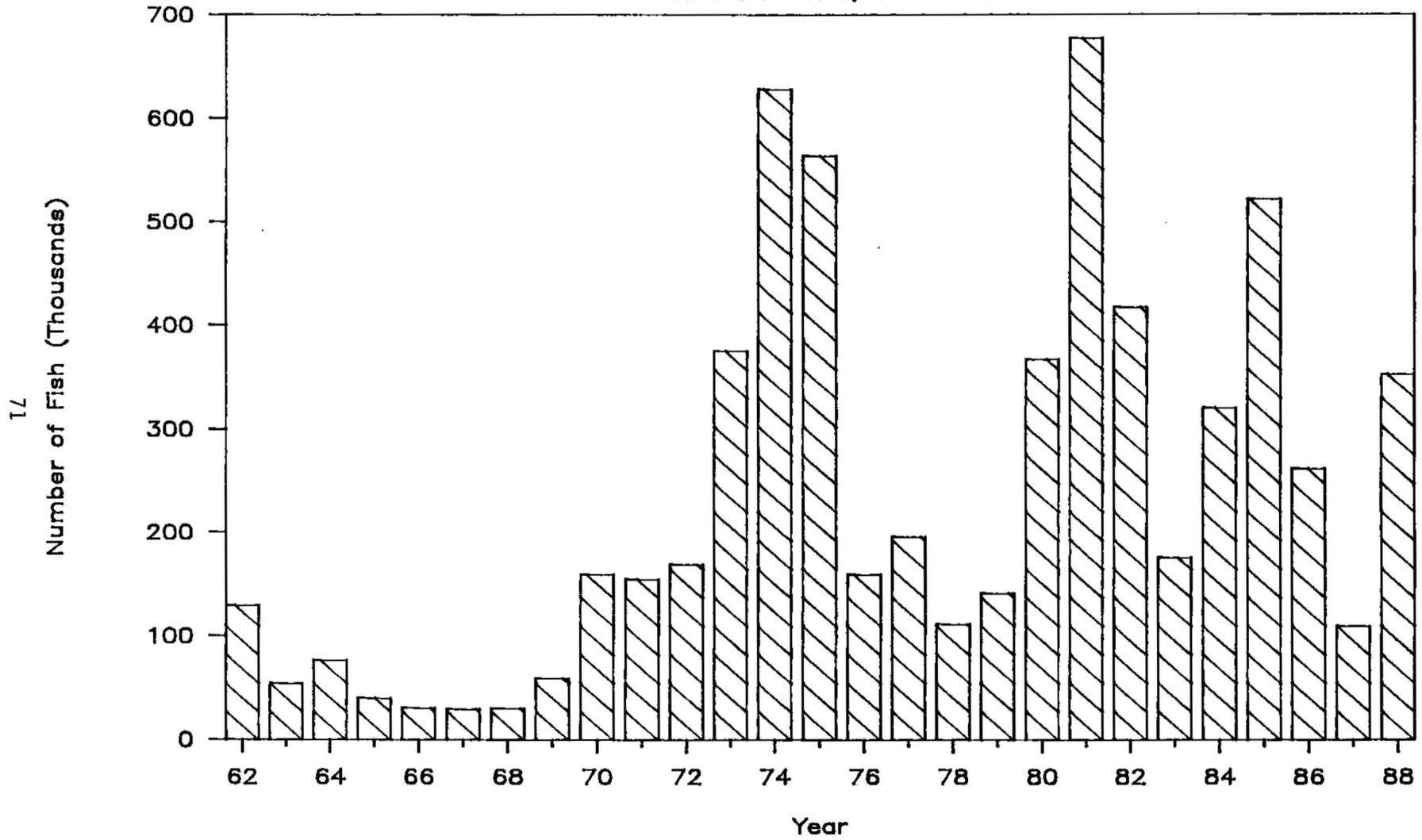


Figure 6 Kotzebue Sound commercial chum salmon harvests, 1962-1988.

Commercial Catch

7-Year Ave. vs. 1988

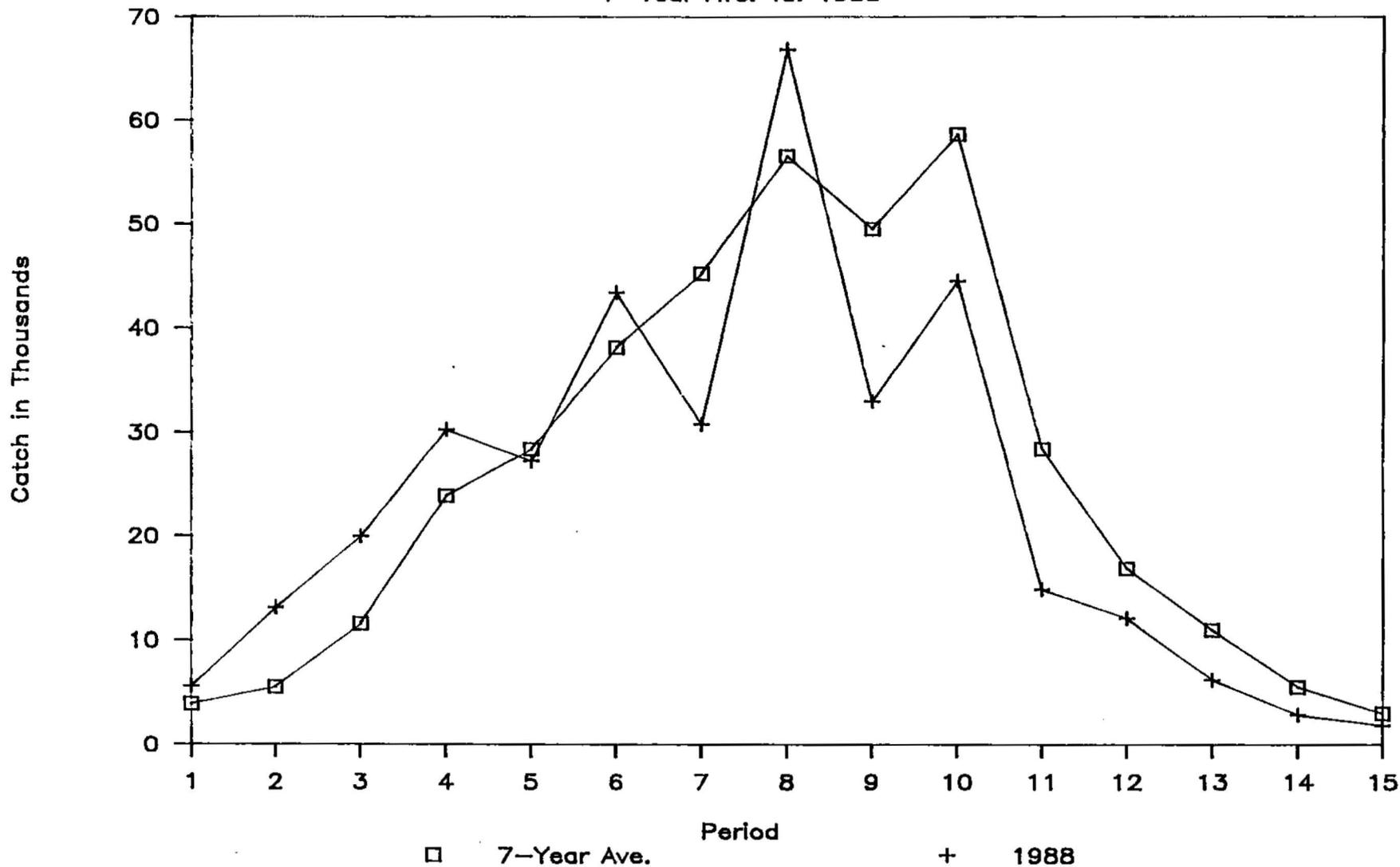


Figure 7 Comparison of 1988 and seven year average (1981-1987) commercial chum salmon period catch, Kotzebue District.

Catch Per Unit Effort

7-Year Ave. vs. 1988

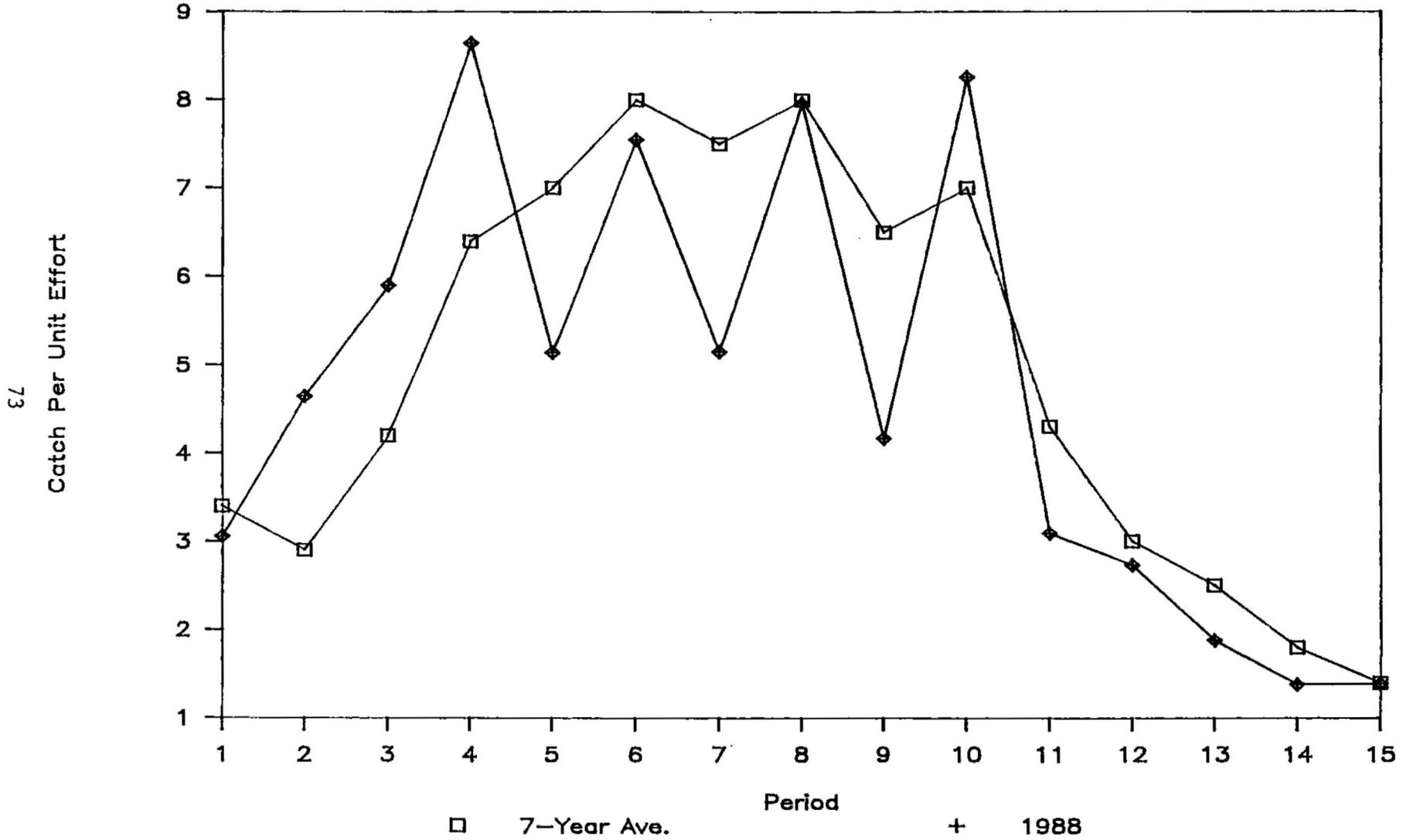


Figure 8 Comparison of 1988 and seven year average (1981-1987) commercial chum salmon period CPUE, Kotzebue District.

Cumulative CPUE

7-Year Ave. vs. 1988

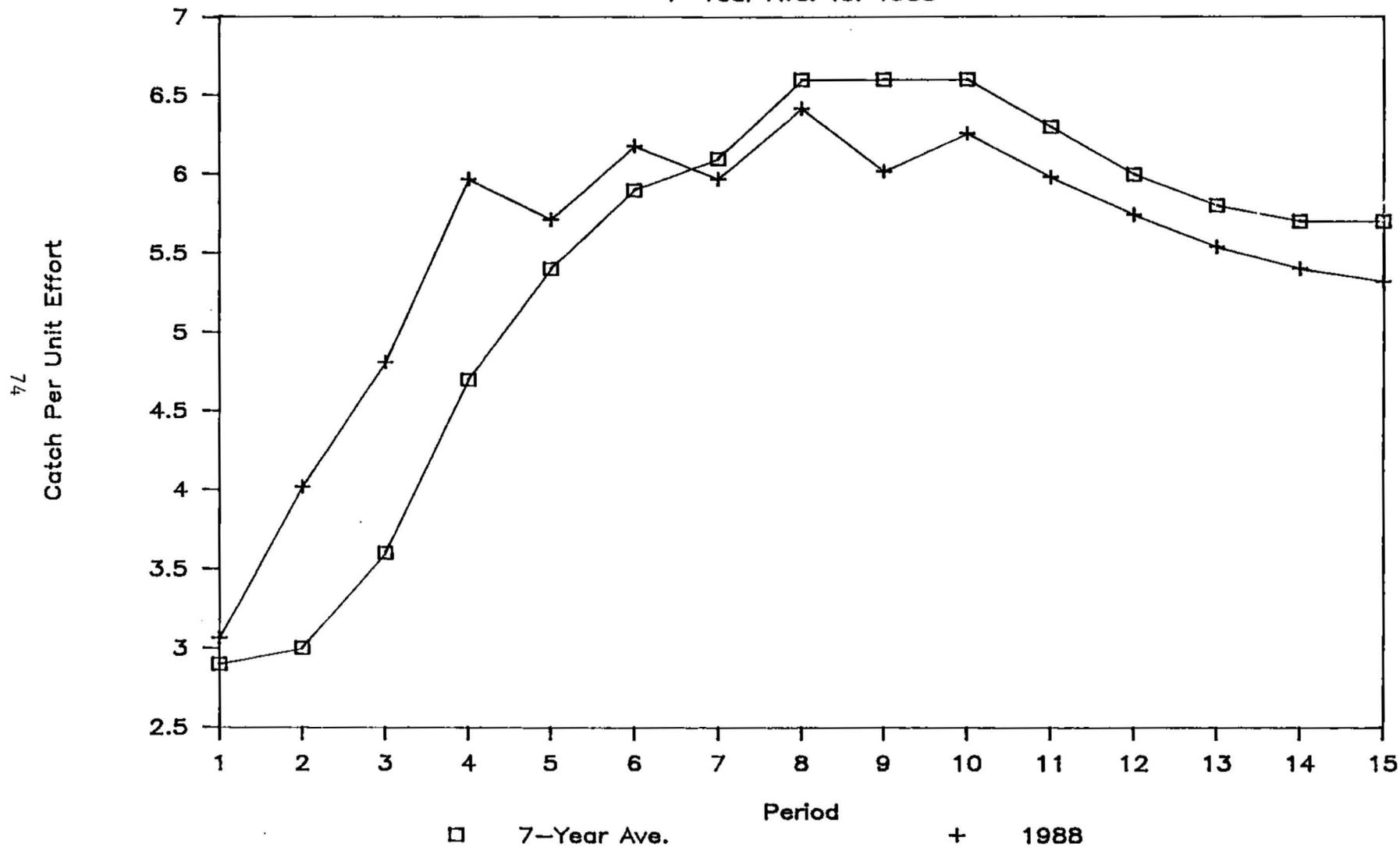


Figure 9 Comparison of 1988 and seven year average (1981-1987) commercial chum salmon cumulative CPUE, Kotzebue District.

Appendix Table C1. Comparative commercial chum salmon catch statistics, Kotzebue District, 1962-1988.

Year	Total Catch	Total Days 1/	Total Boat Days 2/	Average Catch/ Boat Day	Number of Fishermen 3/	Average Seasonal Catch/ Fisherman
1962	129,948	21	793	164	84	1,547
1963	54,445	20	693	79	61	893
1964	76,499	27	560	137	52	1,471
1965	40,025	32	410	98	45	889
1966	30,764	35	548	56	44	699
1967	29,400	33	556	53	30	980
1968	30,212	34	858	35	59	512
1969	59,335	40	798	74	52	1,141
1970	159,664	32	1,368	117	82	1,947
1971	154,956	29	1,468	106	91	1,781
1972	169,664	35	2,095	81	104	1,631
1973	375,432	25	2,217	169	148	2,537
1974 4/	627,912	32	3,769	167	185	3,394
1975 5/	563,345	39	4,301	131	267	2,110
1976	159,656	16	2,236	71	220	726
1977	195,895	21	2,353	83	224	875
1978	111,533	23	2,738	41	208	536
1979	141,545	21	2,462	57	181	782
1980	367,284	27	2,559	144	176	2,087
1981	677,239	27	3,336	203	187	3,622
1982	417,790	23.5	3,115	134	199	2,099
1983	175,762	12.5	1,557	113	189	930
1984	320,206	19.5	2,432	132	181	1,769
1985	521,406	25.5	3,376	154	189	2,759
1986	261,436	15.5	2,049	128	187	1,398
1987	109,467	11.5	1,160	94	160	684
1988	352,915	21.5	2,761	128	193	1,829

1/ Day = 24 hours of open fishing time.

2/ Boat days standardized in 1983 for all prior years. Boat days = number of boats fishing x period length in hours divided by 24. Total boat days = total season boat hours divided by 24.

3/ During 1962 - 1966 and 1968 - 1971 figures represent the number of vessels licensed to fish in Kotzebue Sound, not the number of fishermen.

4/ Includes 6,567 chum salmon from the Deering experimental fishery.

5/ Includes 10,704 chum salmon from the Deering experimental fishery.

Appendix Table C2. Salmon pack by species and type of processing, Kotzebue District, 1962-1988. 1/

Year	Chum Salmon		Other 4/	Salmon Roe	Cured
	cases (48 lb.)	fresh-frozen (rnd. wt. in lbs.)		(lbs.) fresh frozen	
1962	14,500	-	-	-	-
1963	5,396	-	-	-	-
1964	5,421	202,993	-	-	-
1965	1,929	207,350	-	-	-
1966	-	310,716	-	13,600	3,065
1967	-	273,420	-	-	11,488
1968	-	288,500	-	-	11,850
1969	-	455,013	-	-	8,183
1970	-	1,240,000	-	-	48,377
1971	-	1,264,753	-	-	27,542
1972	-	1,547,041	-	-	55,376
1973	-	3,416,431	-	-	144,768
1974	-	5,361,130 2/	-	-	-
1975	-	4,877,313 3/	-	-	-
1976	-	1,415,549	487	-	-
1977	-	1,846,340	1,075	-	-
1978	-	1,009,121	32,419	-	-
1979	-	1,236,429	6,155	-	-
1980	-	3,160,984	7,828	-	-
1981	-	6,139,518	2,210	-	-
1982	-	3,833,051	790	100	-
1983	-	1,647,160	2,449	-	-
1984	-	2,631,582	1,593	-	-
1985	-	4,528,379	1,106	-	-
1986	-	2,271,320	1,691	-	-
1987	-	900,405	597	-	-
1988	-	3,060,292	2,120	-	-

1/ Pack represents type of processing when fish were shipped out of District.

2/ Includes 36,775 lbs. from the experimental commercial fishery at Deering.

3/ Includes 80,801 lbs. from the experimental commercial fishery at Deering.

4/ Chinook and pink salmon.

Appendix Table C3. Dollar value estimates of Kotzebue District commercial fishery, 1962-1988. 1/

Year	Gross Value of Catch to Fishermen	Wholesale Value of Pack 2/	License and Tax Revenue to State
1962	\$ 45,500	\$ 304,500	\$ 11,635
1963	9,140	113,316	6,040
1964	34,660	158,020	5,279
1965	18,000	83,294	2,952
1966	25,000	84,630	2,820
1967	28,700	100,450	4,245
1968	46,000	62,000	2,800
1969	71,000	6/	3/
1970	186,000	6/	5,520
1971	200,000	6/	5,970
1972	260,000	6/	3/
1973	925,000	6/	3/
1974 3/	1,822,784	6/	18,121
1975 4/	1,365,648	6/	16,955
1976	580,375	6/	15,364
1977	1,033,950	6/	19,960
1978	575,260	6/	9,913 5/
1979	990,263	6/	18,302 5/
1980	1,446,633	6/	11,820 5/
1981	3,246,793	6/	11,220 5/
1982	1,961,518	6/	7,085 5/
1983	420,736	6/	24,097
1984 7/	1,148,884	6/	39,969 5/
1985	2,137,368	6/	6,390 8/
1986	931,241	6/	5,610 8/
1987	515,000	6/	6,180 8/
1988	2,581,333	6/	11,150 8/ 9/

- 1/ Some estimates between 1962 and 1981 include only chum value which, in figures, represent over 99% of the total value. Figures after 1981 represent the chum value as well as incidental species such as char, whitefish and other salmon species.
- 2/ Based on type of processing when fish were shipped out of the district.
- 3/ Includes \$9,193 from the experimental commercial fishery at Deering.
- 4/ Includes \$17,776 from the experimental commercial fishery at Deering.
- 5/ Includes permit and vessel fees only.
- 6/ Information not available.
- 7/ Includes tendering fees but not cash bonuses.
- 8/ Includes permit renewal fees only; vessels were not required to be licensed.
- 9/ The Alaska State Legislature raised resident and nonresident permit renewal fees to \$50.00 and \$150.00, respectively, in 1988.

Appendix Table C4. Estimated mean prices paid to salmon fishermen by species, Kotzebue District, 1962-1988. 1/4/

Year	Chum Salmon Avg. Wt.	Average Price	Chinook salmon	Pink salmon	Inconnu	Char
1962	-	\$0.35 3/				
1963	-	0.35 3/				
1964	8.3	0.45 3/				
1965	9.0	0.45 3/			\$1.30 3/	
1966	10.1	0.11			1.40 3/	\$0.55 3/
1967	9.3	0.11			1.50 3/	0.75 3/
1968	9.7	0.14			0.91 3/	0.98 3/
1969	7.5	0.15			1.30 3/	2.84 3/
1970	8.1	0.15				
1971	8.1	0.16			0.16	0.17
1972	9.1	0.17			0.20	0.17
1973	9.1	0.25			0.30	0.16
1974 2/	8.5	0.34			0.30	0.16
1975 2/	8.6	0.28			0.30	0.30
1976	8.9	0.41			0.30	0.30
1977	9.6	0.56			0.30	
1978	9.1	0.57			0.30	0.25
1979	8.8	0.80				0.25
1980	8.6	0.46			0.10	0.20
1981	9.1	0.53			0.75 5/	0.17
1982	9.3	0.51	\$1.25	\$0.15	0.75 5/	0.20
1983	9.4	0.25	1.08	0.13		0.20 5/
1984	8.2	0.44	1.03			0.25 5/
1985	8.7	0.47	1.25			0.25
1986	8.7	0.41	1.25			0.20
1987	8.2	0.57	1.25			0.30
1988	8.7	0.85	1.98			0.35

- 1/ Information not available for some species.
- 2/ Includes price paid to fishermen of Deering during experimental commercial fishery.
- 3/ Price per fish
- 4/ Figures from previous reports recomputed to yield price per pound.
- 5/ Limited market with one buyer.

Appendix Table C5. Commercial and subsistence salmon catches, Kotzebue, 1914-1988.

Year 1/	Commercial Catch			Subsistence Chum Catch			Total Documented Utilization
	Chum 2/	Other 3/	Total	Chum	# Fishermen Interviewed	Avg. Catch/ Fishermen	
1914	8,550	-	8,550	-	-	-	-
1915	4,750	-	4,750	-	-	-	-
1916	19,000	-	19,000	-	-	-	-
1917	44,612	-	44,612	-	-	-	-
1918	27,407	-	27,407	-	-	-	-
1957	-	-	-	298,430 4/	-	-	-
1962	129,948	127	130,075	70,283	81	868	200,358
1963	54,445	143	54,588	31,069	67	464	85,657
1964	76,499	5	76,504	29,762	58	513	106,266
1965	40,034	-	40,034	30,500	89	343	70,534
1966	30,764	1	30,765	35,588	121	294	66,353
1967	29,400	-	29,400	40,108	135	297	69,508
1968	30,384 5/	-	30,384	20,814	65	126	51,198
1969	59,335	48	59,383	29,812	99	301	89,195
1970	159,664	-	159,664	28,486	164	174	188,150
1971	154,956	1	154,957	23,959	152	158	178,916
1972	169,664	3	169,667	11,085	96	115	180,752
1973	375,432	5	375,437	18,942	101	188	394,379
1974	634,479 6/	48	634,527	26,729	88	304	661,256
1975	563,682 7/	36	563,718	27,605	95	291	591,323
1976	159,796	2	159,798	15,765	91	173	175,563
1977	195,895	-	195,895	9,752	83	117	205,647
1978	111,533	7,007	118,540	12,864	85	151	131,404
1979	141,623	910	142,533	14,605	97	151	157,138
1980	367,284	1,654	386,938	10,945	111	98	379,883
1981	677,239	237	677,476	17,766	71	250	695,242
1982	417,790	57	417,847	30,133	204	148	447,980
1983	175,762	229	175,991	8,262 8/	46	180	184,253
1984	320,206	107	320,313	15,508 8/	66	235	335,714
1985	521,406	63	521,469	13,494 9/	243	129	552,963
1986	261,436	106	261,542	36,311 10/	837 10/	60	312,000
1987	109,467	44	109,511	11/	11/	11/	109,511
1988	352,915	152	353,067	11/	11/	11/	353,067
(1983-1987) average	277,655	110	277,765				366,582
(1978-1987) average	310,375	1,041	313,216				340,222

1/ There was no commercial fishing during 1919-1961.

2/ Catches for 1914-1918 from pack data only; number of chum salmon estimated at 9.5 per case (#48) and 34 per barrel.

3/ Includes pink, chinook and sockeye salmon.

4/ Estimated mean annual catches prior to 1957 (study by Raleigh).

5/ Corrected from 1968 annual report due to addition of late catches.

6/ Includes 6,567 chum salmon harvested from Deering experimental fishery.

7/ Includes 10,704 chum salmon harvested from Deering experimental fishery.

8/ Partial survey.

9/ Does not include harvest from the villages of Noatak and Kivalina.

10/ Harvest and number fishermen in Kotzebue are preliminary expanded estimates.

11/ Not surveyed; data unavailable.

Appendix Table C6. Kotzebue District subsistence chum salmon catches by village, 1962-1988.

Year	Village					Totals		Village						District Total
	Noorvik	Kiana	Ambler	Shungnak	Kobuk	Kobuk River	Noatak River 3/	Kotzebue	Deering	Kivalina	Buckland	Candle	Shishmaref	
1962	15,934	3,139	2/	2/	2,321	21,393	48,890	2/	2/	2/	2/	2/	2/	70,283
1963	4,304	1,973	755	1,240	200	8,472	16,762	5,835	2/	2/	2/	2/	2/	31,069
1964	2,167	783	2,142	3,134	1,020	9,246	12,763	7,753	2/	2/	2/	2/	2/	29,762
1965	5,596	1,598	1,340	2,160	877	11,571	5,671	8,058	5,200	2/	2/	2/	2/	30,500
1966	3,141	433	912	899	625	6,010	19,700	3,640	6,238	2/	2/	2/	2/	35,588
1967	2,350	1,489	679	1,500	175	6,193	26,512	4,032	3,098	2/	162	11	100	40,108
1968	2,424	2,488	457	1,600	1,030	7,999	5,490	4,324	2,838	2/	37	89	37	20,814
1969	1,301	2,458	3,525	2,550	1,655	11,489	14,458	1,768	1,897	2/	-	200	2/	29,812
1970	6,077	3,457	2,899	3,450	600	16,483	4,120	6,814	1,242	2/	344	113	2/	28,486
1971	7,144	5,177	2,299	2,653	1,931	19,204	9,919	1,737	763	2/	155	50	131	31,959
1972	1,744	1,435	1,469	2,665	2,119	9,462	741	1,151	369	2/	59	113	29	11,085
1973	2,312	4,470	1,529	4,406	1,917	14,634	216	1,172	1,098	2/	1,722	50	100	18,942
1974	6,809	2,726	1,651	6,243	2,251	19,680	4,330	2/	1,880	2/	639	15	200	26,729
1975	4,620	4,320	3,390	9,060	1,755	23,145	1,515	2/	1,175	2/	1,540	2/	230	27,605
1976	1,555	1,579	2,000	4,213	562	9,909	4,448	2/	1,358	2/	2/	2/	2/	15,765
1977	891	766	385	1,760	325	4,127	2,125	2/	3,500	2/	2/	2/	2/	9,752
1978	2,034	1,493	2,224	4,766	852	11,369	1,495	2/	2/	2/	2/	50	2/	12,864
1979	2,155	1,225	2,400	2,947	651	9,378	2,227	2/	2,000	2/	1,000	2/	2/	14,605
1980	2,229	2,551	660	2,704	350	8,500	2,135	2/	2/	2/	2/	2/	2/	10,635
1981	3,488	1,439	782	2,800	958	9,449	5,465	2,387	295	110	50	2/	2/	17,766 1/4/
1982	7,433	4,918	2,506	4,191	600	19,648	5,479	4,099	807	100	2/	2/	2/	30,133 1/5/
1983 6/	277	223	1,062	3,556	368	5,486	4,035	347	219	200	2/	2/	2/	10,287
1984 7/	2/	2/	2,990	4,241	2/	7,231	6,049	88 1/	1,940	200	2/	2/	2/	15,508
1985	7,015	3,494	3,487	3,115	300	17,411	2/	13,494	573	2/	2/	2/	2/	31,478
1986	8,418	2/	2/	4,483	2/	12,901 8/	1,246	36,311 9/	2/	2/	2/	2/	2/	50,458
1987	5,092	2/	2/	1,975	2/	7,067 8/	2,921	2/	2/	2/	2/	2/	2/	9,988 10/
1988	7,500	2/	2/	6,223	2/	13,723 8/	2/	2/	2/	2/	2/	2/	2/	13,723 10/

1/ No household survey; information from return of mail questionnaires.

2/ Not surveyed.

3/ Represents catches of Noatak Village.

4/ Does not include 310 chum taken in Selawik.

5/ Does not include 110 chum salmon taken in Kivalina.

6/ During 1983 household surveys were conducted in Noatak, Kivalina and Shungnak only. Other harvest information is from limited return of mail-in calendars. Harvest data should be considered minimums only.

7/ During 1984 household surveys were conducted in Noatak, Kivalina, Shungnak, Ambler and Deering only. Other harvest information is from a limited return of mail-in questionnaires.

8/ Includes only catches from Noorvik and Shungnak.

9/ Preliminary expanded subsistence chum catches based on Subsistence Division survey not yet completed; see text.

10/ Total represents documented subsistence chum salmon catches only; see text.

Appendix Table C7. Mean subsistence chum salmon catch per fisherman by village, Kotzebue District, 1962-1988.

Year	Kotzebue	Noatak	Noorvik	Kiana	Ambler	Shungnak	Kobuk	Deering
1962	2/	1190	665	350	2/	2/	335	2/
1963	650	800	160	3/	94	3/	67	2/
1964	515	710	220	260	310	2/	205	2/
1965	400	810	220	265	190	220	145	2/
1966	158	820	137	62	76	45	104	2/
1967	202	914	90	68	49	125	35	2/
1968	135	220	84	96	33	114	206	2/
1969	98	760	163	223	235	318	206	2/
1970	187	242	132	138	242	182	150	2/
1971	53	148	223	207	177	133	386	2/
1972	63	74	84	84	244	266	302	2/
1973	195	36	121	178	305	489	273	2/
1974	2/	393	324	181	165	891	450	2/
1975	2/	138	210	288	282	647	293	2/
1976	2/	212	259	79	250	281	70	2/
1977	2/	425	56	38	55	104	41	2/
1978	2/	79	88	71	131	265	142	2/
1979	2/	114	98	68	160	184	108	2/
1980	2/	164	318	213	132	246	88	2/
1981	213	579	388	131	129	233	317	2/
1982	84	189	323	246	167	262	200	81
1983	4/ 50	269	139	223	531	254	368	44
1984	44 5/	173	2/	2/	214	303	2/	194
1985	107	2/	206	116	152	195	50	72
1986	47 7/	69 6/	271	2/	2/	195	2/	2/
1987	2/	225 6/	189	2/	2/	329	2/	2/
1988	2/	2/	300	2/	2/	389	2/	2/

- 1/ No household survey; information from return of mail questionnaires.
- 2/ Not surveyed.
- 3/ Number of fishermen unknown.
- 4/ Means based on very limited number of mail-in calendars except for the villages of Noatak and Shungnak, where interviews were conducted.
- 5/ Mean based on two fishermen's reported catch.
- 6/ Partial harvest; fishermen just beginning to fish.
- 7/ Based on preliminary figures from Subsistence Division survey which is not yet complete; see text.

Appendix Table C8. Chum salmon aerial survey escapement estimates, Kotzebue District, 1962-1988. 8/

	1962	1963	1964	1965	1966	1967	1968	1969
Noatak River System								
Noatak River (below Kelly River)	168,000 4/	1,970 1/	89,798	6,152 1/	101,640	29,120	39,394	33,945
Eli River	9,080 4/	35	-	-	120	-	5,502	68 1/
Kelly River & Lake	1,818 4/	600	-	3,155	570	225	375	150
Noatak River System Total	178,898	2,605	89,798	9,307	102,330	29,345	45,271	34,163
Kobuk River System								
Main Kobuk River								
Mouth to Kobuk	-	-	-	-	-	-	-	-
Kobuk to Pah River	-	-	-	1,750	266	-	530	-
Pah River to just below Selby River	-	400	-	500	-	-	50	-
Selby River mouth and Slough	-	2,575	-	500	630	1,625	70	-
Selby River mouth to just below Beaver River	-	-	-	-	-	75	170	-
Beaver River mouth	-	1,095	-	-	460	795	1,550	-
Above Beaver River	-	465	-	-	118	-	-	-
Main Kobuk River Total	23,150 2/	4,535	7,985 7/	2,750	1,474	2,495	2,370	7,500 3/
Squirrel River	16,050 4/	2,200	8,009	7,230	1,350	3,332	6,746	6,714
Salmon River	12,936 4/	1,535	9,353	1,500 1/	3,957	2,116	3,367	2,561
Tutuksuk River	10,841 4/	670	2,685	-	1,383	169	823 1/	159
Kobuk River System Total	62,977 3/	8,940	28,032	11,480	8,164	8,112 3/	13,306	16,934

-continued-

Appendix Table C8. (Page 2 of 4).

	1970	1971	1972	1973	1974	1975	1976	1977
Noatak River System								
Noatak River (below Kelly River)	138,145	41,075	64,315 1/	32,144	129,640	96,509	44,574	11,221
Eli River	-	-	3,286	-	22,249	1,302	1,205	742
Kelly River & Lake	-	-	-	3,890 6/	6,978 6/	3,937	217	290
Noatak River System Total	138,145	41,075	67,601 1/	36,034	158,867	101,748	45,906	12,253 1/
Kobuk River System								
Main Kobuk River								
Mouth to Kobuk	-	-	-	1/	2,255	-	-	-
Kobuk to Pah River	1,753	4,953	-	1/	-	1,873	485	-
Pah River to just below Selby River	20	2,039	1,865	1/	4,710	3,968	2,037	-
Selby River mouth and Slough	4,820	3,100	7,400	1/	7,380	-	-	-
Selby River mouth to just below Beaver River	2,385	4,720	3,170	920	13,775 5/	4,861 5/	-	-
Beaver River mouth	4,930	2,000	3,000	850	-	-	-	-
Above Beaver River	-	-	2,720	700	-	-	-	-
Main Kobuk River Total	13,908	17,202	18,155	2,470 1/	28,120	10,702	2,522 1/	-
Squirrel River	4,418	6,628	32,126	12,345	32,523	34,236	7,229	1,964 1/
Salmon River	3,000 1/	5,453	2,073 1/	6,891	29,190	9,721	1,161	-
Tutuksuk River	2,000 1/	1,384 6/	-	-	8,312	1,344 1/	758	-
Kobuk River System Total	23,326	30,667	52,354	21,796	98,145	56,003	11,670	1,758

-continued-

Appendix Table C8. (Page 3 of 4).

	1978	1979	1980	1981	1982	1983	1984	1985
Noatak River System								
Noatak River (below Kelly River)	37,817	19,655	164,474	116,352 1/	20,682 1/	79,773	67,873	43,529 9/
Eli River	5,525	1,794	10,277	-	295	3,044	5,027	1,852 9/
Kelly River & Lake	168	3,200	7,416	13,770 3/	11,604	12,137	3,499	1,200 9/
Noatak River System Total	43,510	24,649	182,167	130,122	32,581	94,954	76,399	46,581 9/
Kobuk River System								
Main Kobuk River								
Mouth to Kobuk	-	-	-	-	-	-	-	-
Kobuk to Pah River	269	75	1,694	18	2,643 1/	2,147	402	2,048 9/
Pah River to just below Selby River	1,448	183	2,063	309	598 1/	2,433	257	241 9/
Selby River mouth and Slough	211	1,110	-	8,321 2/5/	2,454	11,683	-	711 9/
Selby River mouth to just below Beaver River	53	640	6,925 2/	-	7,268	13,011	5,910	3,278 9/
Beaver River mouth	-	-	784	-	1,711	3,059	-	-
Above Beaver River	-	-	-	-	-	1,413	4,052	-
Main Kobuk River Total	1,981	2,008	11,466	8,648	14,674	33,746	10,621	6,278 9/
Squirrel River	1,863	1,500 1/	13,536	9,854	7,690	6,075	5,473	6,145 9/
Salmon River	814	674 1/6/	8,456	4,709	5,392 3/	1,677	1,471	2,884 9/
Tutuksuk River	368	382 1/	1,165	1,114	1,322	2,637	1,132	5,098 9/
Kobuk River System Total	5,026	4,628	34,623	24,325	29,078	44,135	18,571	20,405 9/

-continued-

Appendix Table C8. (Page 4 of 4).

	1986	1987	1988
Noatak River System			
Noatak River (below Kelly River)	37,227 1/10/	5,565 1/ 11/	45,930 1/
Eli River	4,308 10/	2,780	8,639
Kelly River & Lake	839 10/	950	1,460 9/
Noatak River System Total	42,374	9,295	56,029
Kobuk River System			
Main Kobuk River			
Mouth to Kobuk	-	-	-
Kobuk to Pah River	531 10/	2,250	1,135 1/
Pah River to just below Selby River	511 10/	1,470	820 1/
Selby River mouth and Slough	673 10/	1,350	6,890 1/
Selby River mouth to just below Beaver River	3,282 10/	-	-
Beaver River mouth Above Beaver River	1,018 10/	3,140	3,050 1/
Main Kobuk River Total	6,015	8,210	11,895 1/
Squirrel River	4,982	3,400 12/	4,848 1/
Salmon River	1,971	3,333	6,208
Tutuksuk River	4,257	206	3,122
Kobuk River System Total	17,225	15,149	26,073

- 1/ Poor survey conditions or incomplete survey or late survey.
 2/ Probably represents over-estimate and includes some inconnu.
 3/ Foot survey.
 4/ These fish are unidentified salmon but mostly chums.
 5/ This figure includes fish observed from just above Selby Slough to the mouth of the Reed River.

- 6/ Unresolvable discrepancies in historical data put this figure in question.
 7/ Unclear where these fish were observed.
 8/ The figures in this table have been corrected and supercede figures in previous reports.
 9/ Surveyed well before peak of migration.
 10/ Surveyed prior to peak spawning.
 11/ Unacceptable conditions.
 12/ Boat survey.

Appendix Table C9. Percent age and sex composition of chum salmon taken in the Kotzebue commercial fishery, 1962-1988.

Year	Sample Size	Percent		Percent Age Class			
		Males	Females	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	1865	37.3	62.7	8.8	72.3	18.5	0.5
1968	1989	48.2	51.8	21.2	58.0	19.8	0.9
1969	1125	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	1105	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	1167	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	1979	43.4	56.6	5.8	57.8	34.2	2.3
1984	2933	50.2	49.8	14.6	64.3	19.7	1.3
1985	3293	47.8	52.2	0.4	83.7	15.5	0.4
1986	3095	46.0	54.0	0.3	18.6	78.9	2.2
1987	1987	50.6	49.4	15.0	43.0	31.0	11.0
1988 1/	3324	48.0	52.0	7.6	72.1	18.3	1.9
Mean 2/	985	46.5	53.9	14.5	65.8	19.1	0.7

1/ Includes 0.1% age 7 fish (0.6).

2/ Historic mean for years 1962-1985.

Section 2: PACIFIC HERRING

**(Includes Norton Sound and
Port Clarence/Kotzebue Districts)**

SECTION 2 - PACIFIC HERRING

Introduction

Boundaries

The Norton Sound District consists of all waters of Alaska between the latitude of the westernmost tip of Cape Douglas and the latitude of Canal Point Light (Figures 10 and 11). The Port Clarence District consists of all waters of Alaska between the latitude of Cape Douglas and the latitude of Cape Prince of Wales. The Kotzebue District consists of all waters of Alaska between the latitude of Cape Prince of Wales and the latitude of Point Hope (Figure 10).

Spawning Areas and Timing

The arrival of herring on the spawning grounds is greatly influenced by climate and oceanic conditions, particularly the extent and distribution of the Bering Sea ice pack. Most herring spawning populations appear near the eastern Bering Sea coast immediately after ice breakup between mid-May and mid-June. Spawning progresses in a northerly direction and may continue into July or August along portions of the Seward Peninsula or within the Chukchi Sea.

The primary spawning areas within Norton Sound have been from Stuart Island to Tolstoi Point. When sea ice has remained in this area into June, spawning has been more extensive along Cape Denbigh and several locations along the northern shore of Norton Sound between Bald Head and Bluff. More northerly spawning areas have been more difficult to identify due to small herring stock sizes and limited investigations. Likely spawning areas include Imuruk Basin, Shishmaref, Deering-Kiwalik, and Hotham Inlet.

Norton Sound District

Fishing History

Pacific herring (Clupea harengus pallasii) have been utilized for subsistence purposes by coastal residents prior to the mid-1800's when their use was first documented by early explorers. The earliest American commercial effort on Bering Sea herring apparently took place in the early part of this century at Golovin Bay in Norton Sound (Appendix Table D1).

Food Herring

Early records indicate that about 3,200 short tons of "fall herring" were processed in Norton Sound from 1916 to 1941 (Appendix Table D1). This fishery was dependent on salt curing and declined because of poor marketing conditions arising from foreign competition. The Japanese began gillnetting in Norton Sound during 1968 with three vessels. Effort was concentrated about 12 miles offshore between St. Michael and Golovin. Approximately 40 Japanese vessels reported harvesting a record 1,400 short tons (st) of herring during 1969 (Appendix Table D2). An average annual harvest of approximately 440 st was reported in Norton Sound by the Japanese during 1968-1974. The Japanese gill net fishery was prohibited in 1977.

Sac Roe

Domestic commercial effort resumed in Norton Sound in 1964 near Unalakleet and continued on a sporadic basis until 1979. Between 1964 and 1978 the fishery averaged about 14 short tons of herring annually and targeted on "spring herring" for sac roe extraction (Appendix Table D1).

In 1979, a domestic herring fishery for sac roe began on a larger scale in Norton Sound when approximately 1,292 short tons (st) of herring were taken by 63 fishermen (13 purse seiners, 50 gillnetters). Purse seiners took 70% of the total catch.

After the 1979 season, the Alaska Board of Fisheries adopted a public proposal which made gill nets and beach seines the only legal commercial herring fishing gear within Norton Sound. A purse seine fishery could only be opened if the gill net fleet could not take the allowable harvest. This regulation was an attempt to encourage involvement of local fishermen in this developing fishery. During the 1980 season 294 gill net fishermen harvested 2,452 short tons of herring (Appendix Table D3). Because gill net fishermen demonstrated that they were capable of taking the available harvest a regulation was passed in 1981 which prohibited any purse seine gear within Norton Sound.

Commercial harvests from 1981-1984 averaged 4,137 st, and ranged from a low of 3,662 st in 1984 to 4,582 st in 1983 (Appendix Table D3). From 1985-1988, commercial herring harvests have averaged 4,374 st, ranging from a low of 3,548 st in 1985 to a high of 5,194 st in 1986.

Prior to the 1984 season, the harvest by beach seine fishermen was negligible. During 1984, ten beach seine fishermen harvested 327 st. During their 1984 fall meeting, the Board of

Fisheries set a beach seine gear limit of 100 fathoms and limited the harvest to "not exceed 10 percent of the total herring sac roe harvest projection as published by the department." During the fall 1987 Board of Fisheries meetings, beach seine gear was further restricted to a limit of 75 fathoms. Beach seine harvests in 1985, 1986, 1987 and 1988 were 169 st, 215 st, 314 st, and 191 st, respectively. Gill net harvests in 1984, 1985, 1986, 1987, and 1988 were 3,335 st, 3,379 st, 4,979 st, 3,465 st, and 4,064 st, respectively.

Spawn on Kelp

A small scale spawn-on-kelp (Fucus) fishery existed in Norton Sound from 1977 to 1984. Harvests during the 1977-1984 period ranged from less than one ton (1977) to approximately 46 st (1981). In addition, during the 1984 season, one ton of macrocystus kelp was imported into Norton Sound resulting in a harvest of approximately 3 st of product. In response to a public proposal, a Board of Fisheries action prior to the 1985 season resulted in the closure of all spawn-on-kelp fisheries in Norton Sound (Appendix Table D5).

Management Strategies

The overall statewide management strategy is to annually harvest 0-20% of the herring biomass. The upper end of the exploitation range is applied to stocks in good condition. The lower end of the exploitation range is applied to stocks that are exhibiting a trend of decreasing abundance and poor recruitment.

Herring are long lived fish and will usually remain harvestable for at least 5 years after recruiting into the fishery. Harvesting only a percentage of the biomass ensures that some fish will be held over for following years. This type of strategy helps mitigate population fluctuations caused by successive years of poor recruitment, a common occurrence in marine spawning fish. Prior to 1983, harvests in Norton Sound were regulated on a subdistrict basis so harvests would be dispersed over the entire fishing grounds. This was to prevent harvest efforts from concentrating in one area on what was then thought to be a distinct stock of fish.

Commercial Fishery

Sac Roe Fishery Summary 1988

The 1988 Norton Sound herring fishery opened by emergency order on May 27. A total of five gill net openings for 44 hours of fishing and six beach seine openings for 25 hours of fishing occurred this season. The entire district closed by

emergency order on May 31. The total harvest based on fish ticket analysis was 4,672.1 short tons (st) of herring (Table 13). Since 1980, catches have averaged 3,978 st (Appendix Table D3).

There were 348 fishermen who made at least one delivery during the season. This is the second highest effort on record since a large scale domestic fishery began in 1980. Fishing effort during the period from 1980 to 1986 averaged 276 fishermen, with a range of 194 (in 1984) to 332 (in 1981) (Appendix Table D3). Effort levels in 1987 escalated to a record high of 564 fishermen. The total number of fishing vessels which participated was impossible to estimate because of changing effort distribution as the season progressed. A survey flown during the May 28 gill net opening spotted approximately 200 fishing vessels. The fishing effort in 1988 was lower than in 1987 due to: 1) a moratorium on new effort in effect for this season, which allowed only fishermen who had participated prior to January 1, 1987 to fish in 1988; 2) the bulk of the tendering and non-local fleet was not present on the grounds when the fishery was opened.

In 1988, fishermen residing in the Norton Sound area accounted for 48% of the effort and 35% of the harvest; non-local Alaskan resident fishermen accounted for 33% of the effort and 37% of the harvest; non-Alaskan fishermen comprised 19% of the effort and took 28% of the harvest.

During the 1988 season, 343 gill net fishermen landed a total of 4,473.7 st; 6 beach seine fishermen landed 198.4 st of herring (Table 14). The beach seine openings were conducted during separate times from the gill net openings to prevent gear conflicts. Beach seines have been legal gear since initiation of the fishery though not widely used until the 1984 season. The preseason harvest guideline for this gear type in 1988 was 474 st. The 1988 beach seine harvest of 198.4 st represented 41% of the allowable harvest by this gear type.

There were 11 companies present on the grounds during the season to purchase herring. These companies registered 12 processors and 53 tenders to operate in Norton Sound; a total of 12 processors and 49 tenders were reported by company representatives to have arrived on the grounds prior to the fishery closure on May 31 (Appendix G4).

The average sac roe recovery was 9.0%. Based on final operations reports, the average grounds price paid for a short ton of 10% roe herring was \$1,000.00. The average price paid to fishermen for a short ton of 9.0% fish was approximately \$900.00. Of the 4,672.1 st harvested, 416.2 st were purchased as bait herring (roe % less than 6.0%) for which the fishermen received an average of \$93.00 per ton. The total value of the

herring harvest to the fishermen was approximately \$3,864,000.00. This is the highest dollar value in the history of this fishery (Appendix Table D3). The average fisherman earned \$11,072.00

The estimated inseason district biomass was 33,924 st. This peak biomass was observed on a single survey day (May 25), and was the highest peak and single survey biomass documented in the history of the Norton Sound herring fishery. An exploitation rate of 20% could have allowed a commercial harvest of 6,785 st (6,311 st by gill net, 474 st by beach seine). However, due to the timing of the arrival of the peak biomass and the lack of processing and tendering capacity present on the grounds, it was not possible to fully harvest the available surplus. The commercial harvest of 4,672.1 st represented an exploitation of 13.8%.

Sac Roe Fishery Management

The 1988 Norton Sound herring management plan stated that the Department would attempt to manage the fishery for an above average roe recovery (greater than or equal to 8.5%). State of Alaska statutes direct that the resource should be managed so as to maximize the return to the state and the industry.

A new regulation in effect for the 1988 season allowed for an emergency order opening of the fishery rather than a regulatory opening date.

The Norton Sound herring management plan stated that a projected biomass of 23,700 st was expected to return during the 1988 season. This projected return was based upon the 1987 postseason escapement estimates using mean rates of natural mortality and growth and expected age class composition of the return. If aerial survey observations and age class composition data indicated a return of 23,700 st, then 20% or 4,740 st (4,266 st by gill net, 474 st by beach seine) could be harvested.

Aerial survey conditions prior to the season were predominantly good. Waters were clear in ice free areas. Shore ice was not as extensive as in recent years and began dispersing very rapidly due to warm water and air temperatures as the season approached. No herring were spotted on the season's first survey on May 16. A survey flown on the evening of May 18 in the Unalakleet and Cape Denbigh subdistricts spotted a total of 51.6 st, mostly near the Beeson Slough area, where early fish have historically been spotted. A district-wide survey flown on May 20 under poor conditions saw no herring (Table 15). This survey, however, documented rapid movement of ice away from shore, with Norton Bay nearly ice free.

On May 23, three surveys were flown. The first survey flown from Unalakleet to Stuart Island documented a small spawn near St. Michael village, and spotted a total of 357.5 st; the second surveyed from Unalakleet to Nome, and spotted approximately 2,789.6 st. This survey also documented several small spawns in the Nome, Golovin, and Elim subdistricts. The third survey on May 23 again covered the southern shores of the St. Michael subdistrict, where a dozen small spawns and 1,627.1 st were documented. Conditions throughout this survey day were predominantly poor due to wind and turbid water conditions, with the exception of excellent viewing conditions near Nome. Broken, loose ice and ice fog was also present from just north of Tolstoi Point to Stuart Island. However, the third survey of the day, which concentrated on the southern shores, documented a rapid building of the biomass in this area; fish were seen near or in among ice floes, with spawning already beginning to occur. Because of the large amount of loose ice present, it was likely that the total biomass near the southern shores were not being observed. At this time, no processing nor tendering fleet was present in Norton Sound.

On May 24, a survey was flown from Unalakleet to Cape Darby. Conditions were fair to good, with the exception of the Unalakleet subdistrict which was unacceptable due to muddy water and ice conditions. The St. Michael subdistrict was unsurveyable due to ice and fog conditions. Approximately 5,884.5 st were documented, with 3,024 st in the Elim, and 2,445 st in the Cape Denbigh subdistricts, respectively. Small spawns were observed at Cape Denbigh and near Baldhead; extensive spawning (3.8 linear miles) was documented along the coastline between Elim and Cape Darby (Table 16).

On May 25, a survey of the entire district flown under good to fair conditions documented the peak inseason biomass of 33,924 st. Spawning was observed in the St. Michael, Cape Denbigh, and Elim subdistricts. A total of 10.6 linear miles of spawn was documented. As yet, no commercial fleet had arrived on the grounds.

Department crews began test fishing at Cape Denbigh and Unalakleet on May 21. The first test fish captures occurred at Cape Denbigh on May 22. Also on May 22, local fishermen from Elim reported spawning activity near the village. On May 23, a subsistence catch sample obtained from Elim showed a high percent of male herring, with all female herring ripe or near ripe. Increasing test fish catches at Cape Denbigh on May 23 also indicated a high male content, but predominantly ripe female herring. All samples had a predominance of large, old age class herring.

As early as the peak survey day, May 25, the age class began to shift, with more younger herring beginning to appear in

variable mesh gill net catches. Samples obtained in St. Michael Bay with commercial gill net gear on May 25 were found to be large, old age class, ripe herring. With no commercial fleet present to buy herring and with spawning progressing rapidly, it became apparent that the commercial fleet was going to miss the peak spawning biomass. Also on May 25, a Department test fish crew was deployed from Unalakleet to the Elim area to obtain samples of the spawning biomass present there.

On the evening of May 25, company representatives began to arrive in Unalakleet. One company stated that the earliest they would have any buying fleet on the grounds would be late May 25 or early May 26.

On May 26, with many more industry representatives now present and a few vessels also present, a beach party was organized in Unalakleet. Samples were obtained from eight separate locations, from St. Michael Bay to west Cape Denbigh. Roe percents ranged from 4.85% to 9.15%; low roe recoveries were due to partially spawned egg sacs, spawn-outs, and high male proportions in the samples. Very few (5 fish) immature were found. Industry roe technicians from 2 companies provided sample analysis. A large crowd of fishermen and locals turned out to view the beach party samples. Local fishermen from Unalakleet and St. Michael provided valuable assistance by obtaining samples from Black Point, Tolstoi Point, and St. Michael Bay. Samples from the west side of Cape Denbigh to Shaktoolik were obtained by a Department test fish crew.

Immediately following the beach party, the Department management staff met with representatives from five companies present in Unalakleet. At this time just four companies had any tendering or processing capacity on the grounds; a capacity of just 1,930 st was determined to be present at the time of this meeting. One company with 1,000+ st capacity wanted the Department to open immediately; the rest wanted the Department to delay opening the fishery. With more holding/processing capacity expected to arrive during the evening of May 26, and with continued spawning and loss of marketable herring biomass, an opening was announced for May 27, from 8:00 a.m. to 10:00 a.m., for the gill net fleet. With an allowable harvest of 6,785 st (6,311 st by gill net, 474 st by beach seine), it was imperative the fleet be carefully monitored in terms of hold/processing capacity so as not to create a wastage problem.

Throughout the next few days (May 27-May 31), fishing periods were scheduled in rapid succession, alternating gear types, with period lengths based on current available hold capacity of the commercial fleet. The buying fleet continued to arrive on the Norton Sound herring grounds. Department staff closely monitored fleet arrival and movement throughout the season.

Commercial gill net fishing periods were scheduled with the incoming tides when possible to minimize catches of spawned out herring. Beach seine periods were scheduled between gill net periods as soon as clean-up catch reports and tendering capability were available. A total of 5 gill net openings occurred between May 27 and May 30 for a total of 44 hours of gill net fishing; a total of 6 beach seine openings occurred from May 27 to May 31 for a total of 25 hours of fishing.

The total harvest by gill nets based on inseason processor verbal reports was 4,465 st with 8.6% overall recovery. The total harvest by beach seiners based on inseason processor verbal reports was 259 st with 10.2% overall roe recovery. Thus, the total reported harvest inseason was 4,724 st at 8.7% roe recovery. With the exception of a few "hot spots" of fishing, this year's commercial fishery was scratch fishing, at best, due to the late arrival of the large vessel fleet. This is the first time in the history of the Norton Sound sac roe herring fishery this situation has occurred. Although the reported harvest inseason filled the preseason guideline harvest of 4,740 st, over 2,000 st were left on the table. The fishery was closed following the last beach seine opening on May 31 to prevent the harvest of unmarketable or low value herring. The inseason reported harvest represented an exploitation of just 13.9% of the peak inseason biomass.

Weather conditions slowed the pace of the fishery at times, most notably during the May 29-31 openings. Also, as the season progressed, fishing effort declined due to decreasing catch rates and rough sea conditions.

Although ice was present prior to and during the fishery, winds and current kept the ice off the beach during the bulk of the fishery. Loose ice was blown back into the beach in subdistrict 1, from Shorty Cove to St. Michael Island on May 30, but did not interfere with commercial fishing efforts at this late date. Warm waters contributed to rapid melting of the ice.

The Department test fish crew near Elim experienced rough sea conditions during much of their operations there. Even with strong winds and swell action, the coastline waters between Elim and Cape Darby remained relatively clear. Herring were difficult to capture in these deep, clear waters.

One tender and a few fishing skiffs arrived near Elim during the May 30 gill net opening. However, slow catch rates caused them to leave after a few hours of fishing. The Department crew at Elim provided valuable monitoring and sampling coverage of this area.

Herring Abundance

Aerial surveys were flown throughout the herring spawning season to determine relative abundance, distribution, and biomass of herring. Occurrence and extent of milt, numbers of fishing vessels, and visibility factors affecting survey quality were also recorded. Data collection methods were similar to methods that have been used since 1978.

Surface area of herring schools were estimated and then multiplied by a tonnage conversion factor to obtain a biomass estimate. The Relative Abundance Index (RAI) is the standardized unit of surface area measurement and is based on 50m². Tonnage conversion factors of 2.83 st/RAI, 2.58 st/RAI, and 1.52 st/RAI were used depending on the water depth in which herring schools were sighted. Herring schools in shallow water which were in spawn-out configurations were assigned the lowest conversion factor. These surface area biomass conversion factors were derived from research conducted in the Togiak District where purse seiners made sets on herring schools of known surface area and volume.

During the 1988 Norton Sound herring season, 15 aerial surveys totaling 49.8 hours of flight time were flown from May 16-June 1 (Table 15). The peak inseason biomass of 33,924 st was documented on May 25 under fair to excellent conditions. This is the largest herring biomass ever observed in the Norton Sound district. Following the peak survey day on May 25, conditions for aerial survey of biomass became poor to unacceptable due to wind and swell action creating water turbidity, as well as the presence of turbidity from several consecutive days of spawning activity. In addition, loose ice from the break up of Pastol Bay (south of Stuart Island), drifted into the inner sound and was blown against the southern shores. This loose ice traveled north and gradually reached Blueberry Point, just north of Unalakleet.

Spawning activity was observed from May 23 - June 1, with peak spawning occurring from May 25 - 27. Spawning activity began first in the Elim subdistrict (May 23), and eventually reached the south side of Stuart Island (May 29 and June 1). Areas of continuous spawn on May 26 contributed to poor survey conditions overall following the May 25 peak survey. A total of approximately 50.2 linear miles of milt was observed in 108 sightings (Table 16). Spawning occurred primarily in the St. Michael (s.d. 1) subdistrict (Figure 11).

Spawn and substrate evaluations were conducted June 4 and 5 in the St. Michael subdistrict. Wind and large swells hampered surveys of St. Michael Bay, and most of the coastline from the bay to Klikitarik. From Klikitarik to Black Point, sea conditions were improved but daylight had diminished; only sheltered areas and areas where spawn deposition commonly

occurs were surveyed. All spawn observed was deposited on Fucus (kelp) or on rocks adjacent to Fucus plants. The most extensive areas of spawn deposition were found in St. Michael Bay and Leibes Cove (Figure 11), where the average number of egg layers ranged between 4 and 8. Other sites surveyed typically had lower overall number of egg layers as well as percentage of coverage. No eyed eggs were found, and mortality was estimated at less than 10%. It was noted that algae and grit was present within egg layers at most sites surveyed.

The Fucus plants observed in subdistrict 1 appeared to be in generally good condition, with rich, green color and buds beginning to form. However, dense kelp beds seemed fewer in number than in previous years. Some kelp beds, which in the past have been very dense, appeared to be sparse; it is possible plants were harvested by roe-on-kelp pickers, or broken away by rough sea conditions. Ice scouring was apparent in some areas examined.

Spawn deposition surveys were also conducted in the Cape Denbigh subdistrict. The first survey examined the coastline from the Department's camp near the tip of the cape, north to the mud flats near the Sineak River mouth (north of Shaktoolik River). Overall spawn coverage appeared to be less than normal in this area. The density of Fucus plants appeared reduced compared to previous years. Egg coverage on bare rock was extensive in the areas surveyed; common egg layer coverage was 2 to 4 layers, with as many as 8 layers in a few places. Near the tip of Cape Denbigh, spawn was found deposited subtidally to a depth of 5 feet or more. Estimated mortality at the time of survey was approximately 50%. However, many of the eggs on rocks had been broken away. Although sloughed eggs, when examined, appeared to be in good shape, the survival rate of free floating eggs is unknown.

The west side of Cape Denbigh, from the tip of the cape to Point Dexter, was surveyed for spawn deposition on June 3. Very little Fucus substrate was found at Point Dexter, and no eggs were present. Other known spawning areas (milt sighted earlier in the season) were spot-checked and essentially no eggs were found. Local subsistence roe-on-kelp pickers reported having to search more during 1988 than in recent past seasons, although some "good spawn" was found at the point just north of the Department camp, and near the southern cape. Locals reported roe-on-kelp harvesting began on May 26.

Other Research

Two Department herring field crews were operational during the 1988 season. One crew operated from Cape Denbigh. The second

crew was a "mobile" crew, operating from Unalakleet, Portage (near Elim), and finally St. Michael Bay, as changing ice conditions and test fishery needs arose (Figure 11). A test fish camp was not established at the traditional Klikitarik site due to ice conditions. These crews operated variable mesh test fish gill nets, sampled commercial and variable mesh catches, assisted with fishery monitoring and information dispersal, assessed spawn deposition, patrolled the closures, and were ADF&G observers aboard volunteer commercial test fishing ventures prior to the commercial fishing season. Their assistance in monitoring biomass distribution, fish ripeness, and age and sex composition of biomass present prior to and during the commercial fishery openings was essential to the proper management of the fishery. Separate summaries have been written for these projects.

Unalakleet field office personnel during the season consisted of the area management biologist, the assistant area biologist, a seasonal fisheries biologist (scale reader, public information receptionist, camp logistic support), and a data entry clerk (fishery monitor/public information receptionist).

Field personnel consisted of two seasonal fisheries biologists and two fisheries technicians. Additional support staff from the regional office in Anchorage consisted of the regional management biologist, and the regional research supervisor. These personnel provided valuable assistance with inseason age cohort analysis, on-site fishery observations, beach party coordination, drafting of emergency orders, input into management decisions, and biological sampling. Their willingness to participate in all phases of the program was vital to proper monitoring and management of the fishery. Additional support was provided by the statewide herring biometrician.

Test fishing with variable mesh gill nets was conducted from May 18 - June 2. A total of 683 Pacific herring was sampled from these catches. Overall age class composition of these catches (percent by number) was <1%, <1%, 3%, 22%, 18%, 11%, and 45% age 3, 4, 5, 6, 7, 8, and 9+ herring, respectively (Figures 13 and 14). Overall, male herring comprised 56% of the sample of 683 herring which were taken from catches during the entire period of test fishing.

The commercial fishery targeted on the older age class herring through the use of larger mesh gill nets (Figure 11). A total of 388 and 178 Pacific herring was sampled from gill net and beach seine catches, respectively. The age composition (percent by number) of the commercial gill net catches was 0%, <1%, 8%, 29%, 17%, and 45% age 4, 5, 6, 7, 8, and 9+ herring, respectively. The age composition (percent by number) of the

commercial beach seine catches was 0%, 6%, 26%, 33%, 15%, and 20% age 4, 5, 6, 7, 8, and 9+ herring, respectively (Figure 14).

Catch Reporting and Enforcement

Buyers registered for the 1988 season were required to report herring purchases twice daily (8:30 a.m. and p.m.) and immediately following beach seine openings at times announced inseason during fleet broadcasts. Due to the rapid scheduling of successive openings which alternated gear types, clean-up catch reports were requested as soon as catch figures became available. Compliance with catch reports were generally very good. The single side band and VHF radios worked very well for receiving verbal harvest data, and for communicating fishery information and opening announcements to the buying fleet.

Protection efforts in Norton Sound consisted of two single engine aircraft (Supercub and C180), a helicopter, and two Boston Whalers. Personnel consisted of five permanent, full-time Fish and Wildlife Protection officers, and one seasonal Fish and Wildlife Protection Aide.

Fish and Wildlife Protection officers patrolled the fishing grounds during each opening and closure. A total of 36 citations were issued for fishing closed periods; 2 citations were issued for incorrect or lack of ADF&G number; 1 citation for fishing without a license; and 1 citation for no ADF&G number plate. In addition, one fishing vessel was seized for fishing excess gear. Three cases were made for violation of the superexclusive use area designation, with more likely to follow pending further investigation of postseason fish ticket information. A total of 11.1 st of herring were confiscated by the State of Alaska during the 1988 season. Additional forfeitures are possible pending upcoming court case decisions.

Outlook for 1989

The herring biomass has been fairly stable in Norton Sound since 1981, averaging about 24,900 st. During 1988, the peak biomass was estimated to be 33,924 st. Projections from 1988 postseason escapement estimates using a schedule of increasing natural mortality with age indicate a returning biomass in 1989 of approximately 21,250 st. Since methods to reliably estimate recruitment have not been developed, returns of ages 3 through 5-year-old herring could increase the 1989 observed biomass over the projected biomass estimates. The 1989 spawning population is expected to be dominated by age 10, 7, and 8 year old herring (Figure 14).

Department personnel will be conducting aerial surveys and sampling age class compositions inseason to obtain current year biomass information. Since methods to reliably forecast herring returns are still being developed, and estimates of recruitment are not available, inseason assessment of biomass will supercede projected biomass for management of the Norton Sound herring fishery. Exceptions are where weather prevents obtaining an inseason estimate, and in the beach seine fishery which is set by regulation at 10% of the projected biomass. Harvest should approach 4,250 st (3,825 st by gill nets, 425 st by beach seines). The Norton Sound District herring biomass will be harvested at a 20% exploitation rate if inseason aerial biomass surveys and age class composition information indicate the run will achieve at least the preseason projected level (21,250 st). If the run does not materialize as projected, the harvest exploitation rate may be reduced from the maximum level.

The fishery will be opened by emergency order. Fishing periods will initially be established to occur simultaneously between subdistricts. However, subdistricts may be closed independently of each other to prevent overharvest if herring biomass distribution and harvest rates make such action necessary. Beach seine fishing periods may be reduced in length, and may be established separately from gill net fishing periods to provide the Department the opportunity to closely monitor the harvest rate and gain accurate catch reports. This management technique may additionally increase the duration of the beach seine fishery so it occurs over approximately the same length of time as the gill net fishery.

Table 13. Herring harvest and effort by date and subdistrict, Norton Sound District, all gear types combined, 1988.

Date	Subdistrict 1 Canal Point-Spruce Creek			Subdistrict 2 Spruce Creek-Junction Creek			Subdistrict 3 Junction Creek-Island Point			Subdistrict 5 Kwiniuk River - Cape Darby			District Totals		
	Number Fishermen	Daily Catch(st)	1/ Daily Roe %	Number Fishermen	Daily Catch(st)	1/ Daily Roe %	Number Fishermen	Daily Catch(st)	1/ Daily Roe %	Number Fishermen	Daily Catch(st)	1/ Daily Roe %	Number Fishermen	Daily Catch(st)	1/ Daily Roe %
5/27	167	548.5	8.7	3	57.6	9.2	82	571.2	8.3	0	-	-	250	1,177.2	8.6
5/28	199	1,071.0	9.3	0	-	-	80	557.9	9.4	0	-	-	279	1,628.9	9.3
5/29	121	404.5	8.6	6	20.7	11.0	33	100.7	8.7	0	-	-	157	525.9	8.8
5/30	177	737.1	9.5	18	21.0	10.0	37	77.0	8.0	5	6.4	7.7	229	841.5	9.4
5/31	111	498.5	8.7	0	-	-	0	-	-	0	-	-	111	498.5	8.7
Totals	270	3,259.5	2/ 9.1	25	3/ 99.3	9.7	116	4/ 1,306.9	8.8	5	5/ 6.4	7.7	6/ 348	7/ 4,672.1	8/ 9.0

1/ Daily roe % does not include bait roe %.

2/ Includes a harvest of 247.5 st of bait herring (roe % = 4.5).

3/ Includes a harvest of 12.2 st of bait herring (roe % = 3.3).

4/ Includes a harvest of 153.9 st of bait herring (roe % = 4.5).

5/ Includes a harvest of 2.6 st of bait herring (roe % = 5.2).

6/ Actual number of participating fishermen; one fisherman made gill net and beach seine deliveries.

7/ Includes a harvest of 416.2 st of bait herring (roe % = 4.5).

8/ A total of 11.1 st of herring was confiscated by Alaska Department of Public Safety.

Table 14. Norton Sound herring harvest by subdistrict by gear type, 1988.

Stat Area	Location	Gill Net				Beach Seine				Totals			
		Sac Roe (s.t.)	Avg. Roe %	Bait (s.t.)	# fm	Sac Roe (s.t.)	Avg. Roe %	Bait (s.t.)	# fm	Sac Roe (s.t.)	Avg. Roe %	Bait (s.t.)	# fm
333-70	Canal Point- Spruce Creek	2974.2	9.1	240.5	268	37.8	8.6	7.0	1	3012.0	9.1	247.5	270
333-72	Spruce Creek- Junction Creek	29.6	10.7	12.2	22	57.6	9.2	0	3	87.1	9.7	12.2	25
333-74	Junction Creek- Island Point	1057.0	8.8	153.9	111	96.0	9.6	0	5	1153.0	8.8	153.9	116
333-77	Kwiniuk River- Cape Darby	3.8	7.7	2.6	5	-	-	-	0	3.8	7.7	2.6	5
Totals		4064.5 ^{1/}	9.0	409.2 ^{2/}	343	191.4	9.3	7.0	6	4255.9 ^{1/}	9.0	416.2 ^{2/}	348 ^{3/}

1/ Includes 9.8 st of sac roe herring confiscated by the Alaska Department of Public Safety.

2/ Includes 1.3 st of bait herring confiscated by the Alaska Department of Public Safety.

3/ Number of individual participants (one fisherman delivered gill net and beach seine herring).

Table 15. Daily observed peak biomass estimates of Pacific herring, Norton Sound District, 1988. 1/

Date	Flight No.	Observer Initials	Survey		Spawn		Estimated Biomass (st) By Index Area 3/								
			Hours	Rating 2/	No.	Length (mi)	KLK	UNK	CDB	NTB	EIM	GOL	NCM	TOTAL	
5/16	1	CL/SM	3.9	2	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5/18	2	SM	0.9	2	0	0.0	0.0	2.6	49.0	0.0	0.0	0.0	0.0	0.0	51.6
5/20	3	CL/SM	5.1	2	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5/23	4	SM	2.0	4	1	0.2	357.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	357.5
5/23	5	CL	3.0	4	8	0.5	0.0	0.0	1505.0	0.0	135.8	76.3	1072.5	2789.6	
5/23	6	CL/SM	1.6	4	12	0.5	1627.1	0.0	0.0	0.0	0.0	0.0	0.0	1627.1	
5/24	7	CL/SM	2.6	3	7	4.0	0.0	0.0	2445.6	415.0	3024.0	0.0	0.0	5884.6	
5/25	8	CL/SM	6.0	3	58	10.6	7508.5	3123.1	15555.2	1117.0	5154.1	878.2	587.9	33924.0 1/	
5/26	9	CL	4.5	4	18	22.0	3681.3	901.3	4168.4	792.9	3110.0	205.8	571.2	13430.9	
5/27	10 4/	RC	2.7	5	2	12.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
5/28	11	CL	3.4	4	0	0.0	0.0	0.0	0.0	0.0	2198.6	0.0	0.0	2198.6	
5/29	12	CL	3.5	4	1	0.2	0.0	0.0	425.1	224.5	478.8	69.7	214.3	1412.4	
5/29	13	SM	1.7	4	0	0.0	677.3	350.8	0.0	0.0	0.0	0.0	0.0	1028.1	
5/30	14	SM	4.2	4	0	0.0	736.0	1686.7	1338.4	209.2	980.0	0.0	0.0	4950.3	
6/01	15	SM	4.7	4	1	0.2	456.8	0.0	1075.4	663.4	772.5	1885.1	41.0	4894.2	
			49.8		108	50.2									33924.0 1/

1/ Norton Sound district peak biomass.

2/ Rating 1=excellent 2=good 3=fair 4=poor 5=unacceptable

3/ KLK = s.d.1 NTB = s.d.4 NCM = s.d.7
 UNK = s.d.2 EIM = s.d.5
 CDB = s.d.3 GOL = s.d.6

4/ Spawn survey.

Table 16. Norton Sound herring spawn estimates by subdistrict (s.d.), 1988.

Date	s.d. 1		s.d. 2		s.d. 3		s.d. 4		s.d. 5		s.d. 6		s.d. 7		Total	
	#	miles	#	miles												
5/16	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
5/18	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
5/20	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
5/23	1	0.2	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	0.2
5/23	0	0.0	0	0.0	0	0.0	0	0.0	2	0.2	2	0.1	4	0.2	8	0.5
5/23	12	0.5	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	12	0.5
5/24	0	0.0	0	0.0	3	0.1	1	0.1	3	3.8	0	0.0	0	0.0	7	4.0
5/25	44	7.3	0	0.0	5	1.1	0	0.0	6	2.1	0	0.0	3	0.1	58	10.6
5/26	12	19.9	0	0.0	3	2.0	0	0.0	0	0.0	0	0.0	3	0.1	18	22.0
5/27	1	6.0	0	0.0	1	6.0	0	0.0	0	0.0	0	0.0	0	0.0	2	12.0
5/28	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
5/29	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	0.2	1	0.2
5/29	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
5/30	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
6/01	1	0.2	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Totals	71	34.1	0	0.0	12	10.1	1	0.1	11	6.1	2	0.1	11	0.6	108	50.2

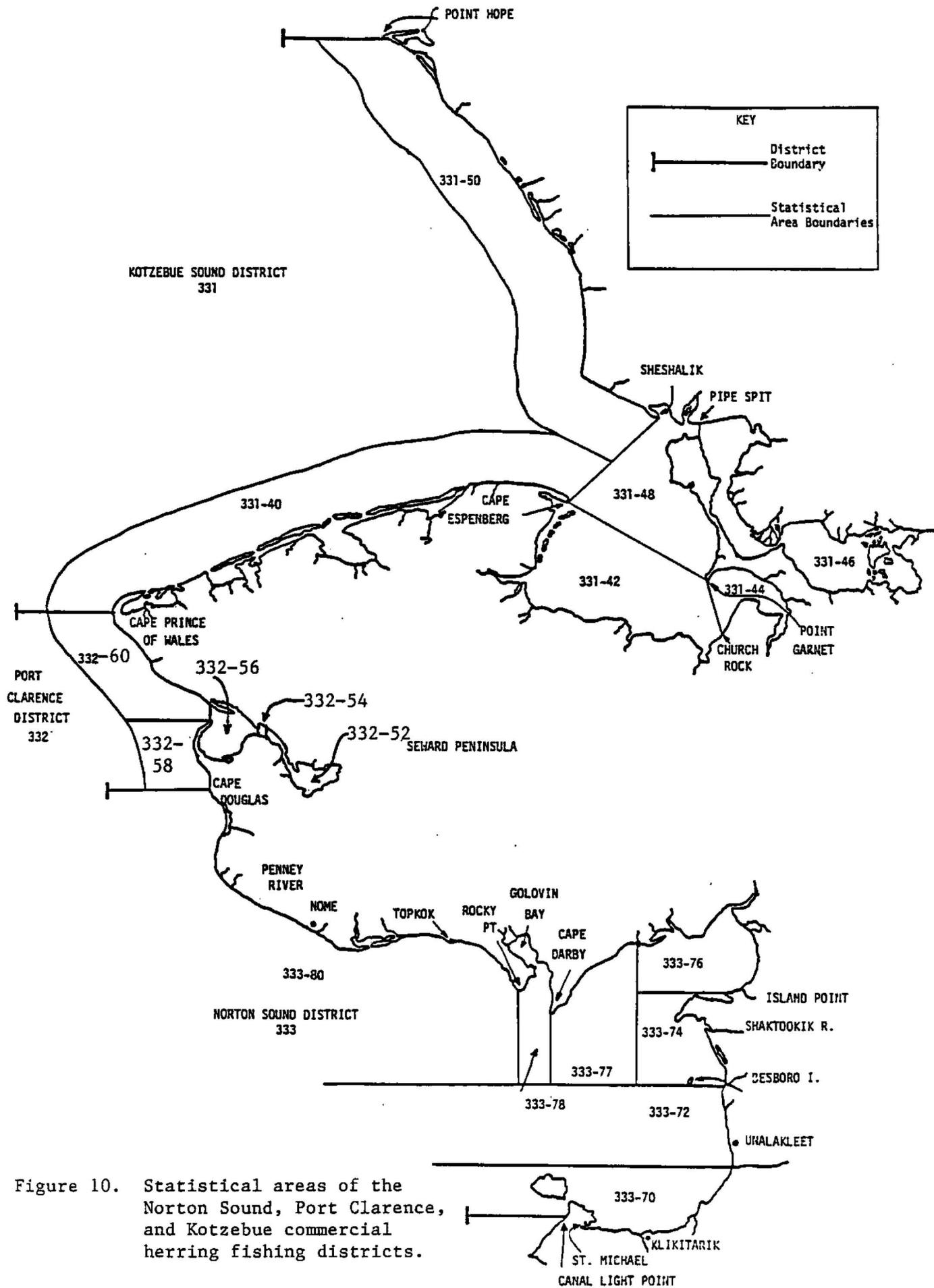


Figure 10. Statistical areas of the Norton Sound, Port Clarence, and Kotzebue commercial herring fishing districts.

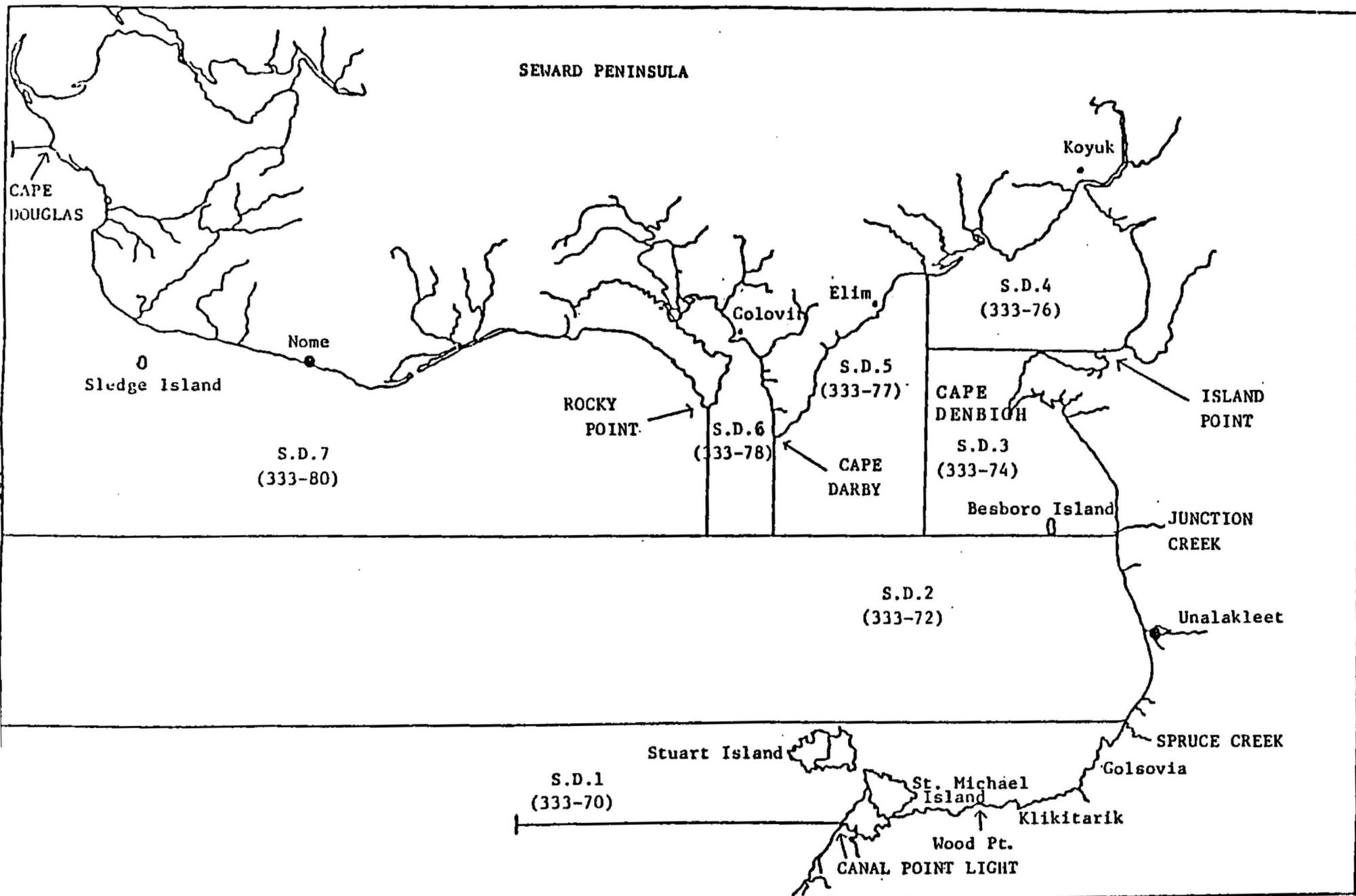


Figure 11. Norton Sound commercial herring district (333) and statistical boundaries.

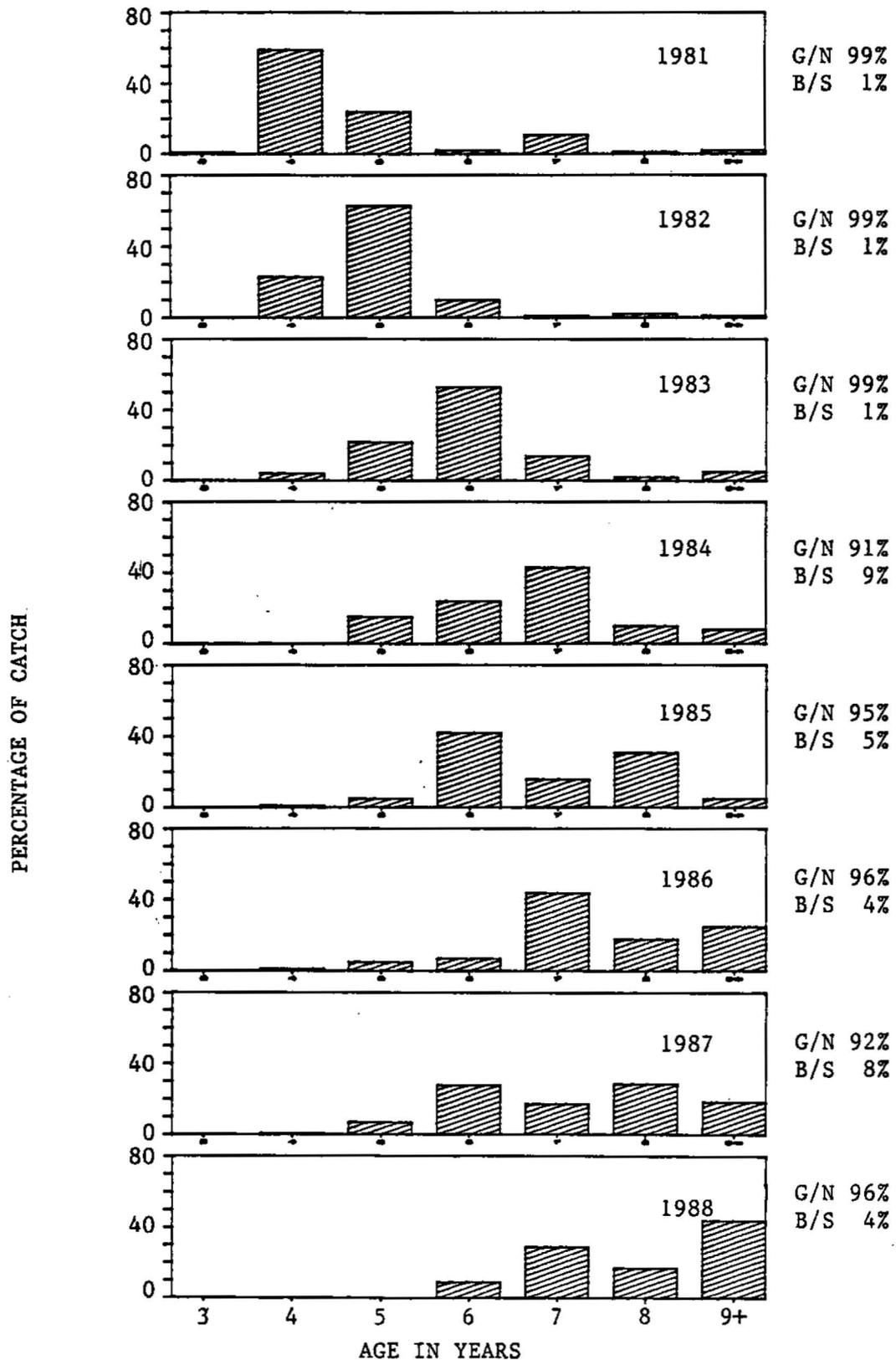


Figure 12. Herring age class composition of the commercial catch as depicted by percentage of total catch, Norton Sound District, 1981-1988.

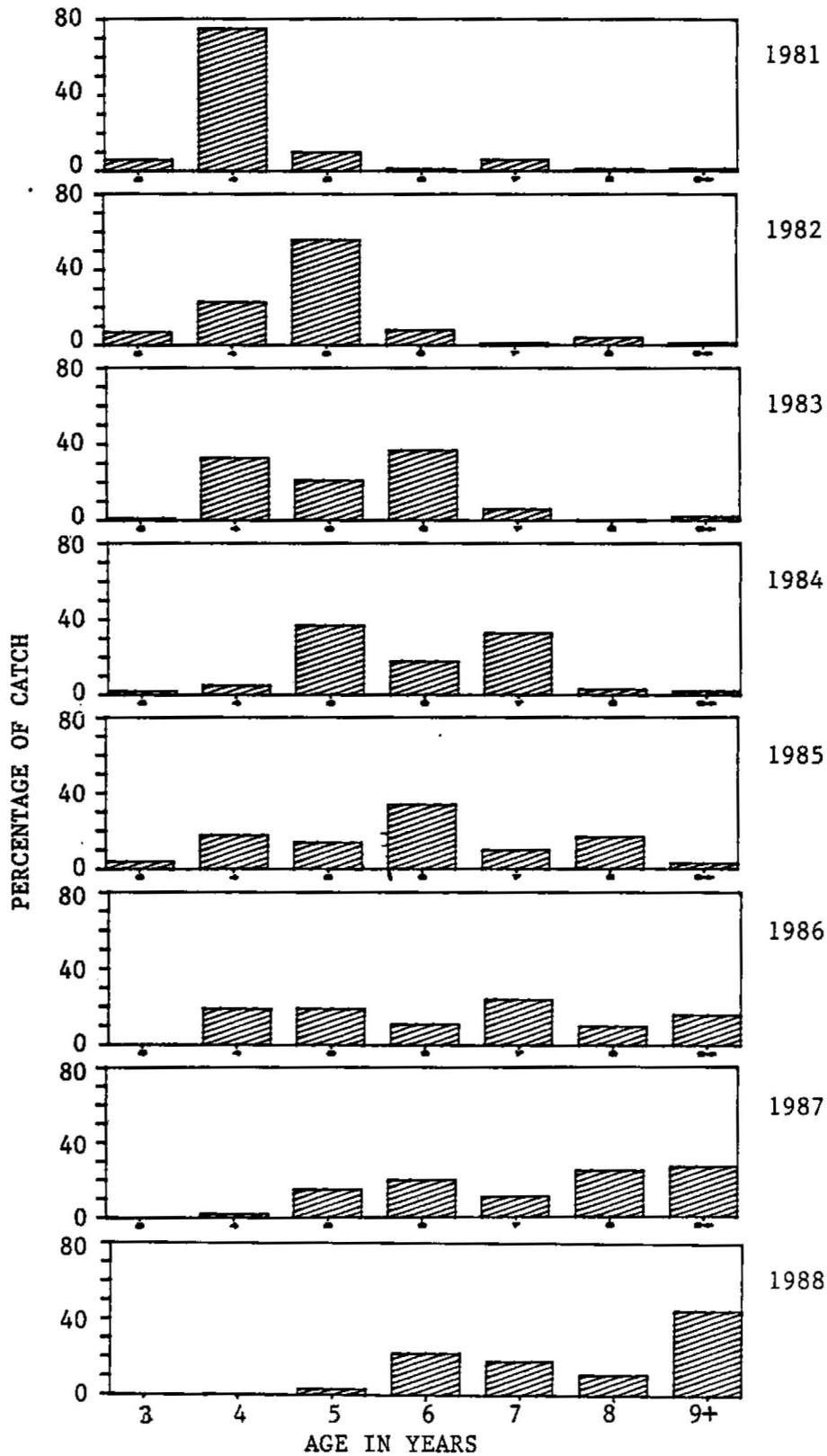


Figure 13 . Herring age class composition as depicted by percentage of total catch, variable mesh gill nets, Norton Sound District, 1981-1988 (% by number).

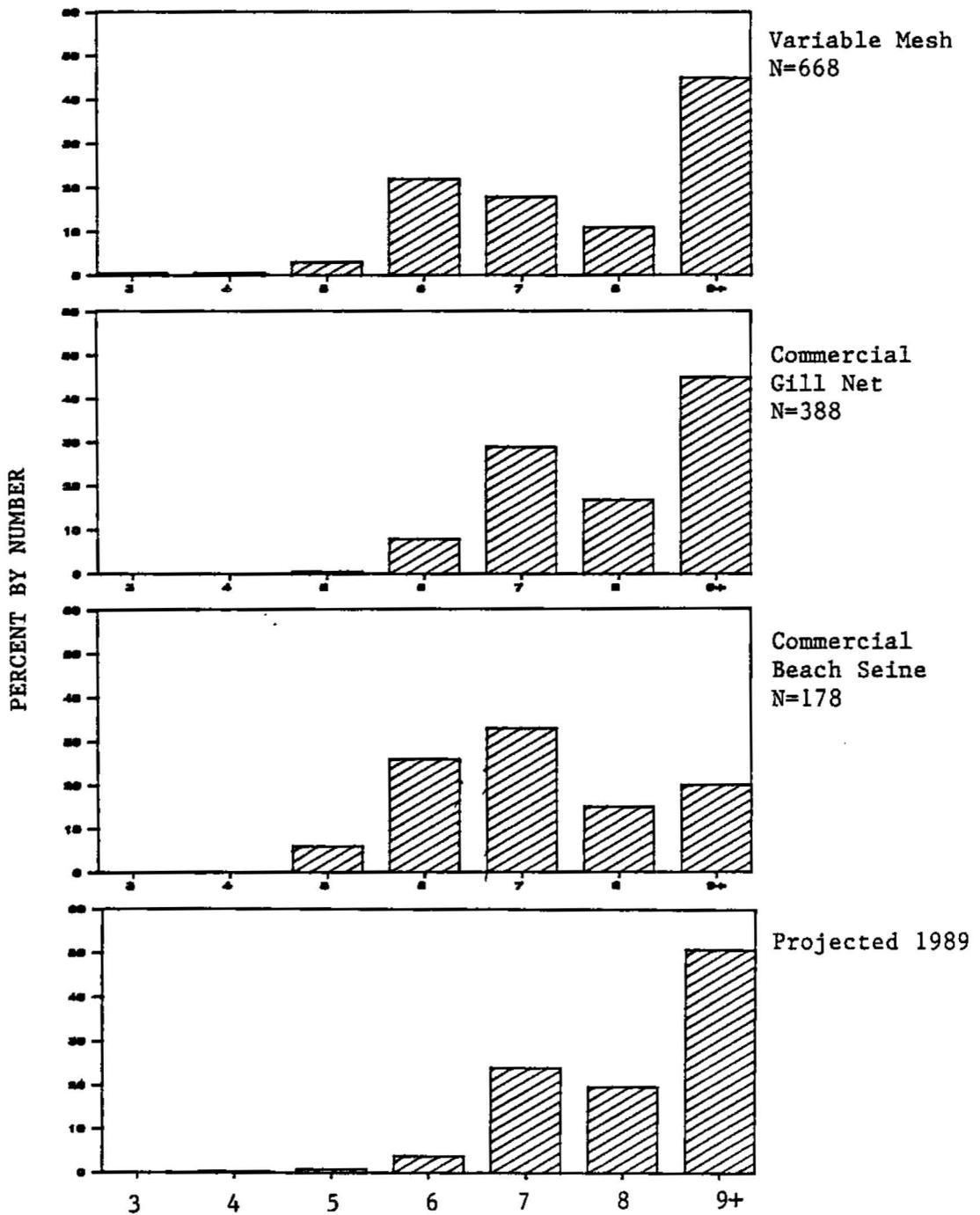


Figure 14. A comparison of Pacific herring age composition data by gear type of capture, 1988, and the projected age composition of the 1989 return, Norton Sound District.

Appendix Table D1. Norton Sound herring and spawn-on-kelp harvests (in st) by U.S. commercial fishermen, 1909-1988.

Year	Sac Roe Herring	Food or Bait Herring	Total	Spawn-on-kelp
1909-1916		1/	1/	-
1916-1928	-	1881	1881	-
1929	-	166	166	-
1930	-	441	441	-
1931	-	86	86	-
1932	-	529	529	-
1933	-	31	31	-
1934	-	4	4	-
1935	-	15	15	-
1936	-	-	-	-
1937	-	6	6	-
1938	-	10	10	-
1939	-	6	6	-
1940	-	14	14	-
1941	-	3	3	-
1942-1963	-	-	-	-
1964	20	-	20	-
1965	-	-	-	-
1966	12	-	12	-
1967	-	-	-	-
1968	-	-	-	-
1969	2	-	2	-
1970	8	-	8	-
1971	20	-	20	-
1972	17	-	17	-
1973	35	-	35	-
1974	2	-	2	-
1975	-	-	-	-
1976	9	-	9	-
1977	11	-	11	t race
1978	15	-	15	4
1979	1292	-	1292	13
1980	2451	1	2452	24
1981	4371	-	4371	47 2/
1982	3864	69	3933	38
1983	4181	401	4582	29 3/
1984	3298	274	3662	19 4/
1985	3420	128	3548	- 5/
1986	4926	268	5194	-
1987	3779	303	4082	-
1988	4256	416	4672	-

- 1/ Fishery occurred some years, but harvest unavailable. Fishery from 1909-1941 occurred near Golovin; 1964 to present has occurred in southeast Norton Sound.
- 2/ Does not include approximately 6 st of wastage.
- 3/ Does not include approximately 2 st of wastage.
- 4/ Includes 3 st of spawn on *Macrocystus* kelp.
- 5/ All spawn-on-kelp fisheries closed by regulation prior to the 1985 season.

Appendix Table D2. Japanese gillnet herring catches in Norton Sound, 1968-1977. (North of 63° N. Latitude and East of 167° W. Longitude)

Year	Gillnet Catch (st)	Remarks
1968	131	First foreign effort on herring in Norton Sound
1969	1400	Peak catch with large effort (about 40 ships). Two vessels apprehended.
1970	69	
1971	703	
1972	15	
1973	38	
1974	764	
1975	0	
1976	-	Data unavailable.
1977	-	Herring fishery closed to foreign nations.
Total	3120	Excludes 1976 catches.

Appendix Table D3. Herring biomass estimates and commercial fisheries data for the Norton Sound District, 1979-1988.

Year	Biomass 1/ (st)	Harvest 2/ (st)	% Exploit- ation 3/	Roe %	Dollar Value (millions)	Number Fish- ermen
1979	7,700	1292	16.8	7.0	.6	67
1980 4/	8,400	2452	29.2	8.1	.5	294
1981	25,100	4371	17.3	8.8	1.5	332
1982 4/	17,400	3933	22.6	8.8	1.0	237
1983	28,100	4582	16.3	8.6	1.4	272
1984	23,100	3662 5/	15.8	10.3	.9	194
1985	20,000	3548	17.7	9.9	1.4	277
1986	28,062	5194	18.5	9.6	2.9	323
1987	32,370	4082	12.6 6/	8.6	2.6	564
1988	33,924	4672	13.8 7/	9.0	3.9	348

1/ Methods of calculating biomass have varied over the years. Biomass estimates listed follow methods used during that year.

2/ Includes both bait and sac roe harvests.

3/ Represents total District exploitation. During many years southern subdistricts are closed because exploitation of the local biomass reaches 20%, while northern subdistricts have remained open because little or no harvest has occurred.

4/ Minimal biomass estimates due to poor survey conditions.

5/ Includes an estimated 90 st of wastage.

6/ Peak estimate made after the commercial fishery; the fishery was not re-opened due to the high probability of spawnouts present after two consecutive days of heavy spawning.

7/ Peak biomass was sighted prior to arrival of the commercial buying fleet.

Appendix Table D4. Norton Sound commercial herring harvest (st) by subdistrict by year, 1979-1988. 1/

Subdistrict	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
1 (St. Michael)	319	1176	3068	2062	434	--	1538	2559	2218	3260
2 (Unalakleet)	405	632	831	946	1265	--	188	--	174	99
3 (Cape Denbigh)	555	632	471	925	2733	3572	1675	2450	1690	1307
4 (Norton Bay)	--	5	1	--	--	--	--	--	--	--
5 (Elim)	--	--	--	--	65	--	147	185	--	6
6 (Golovin)	--	7	--	--	85	--	--	--	--	--
7 (Bluff/Nome)	14	--	--	--	--	--	--	--	--	--
Norton Sound District Totals	1292	2452	4371	3933	4582	3572 2/	3548	5194	4082	4672

1/ Includes herring taken for sac roe and bait.

2/ Does not include an estimated 90 st of wastage.

Appendix Table D5. Norton Sound commercial spawn-on-kelp
(Fucus) harvest, 1978-1984. 1/

Year	st	Fishermen
1978	4	9
1979	13	19
1980	24	20
1981	47	22
1982	38	44
1983	29	35
1984	19	32

1/ Norton Sound commercial spawn-on-kelp harvest closed
by regulation prior to the 1985 season.

Port Clarence--Kotzebue Districts

Introduction

The regulation book states that in the Port Clarence and Kotzebue Districts, herring may be taken from April 15 through November 15, except that herring may not be taken during the open commercial salmon fishing season. However, prior to the 1987 season, no spring sac roe commercial fisheries had ever occurred within these districts. Interest in exploring these stocks has been expressed in recent years by industry personnel operating in the Norton Sound District. However, no large scale effort to develop the fishery has occurred due to the late ice breakup and fishery timing in the Port Clarence and Kotzebue Districts.

The Port Clarence and Kotzebue commercial herring fisheries have been in regulation since 1982. The 1983 and 1984 regulation books set a guideline harvest of 150 mt (165 st) for each district. Since the guideline harvest has never been changed or repealed by the Board of Fisheries, it is assumed 165 st guideline harvest is still in effect. Presently purse seines, beach seines, and gill nets are legal commercial gear within these districts.

Local fishermen from Teller, Shishmaref, and Kotzebue have also expressed increasing interest in exploiting these stocks. While small harvests of herring for food/bait have occurred during the fall, the fisheries in these districts have been limited by lack of markets. Local fishermen and fishery operators in Kotzebue have also expressed interest in developing a spawn-on-kelp fishery within these districts.

Resource Investigations

Resource investigations of Port Clarence and Kotzebue Sound area herring stocks were conducted by ADF&G from March 1976-September 1978 (Barton 1978). These studies indicated that herring populations from Golovin Bay (Norton Sound) northward differed significantly in size and behavioral characteristics from herring populations occurring from southern Bering Sea. Differences between populations were summarized as follows (Barton, 1978).

Seward Peninsula Populations

South Norton Sound to
southern Bering Sea
populations

Smaller herring at age with lower probable vertebral counts.

Larger herring with higher vertebral counts.

Lower abundance.

Higher abundance

Subtidal spawning (3m) in shallow bays, inlets and lagoons

Intertidal and shallow subtidal spawning along exposed rocky headlands.

Zosteria sp. primary spawning substrate.

Fucus sp. primary spawning substrate.

More euryhaline.

Less euryhaline.

Overwinter in shallow bays; water is warmed by river discharge under ice cover.

Overwinter in deep ocean layers near the Pribilof Islands.

Fall (non-spawning) runs documented.

No fall runs documented

Larval development in brackish water

Larval development probable in more saline water.

Data collected from herring populations along the Seward Peninsula strongly indicated that a separate stock of herring occurs in the Port Clarence and Kotzebue Sound areas. This does not preclude the possibility of the occurrence of more southern stocks from utilizing this region, i.e., stocks which winter near the Pribilof Islands and migrate to the western Alaska coast to spawn. It is unlikely however, that herring stocks along the Seward Peninsula migrate to the central Bering Sea for wintering, but rather remain in coastal lagoons, bays or inlets which are warmed by river discharge under the ice (Barton 1978). This may be a major factor in explaining size differences, i.e., environmental conditions. Water temperatures and feeding conditions in deep ocean waters are probably more favorable for growth than those in herring winter habitats along the Seward Peninsula, which apparently have become adapted to Arctic conditions (Barton 1978).

Fall Food/Bait Fishery

Although a fall fishery has probably existed for subsistence use within these areas for many years, a commercial venture

has only been attempted recently. During the fall of 1986, one fisherman sold 130 pounds of fall herring from the Port Clarence District for \$1.00 per pound. In 1987, a total of 1,100 pounds of fall herring was sold at \$.30 per pound for use as dog food and crab bait. Limited markets will most likely preclude expansion of a fall fishery. No deliveries of fall herring were reported in 1988.

Sac Roe Fishery Summary 1988

Company representatives contacted the Norton Sound/Kotzebue area biologist on June 5 and 6 about buying herring at Port Clarence. Consequently, a tender, processor, and a Japanese tramper traveled to Port Clarence on June 6. The Commercial Fisheries management staff agreed to intensify their aerial surveys of the area and make a biologist available to monitor the fishery.

One purse seine vessel was observed inside Port Clarence during an aerial survey on June 6. The purse seiner had made it through the ice to Teller, followed by the other vessels, on June 7. In addition to the seiner, 6 gill net card holders (2 from Teller, 2 from Nome, 2 non-residents) composed the fishing fleet. The gill net fleet consisted of 2 small Lund skiffs (.5-1 ton capacity), 3 larger skiffs (5-ton capacity, 1 with power) and 1 production boat (15 ton capacity).

On June 7 three gillnetters began prospecting inside Grantley Harbor and eastern Port Clarence. Catches were predominantly whitefish, with just enough herring to sample for roe maturity. Only one-half of the females were ripe, which dropped the mature roe content to 5%. Ice conditions and fog confined most prospecting to the same area on June 8 and 9. Herring catches remained low, with a large number of whitefish still being caught near Grantley Harbor, and Starry flounder along Cape Riley. Most incidental catches were given away for dog food in Teller.

On June 8 a high number of males, immature females, and some spawned out herring caused the roe percent to remain low (4-5%) in samples taken from 2 1/2 and 2 5/8 inch gill nets fished inside Grantley Harbor. A sample of herring caught with a 2 3/4 inch mesh gill net near Cape Riley yielded a roe recovery of 7.0%.

On June 9 the smaller mesh continued to catch herring of a mixed roe maturity. The larger mesh caught a sample with a roe recovery of 8.0%. The morning fog lifted just enough around noon on June 9 for the spotter from the purse seiner to observe several schools of fish along Cape Riley and Willow Creek. The gillnetters set along this area, but were unable to catch any

herring. The spotter observed the fish moving around the nets. The seiner made a set on what turned out to be tom cod.

Herring catches remained minimal on June 10, producing a 4.75% and 8.5% mature roe from a 2 5/8 inch and 2 3/4 inch mesh gill net, respectively, fished on the outside of the Grantley Harbor spit.

Several schools of fish were also observed along the Port Clarence spit near Point Spencer. In the late afternoon of June 10, one gillnetter navigated through ice and fog to Point Spencer and caught mostly ripe fish with an estimated roe recovery of 8.5%. The rest of the fleet pushed through the ice and began fishing at Point Spencer by midnight. Initial gill net samples indicated a mature roe percent of 8-10.0%.

The bulk of the gill net catch was caught on the incoming tide from 1:00 a.m. to 8:00 a.m. on June 11 (approximately 18st). Catches dropped off rapidly, and all gill nets were out of the water by 6:00 p.m. on June 12. The total gill net harvest was estimated to be 23.6 short tons, with an average roe recovery of 8.9%.

Incidental species caught, mostly after the peak, were whitefish, tom cod, char, and (5) red king crab.

A total of 56.4 st of herring with an average roe recovery of 7.6% was harvested in a purse seine set made at 10:00 a.m. on June 11 on the outside of the Port Clarence spit. An estimated 50 to 100 st was reported to have escaped over the corks of this set.

Three attempts to seine herring were made on June 12. The first two were made at or near Point Spencer and resulted in no fish being captured. The third set, made on the outside of Port Clarence spit near the Brevig subsistence camp, captured spawned out herring which were released.

One last seine set was made on June 13, which captured a small school of tom cod.

A total of 80 st of herring was harvested by both gear types. The average roe recovery was approximately 8.2%. The Port Clarence catches were sold at the Norton Sound price of \$1000/st @ 10% roe. The total commercial catch was thus valued at approximately \$57,500. This harvest represents the only large scale commercial sale of herring in this district during the 1988 sac roe season.

The peak biomass observation was made on June 12 when 708 st were observed, primarily at Point Spencer (Table 17). This observed biomass combined with the 80 st harvested to date

indicated a peak biomass of 788 st present on the grounds of the Port Clarence district during the fishery. Although not verified by grounds test fishing, the fish observed were assumed to be herring since a major spawn was sighted during the same survey on June 12 (Table 17). The exploitation rate of the inseason biomass observed was approximately 10.2%.

Herring Abundance and Research

The Port Clarence District is small in comparison with the Norton Sound District. An overwintering population is thought to inhabit Grantley Harbor and Imuruk Basin, although the size of the fish captured in the Port Clarence fishery appears similar to those in Norton Sound. Age, size and sex data were collected from the purse seine commercial/test catches and from the commercial gill net catches. The age composition of 210 purse seine samples taken was 2%, 20%, 43%, 15%, 5%, 8%, and 7% age 4, 5, 6, 7, 8, 9, and 10+ year old herring, respectively. The age composition of 451 gill net samples taken was 4%, 18%, 11%, 13%, 16%, and 38% age 5, 6, 7, 8, 9, and 10+ year old herring, respectively (Figure 15).

Two probable spawns were sighted during the 1988 season, on June 11 and 12, although they were not observed in progress. The bulk of spawn was sighted in Brevig Lagoon, and four miles south of the tip of Point Spencer (outside). Local residents have reported spawning in similar areas near Teller and Brevig Mission in the past. The spawning substrate in these ponds is thought to be eel grass and other filamentous plants. Drags made in an attempt to recover spawn substrate near the observed spawn sightings were not successful.

Aerial surveys are very difficult in the Port Clarence District due to organic coloring of the waters of Imuruk Basin, Tuksuk Channel, Grantley Harbor and to a lesser extent, Port Clarence. Aerial surveys were impractical in Imuruk Basin and Tuksuk Channel. Additionally the presence of other species of fish caught in test commercial gear sets indicate the need for verifying any biomass sighted. The peak biomass observed was sighted under poor conditions (Table 17).

Table 17. Daily observed peak biomass estimates of Pacific herring, Port Clarence District, 1988.

Date	Flight No.	Observer Initials	Survey		Spawn		Estimated Biomass		Total	
			Hours	Rating 1/	No.	Length (mi)	NOM 2/	PtC	PtC Catch	PtC Biomass
5/31	1	CL	1.2	5	0	0.0	6.1	.0	0	0.0
6/06	2	CL	1.5	5	0	0.0	0.0	88.4	0	88.4
6/09	3	CL	2.2	5	0	0.0	88.1	63.3	0	63.3
6/11	4	CL	2.4	5	1	0.1	327.7	177.7	74	251.7
6/12	5	CL	3.8	4	3	10.2	688.9	707.9	80	787.9
6/13	6	CL	3.2	4	0	0.0	646.4	260.4	80	340.4
Totals			14.3	5	4	10.3				787.9 3/

119

- 1/ Ratings: 1 = excellent; 2 = good; 3 = fair; 4 = poor; 5 = unacceptable
- 2/ NOM = Nome subdistrict (Norton Sound District). This area (west of Nome) surveyed due to its' close proximity to Port Clarence District; biomass sightings were not included in PtC (Port Clarence) District biomass estimates.
- 3/ Peak biomass includes 6/12 observed biomass of 707.9 st. added to commercial harvest to date of 80 st.

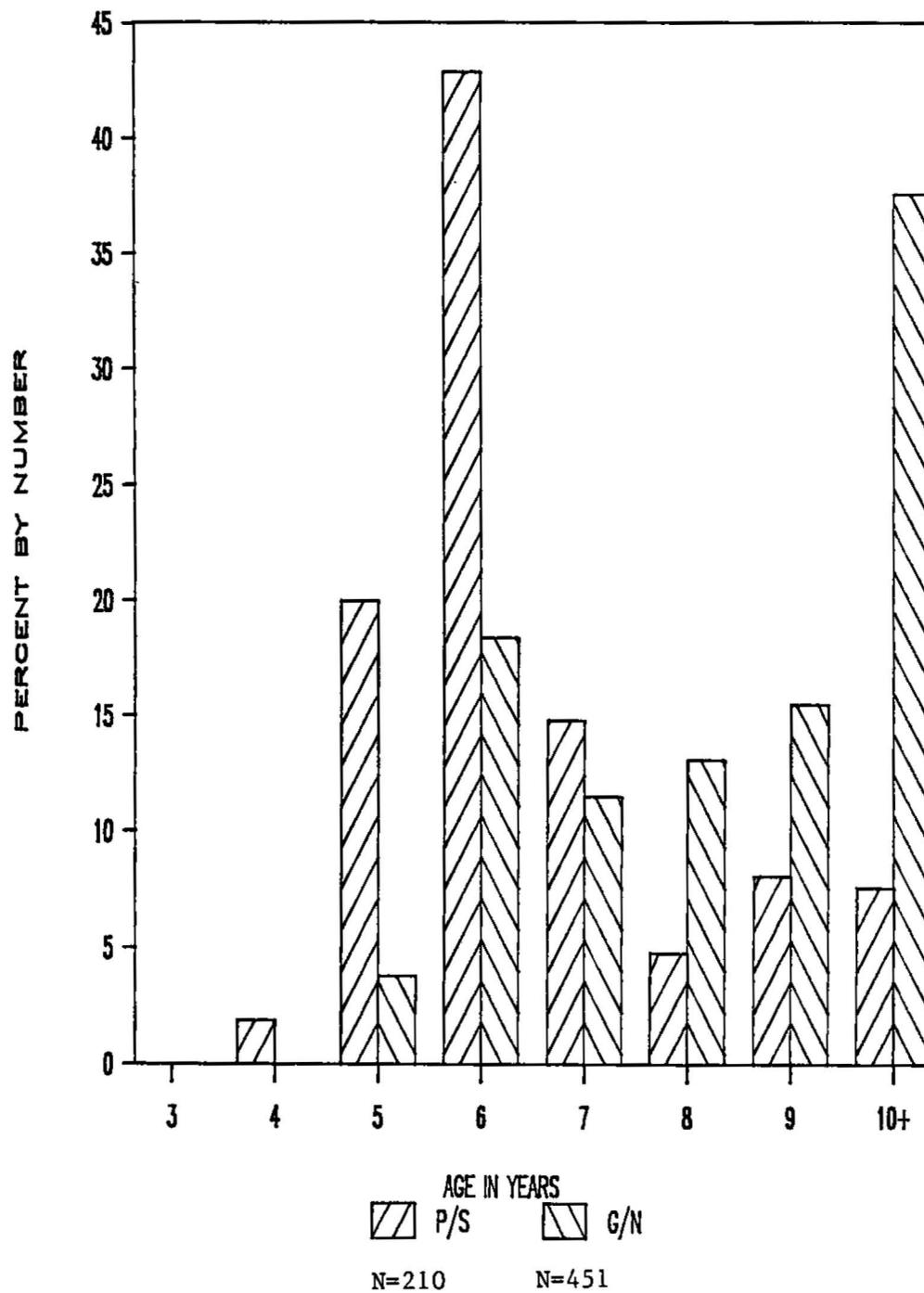


Figure 15. Age composition of the commercial purse seine (P/S) and commercial gill net (G/N) catch samples, Port Clarence District, 1988.

Section 3: KING CRAB

Section 3: KING CRAB

Introduction

The Norton Sound section of the Northern District in Area Q is described in the shellfish regulations as all waters east of 168 degrees W. long., between the latitudes of Cape Romanzof and Cape Prince of Wales (Figures 16 and 17). The only shellfish fishery in Norton Sound is for red king crab (Paralithodes camtschatica). Blue king crab (P. platypus) and tanner crab (Chinochetes opelio) also occur within the section but are very seldom caught by commercial or subsistence fishermen. Red king crab have been utilized for subsistence purposes by local residents for many years, but the commercial fishery was not initiated until eleven years ago. In April 1977, the Alaska Board of Fisheries opened an "exploratory" commercial fishery in order to increase the knowledge and commercial utilization of Norton Sound king crab. Since 1976 there have been five National Marine Fisheries Service (NMFS) research trawl studies in Norton Sound as well as four Alaska Department of Fish and Game (ADF&G) research pot fishing studies. Data from these studies, from winter research studies, and from twelve commercial fishing seasons have greatly increased our knowledge of the Norton Sound king crab.

Prior to the start of the 1988 summer commercial fishery a conservative quota of 200,000 pounds of legal male red king crab was set. Using data collected by NMFS and ADF&G in 1985 (Figure 19) and applying recruitment, harvest, and natural mortality factors observed in subsequent years, the legal male population was estimated to be roughly 2 million pounds. Harvests for the previous five years (1983-1987) had averaged 397,800 pounds. The projected harvest of 200,000 pounds was less than recent year quotas since the 1985 NMFS trawl survey had indicated a slight decline in recruitment for 1987; in addition, there was concern over the lack of current research data and the reduced level of recruitment (22%) observed during the 1987 summer commercial fishery. Also implemented was a harvest strategy adopted by the Alaska Board of Fisheries (5AAC 34.915) in 1981. The harvest strategy (5AAC 34.915) set the optimum yield (O.Y.) in Norton Sound at 1/2 the normal exploitation rate as determined in 5AAC 34.080, to provide protection to a long established subsistence fishery.

During the spring 1988 Board of Fisheries meetings, regulation 5AAC 34.080 was amended. Prior to these changes, harvest strategy guidelines set forth in 5AAC 34.080 determined exploitation rates based on current levels of prerecruit, recruit, and postrecruit crab in the current estimated population. The exploitation rate set during the years 1981-

1987 for the summer commercial fisheries was 15% of the estimated population (1/2 the "normal" exploitation rate of 30% as determined by a table previously found in 5AAC 34.080). The regulation change made in 1988 authorized the Department more discretion in setting a harvest guideline of 0-20% of depressed, or threshold (where established or appropriate) populations. Thus, a harvest guideline of 10% of the estimated 2 million pound population of legal male crab was set. Again, concern over the lack of current population size and age structure data weighed heavily in the harvest guideline set for 1988.

An additional regulation which is intended to protect the subsistence fishery is a nearshore closure (approximately 15 miles) to summer commercial fishermen (Figure 17).

Other important regulations for the summer commercial fishery included:

1) A fishing season from August 1 to September 3 or until closed by emergency order. These dates afford protection to soft shell and breeding crabs and are also timed to occur prior to severe winter weather.

2) A minimum carapace width of 4 3/4 inches (121mm) for males. This is for the purpose of allowing males to breed for 1 to 2 years prior to exposure to commercial harvest, although the size at which male crab reach sexual maturity has not been verified by any specific study in the Norton Sound area.

Regulation 5AAC 34.935 (CLOSED WATERS) also allowed the Department the discretion to reduce the closed waters area to allow an efficient harvest of red king crab during the summer fishery. However, at no time was this action taken, nor considered, during 1988 due to the availability of commercial quantities of legal male king crab well outside of the closed area.

Prior to the 1985 fishery, all statistical areas received new number designations corresponding to their latitude/longitude locations (Table 20, Figure 17).

Norton Sound Red King Crab

Commercial Fishery

The Norton Sound commercial red king crab fishery opened by regulation at noon, August 1. No vessels were present on the scheduled tank inspection day, July 31. Two vessels present on the grounds on the morning of August 1 received onboard

registrations, tank checks and inspection stickers before noon. The 1988 fleet consisted of a catcher-processor and a fishing vessel. In addition, a processing vessel arrived on the grounds on August 5 to process crab from the fishing vessel. The two fishing vessels brought a total of 360 pots to fish in Norton Sound. No price information was available following the fishery nor upon receipt of the fish tickets.

The season was open for 9.9 days. The season was closed by emergency order at 9:00 a.m. ADT, August 11 when it was anticipated a harvest of 200,000 pounds would be reached. A 24 hour notice was given.

All fish tickets were received prior to the vessels departing the Norton Sound Section. The final reported harvest based on fish ticket analysis was 236,688 pounds of red king crab (Table 18, Appendix Table E1). No deadloss was reported. High captures of crab on August 9 and 11 (15,000+ pounds each day) accounted for the higher than desired total harvest.

The catches in 1988 were reported from 4 statistical areas (656330, 656401, 666330, and 666401) (Table 18, Figure 17). No portion of the closed area was opened during the fishery. The average catch per pot pull for the season was 32.4 legal male crab; a total of 76,148 crab were captured in 2,350 pot lifts. The average weight of legal male crab was 3.15 pounds. This was verified by onboard Department observers (Gephard and Lean 1988).

A Department observer was onboard the catcher-processor during the entire fishery. A second Department observer was placed onboard the processing vessel on August 5, and transferred to the fishing vessel the same day for the remainder of the fishery. A total of 1,522 legal males were measured for carapace lengths; the mean carapace length was 119.0 mm (Figure 22). The proportion of recruit to postrecruit crab was approximately 25% to 75% (Table 19). A total of 1,748 (74%) pot lifts were observed. A total of 12,384 and 929 sublegal male and female crab were observed, respectively. Complete observer data summaries are available in the 1988 Norton Sound observer project summary report (Gephard and Lean 1988).

Compliance with the daily verbal catch reports was excellent. The Fish and Wildlife Protection Officers stationed in Nome were available for answering regulatory questions and to assist with registration and inspections.

Commercial catches in the summer fishery have ranged from 2.9 million pounds in 1979 to 228,921 pounds in 1982 (Appendix Table E2). Substantial deadloss, up to 427,000 pounds or 15% of the 1979 harvest, occurred during the first three years of the fishery due to crab being held for long periods of time in

live tanks containing low salinity surface waters. Deadloss since 1979 has become insignificant as most crab are held in live tanks for short periods of time and are processed on the fishing grounds.

The greatest fishing effort occurred in 1979 and 1981. During each of these years approximately 35 vessels made 34,000 pot lifts. The crab catch per pot steadily declined from a high of 64 in 1978 to 6 in 1982 as a result of declining crab abundance. Average weights of crab ranged from 2.7 to 3.0 pounds during 1977-1979 and increased to 3.6-3.7 pounds in 1980-1982 as the population declined due to lack of recruitment and older postrecruit crab became proportionately more abundant (Appendix Table E2). From 1983-1986, recruit crab dominated the fishery as the population began to recover and older postrecruit crab passed through the fishery (Table 19). The 1987 season seemed to indicate a shift in this trend, with postrecruit crab again beginning to dominate the fishery. Although information gathered by Department observers during the 1988 summer fishery was questioned due to uncertainty and inconsistency in shell aging, recruitment into this year's fishery was approximated at 25%.

A winter commercial crab fishery also occurs in the Norton Sound section. Prior to 1985, regulations provided for a commercial season from January 1 through April 30. During the spring 1985 meetings, the Board of Fisheries adopted a public proposal which set the new season from November 15 through May 15.

Local fishermen participate in this limited fishery and operate pots and handlines through the ice. Fishing effort, which usually occurs within 5 miles of Nome, is greatly influenced by ice conditions and the abundance of crab in nearshore waters. In 1988, ten commercial fishermen reported a harvest of 425 crab. The average price was \$2.33 per pound. Weights on most crab were not taken, however fish tickets were edited to reflect the approximate weights (based on the average weights of fish tickets which did show delivery weights). The average weight of crab sold was 2.31 pounds. Although most crab were sold under the auspices of catcher/seller permits to local Nome residents and businesses, a pilot project, the Nome-Crab-Coop was funded by Kawerak, the non-profit branch of a local native corporation. The purpose of this project was to promote pot fishing technology and development of a local market for fresh-caught crab. Although interest was high, unstable ice conditions hindered the efforts of the organizer and fishermen alike. The largest recorded catch and effort occurred in 1978 when 9,625 crab were landed by 37 fishermen (Appendix Table E3).

Subsistence Fishery

Red king crab are utilized by Norton Sound residents mainly during the winter. Fishing occurs through holes or cracks in the ice with the use of handlines and pots.

In order to document trends in the subsistence harvest, the Board of Fisheries enacted a regulation in 1977 requiring subsistence fishermen in Norton Sound to obtain a permit prior to fishing and record daily effort and catches on these permits. Catches for the 1987-88 season are presented in Table 21 and historic catches are presented in Appendix Table E3.

After the first commercial harvest of about one half million pounds in the summer of 1977, a successful winter fishery was conducted in 1977-78 when the average subsistence catch was 84 crab and the average winter commercial catch was 260 legal sized crab. The winter fishery declined sharply the following year and remained at very depressed levels through 1981-82 season.

The lack of success in the winter crab fishery during some past years has been attributed to a declining crab population caused by removal of crab in the summer commercial fishery together with low recruitment, low effort due to poor ice conditions, and changes in nearshore winter distribution of crab. All of these factors probably had some effect on the success of the winter fishery in varying degrees. During the 1978-79 winter fishery, the king crab population was still relatively high. Despite this relatively large population, winter catches were the poorest on record indicating that the major factors limiting winter catches during 1978-79 were probably poor ice conditions and the offshore distribution of crab. During the winter of 1981-82, poor winter catches could more reasonably be attributed to a declining crab population resulting from poor recruitment not offsetting commercial catch removals since the crab population was at its lowest documented level.

Since the winter of 1983-84, the permits issued have required more detailed information than past years, asking for the gear type used, the sex of the catch, the number of crab caught and the number of crab kept (Appendix Table E3). Permit information again showed that pots were by far the most commonly used gear type. Gear type information is not available from past permits; however, it has been observed that historically the major gear type was handlines. During the season of 1982-83, fishermen began to use pots more frequently.

Subsistence fishing effort and catches vary from winter to winter, largely due to ice conditions each year. From the winter of 1982-83 through 1984-85, the number of permits issued averaged 200; the average harvest per fisherman during this

time was 88 crab. More recently, during the winters of 1985-86 and 1986-87, just 136 and 138 permits were issued, respectively. The average catch per fisherman during 1985-86 and 1986-87 was 66 and 59 crab, respectively. Unstable ice conditions during both seasons discouraged many subsistence fishermen from participating in the winter fishery. In 1987-88, fishing effort was at very low levels due to unstable ice conditions (Table 21, Appendix Table E3). A total of 71 permits were issued, with 40 actually fished. The total reported harvest for the 1987-88 winter season was 2,724 crab, 69 of which were female (Table 21, Appendix Table E3). A total of 759 male and 90 female crab were captured but released. The average harvest per fisher was 68 crab.

Stock Status/Research

In 1976 when monitoring of the Norton Sound king crab population first began (Appendix Table E4), the population was mainly composed of prerecruit and recruit crab (Figure 20). This first population assessment survey by the NMFS estimated the legal male king crab population at 8.1 million pounds (Appendix Table E4). The legal male crab population peaked in 1978 at an estimated 11 million pounds. During the 4 years following 1978, recruitment into the legal male crab population was very low. Subsequent NMFS surveys in 1979 and 1982 documented a population of predominantly postrecruit crab, and estimated a decline in the population to 2.6 million pounds by 1982 (Appendix Table E4). The Department of Fish and Game conducted their first population assessment survey in 1980, with subsequent surveys in 1981 and 1982 (Figure 21). These survey assessments documented a similar decline of from 6.6 million pounds (1980) to 1.3 million pounds (1982). Beginning in 1981, sublegal crab abundance began to increase, and by 1983 recruitment into the legal male population also began to increase. No assessment work was conducted in 1983 or 1984. However, samples of the commercial catches indicated a significant increase of recruit crab into the legal male population (Figure 22); from an historic low of 10% in 1981 to 59% in 1984 (Table 19). The 1984 population was similar to the 1976 population in that it was composed of mainly sublegal and recruit crab, however, the 1984 population consisted of considerably fewer crab than the 1976 population.

In 1985 both NMFS and the Department conducted population assessment surveys in Norton Sound (Appendix Table E4, Figure 19). The Department fished 65 stations throughout Norton Sound capturing 4,645 legal males, of which one-third were tagged. Subsequent recapture of tagged crab by the commercial fleet in August of 1985 provided tag to untagged ratios, and the population prior to the fishery was estimated at 2.4 million pounds. After the commercial fishery in 1985, NMFS conducted a population assessment survey using trawl gear over a slightly

larger area than that surveyed by the Department. Catches of male king crab by NMFS were in the process of or had just molted with the result being that their estimate of 3.4 million pounds of legal male king crab included some recruitment. Adjusting this estimate for molting, and including the summer commercial harvest, the estimate became 3 million pounds present prior to the 1985 August fishery. Both surveys documented relatively substantial numbers of recruit crab and a healthy percentage of prerecruit crab, though at this level it will take some time to rebuild the stock (Figure 19).

No population assessment work has been conducted by ADF&G in Norton Sound since 1985. Prior to the 1986 summer fishery, the legal male population was estimated to be 2.8 million pounds. As stated in the introduction, the population of legal male crab prior to the 1987 summer season was assumed to be close to 2.6 million pounds based on the high level of recruit crab documented during the 1986 summer season. However, with just 22% recruit crab observed during the 1987 summer fishery, it appears the population prior to the fishery may have been significantly below the previous four year average (1983-86). Adjusting for natural mortality and the lower level of recruitment observed during 1987, the 1988 population was estimated at 2.0 million pounds of legal male crab.

Following the 1988 summer fishery, the NMFS conducted a trawl survey. Preliminary results indicate the legal male king crab population prior to the summer fishery may have been as high as 3.3 million pounds. This figure is based on the estimate made by NMFS of 3.038 millions pounds combined with the 1988 summer commercial harvest (~237,000 pounds)(Appendix Table E2). The NMFS trawl survey was made just after the summer fishery, from August 16-30, and included some newly molted crab. If final analysis of the trawl survey data indicates the population estimate of 3.3 million is accurate, the summer harvest represented an exploitation of approximately 7.2% of the legal males available during the August fishery.

The Department has conducted winter crab studies near Nome since 1982. Results of the winter studies from 1982-83 through 1984-85 are available in separate project reports, and are summarized in Table 22. From March 12 to April 23, 1986, the Department conducted winter crab studies. Crab pots were fished through the ice near Nome at previously established locations, when ice conditions permitted, as in previous years. The study was conducted by an ADF&G project biologist with assistance provided by students of the local community college biology class. A total of 595 male and 74 female king crab were captured in 32 pot lifts. The average pot lift caught 19.2 male and 2.4 female king crab. The 595 male king crab were measured for carapace length and categorized by shell condition. Sublegals comprised 61% of the catch and legals 39%

(Table 22). Of the 234 legal crab captured, 55.1% were recruits and 44.9% were postrecruits. The average carapace length was 97mm. A total of 298 male crab (114 sublegal, 184 legal) were tagged and released (Lean 1987).

Past research has shown that female crab 75mm and greater in carapace length will have egg clutches 99% of the time. Females made up 11.6% of the catch in 1986, by far the highest percentage of females caught since the project began. Of the 74 females categorized as to percent fullness of egg clutch, 88% were without eggs, 4% were considered full and the remaining 7% were found to have partial clutches. The mean carapace length was 70mm, the shortest mean recorded since the project began in 1982, indicating the majority of females sampled were juvenile crab (Lean 1987).

From February 11 to March 30, 1987, the Department again conducted winter studies. Crab pots were fished through the ice near Nome at previously established locations, when ice conditions permitted, as in previous years. The study was conducted by an ADF&G project biologist with assistance provided by students of the local high school and local public volunteers. A total of 151 male and 6 female king crab were captured in 26 pot lifts. The average pot lift caught only 5.8 male and 0.2 female king crab. A total of 144 male and 5 female king crab were measured for carapace length and categorized by shell condition. Sublegals comprised 44% of the catch of male crab; legals comprised 56% of the catch (Table 22). Of the 81 legal crab captured, 18.5% were recruits and 81.5% were post recruits. The average carapace length was 103.6 mm. A total of 60 male crab (25 sublegal, 35 legal) were tagged and released.

Females made up only 3.8% of the catch in the 1987 winter study. Of the six females captured five were measured; all were juvenile females. The mean carapace length was 71 mm.

During 1988, the Department attempted to fish with crab pots at stations established during the previous year's projects. A total of three pots were set during two attempts, only to be lost when strong offshore (N-NE) winds moved the ice away from the shore. Subsequent attempts to set pots were thwarted by weekly storms from mid-February to mid-March, and an early arrival of spring weather ended any hope of test fishing for crab during the 1988 season. Due to loss of gear and continued poor weather and unstable ice conditions, no crab were caught. Because of the unstable ice edge experienced during the 1986, 1987, and 1988 seasons (possibly created by the new port structure completed in 1986), the operational plan for the upcoming 1989 project will include establishment of new stations, ranging approximately 8 miles, west and east of Nome. It is hoped that establishing these new stations will increase

the ability of the Department to monitor winter king crab abundance and subsistence fishing effort in the Nome area.

The 1986 and 1987 winter crab studies documented the lowest male king crab catches per pot lift since the project began using standardized stations and baiting techniques. From 1983-1985, the average catch per pot was 24 male crab. In 1986 and 1987, the average catch per pot was 19.2 and 5.8 male crab, respectively.

Subsistence fishermen and winter commercial fishermen also reported decreased catches in the vicinity of Nome during 1986, 1987 and 1988. The 1986 study documented the largest average female catch per pot lift; the 1987 study documented few female captures.

Future Investigations

The winter crab studies began as an index of nearshore crab abundance during the season of heaviest local subsistence use. Today some of the controversy of mining impacts on crab distribution has taken the place of previous controversy over commercial versus subsistence use of the resource. From the perspective of the local management biologists this documentation of crab abundance is important because it is presently the most objective comparison of crab availability to local people. Controversy over this preferred personal use resource is likely to continue in the future, especially if winter crab harvests decline even for a short time.

The NMFS conducted their trawl survey of the Norton Sound section during 1988, on the 'every three years' schedule as they have done since 1976. However, due to declining funding levels, they have informed the ADF&G that this is the last survey planned for the Norton Sound section in the near and distant future. Results of the 1988 survey, which are considered preliminary, indicated a population estimate of legal male crab significantly higher than estimated by ADF&G for the 1987 and 1988 seasons. Although these estimates were based on the best information available at the time, it clearly indicates that large vessel research is necessary to sample the population and project reasonably accurate population estimates during any given year. This should serve to give notice that since NMFS will not be conducting a survey in Norton Sound in 1992, the burden of good biological data and population estimates of king crab in Norton Sound will fall on the State of Alaska. Plans for obtaining funds for future surveys in Norton Sound should be begun now if the Department is going to continue to allow commercial exploitation. Without good data and population estimates, proper monitoring and management of the red king crab resources cannot occur.

Outlook for 1989

Management Strategy

Significant recruitment into the legal population occurred during each year from 1983-1986, but apparently declined in 1987 and 1988 (Figure 22). The preliminary 1988 trawl survey data from NMFS indicates approximately 3.0 million pounds of legal male crab will be available to the 1989 summer commercial fleet. This is considerably below the peak estimate of 11.0 million pounds in 1978. The population of legal male crab in Norton Sound is still considered to be depressed. With recruitment currently at an apparent low level (25% observed during both the 1988 summer fishery and NMFS trawl survey) (Figure 18), and the requirement to provide for the subsistence fishery, the management staff recommends the conservative management strategy initiated in 1983 and implemented in 1984-88 be retained in 1989. The guideline harvest for the 1989 season will be 10% of the estimated population, or approximately 300,000 pounds of legal male crab.

Table 18. Commercial harvest of red king crab from Norton Sound, Alaska by statistical area, 1988 (summer fishery only).

Stat Area	# Vessels	Total Harvest Number	Total Harvest Pounds	Total Pots Lifted	Average Crab/Pot	Average Weight
656330	1	10,874	36,129	362	30.0	3.32
656401	2	54,017	165,644	1,689	32.0	3.07
666330	1	3,860	13,020	118	32.7	3.37
666401	1	7,397	21,895	181	40.9	2.96
Totals	2	76,148	236,688	2,350	32.4	3.11

Table 19. Percent recruit size crab for the Norton Sound male red king crab population from commercial catch samples.

Length (mm) Category 1/	Year											
	77	78	79	80	81	82	83	84	85	86	87	88
Recruits	53	29	33	15	10	27	55	59	45	49	22	25
Postrecruits	47	71	67	85	90	73	45	41	55	51	78	75

1/ Recruits = All new shell legal size male crab of carapace length ≤ 115 mm.

Postrecruits = All other legal sized male king crab.

Table 20. Norton Sound section red king crab statistical area conversion chart.

NEW (effective 1985)	OLD (pre-1985)
616431	346-45
616401	346-55
616331	346-65
626432	346-34
626402	346-44
626401	346-54
626331	346-64
626301	346-74
636402	346-43
636401	346-53
636330	346-63
636301	346-73
646402	346-42
646401	346-52
646330	346-62
646301	346-72
656402	346-41
656401	346-51
656330	346-61
656300	346-71
666431	347-31
666402	347-41
666401	347-51
666330	347-61
666300	347-71
666230	347-81
676501	347-32
676430	347-42
676400	347-52
676330	347-62
676300	347-72
686500	347-33
686432	--
686431	347-43
686400	347-53
686330	347-63
686301	347-73

Table 21. Winter 1987-88 subsistence red king crab catches and effort by gear type, Norton Sound, Nome area.

Gear type	# Fishermen	# Males Caught	# Males Kept	# Females Caught	# Females Kept	Total Crab Captured	Total Crab Kept	Average 1/ Harvest/fm
Pots	23	2,832	2,150	136	58	2,968	2,208	96
Handlines	7	50	41	5	2	55	43	6
Both	4	333	316	18	9	351	325	81
Unknown	6	199	148	0	0	199	148	25
Totals	40	3,414	2,655	159	69	3,573	2,724	68

1/ Harvest refers to crab that are kept.

Table 22. Catch of Norton Sound king crab from winter research pots, percent by size categories. 1/

Year	Sublegal			Legals		
	Prerecruit twos	Prerecruit ones	total	recruits	Post-recruits	total
1983	26	38	64	26	10	36
1984	35	31	66	19	16	35
1985	25	45	70	20	10	30
1986	26	35	61	22	17	39
1987	18	45	63	15	66	81
1988 2/	—	—	—	—	—	—

1/ Sublegals = male king crab < 4 3/4" carapace width
 Prerecruit Ones = Sublegals \leq 89mm carapace length
 Prerecruit Twos = Sublegals \geq 90mm carapace length
 Legals = male king crab \geq 4 3/4" carapace width
 Recruits = Legal new shell crab < 116mm carapace length
 Postrecruits = all nonrecruit legal males

2/ No crab caught during 1988; see text.

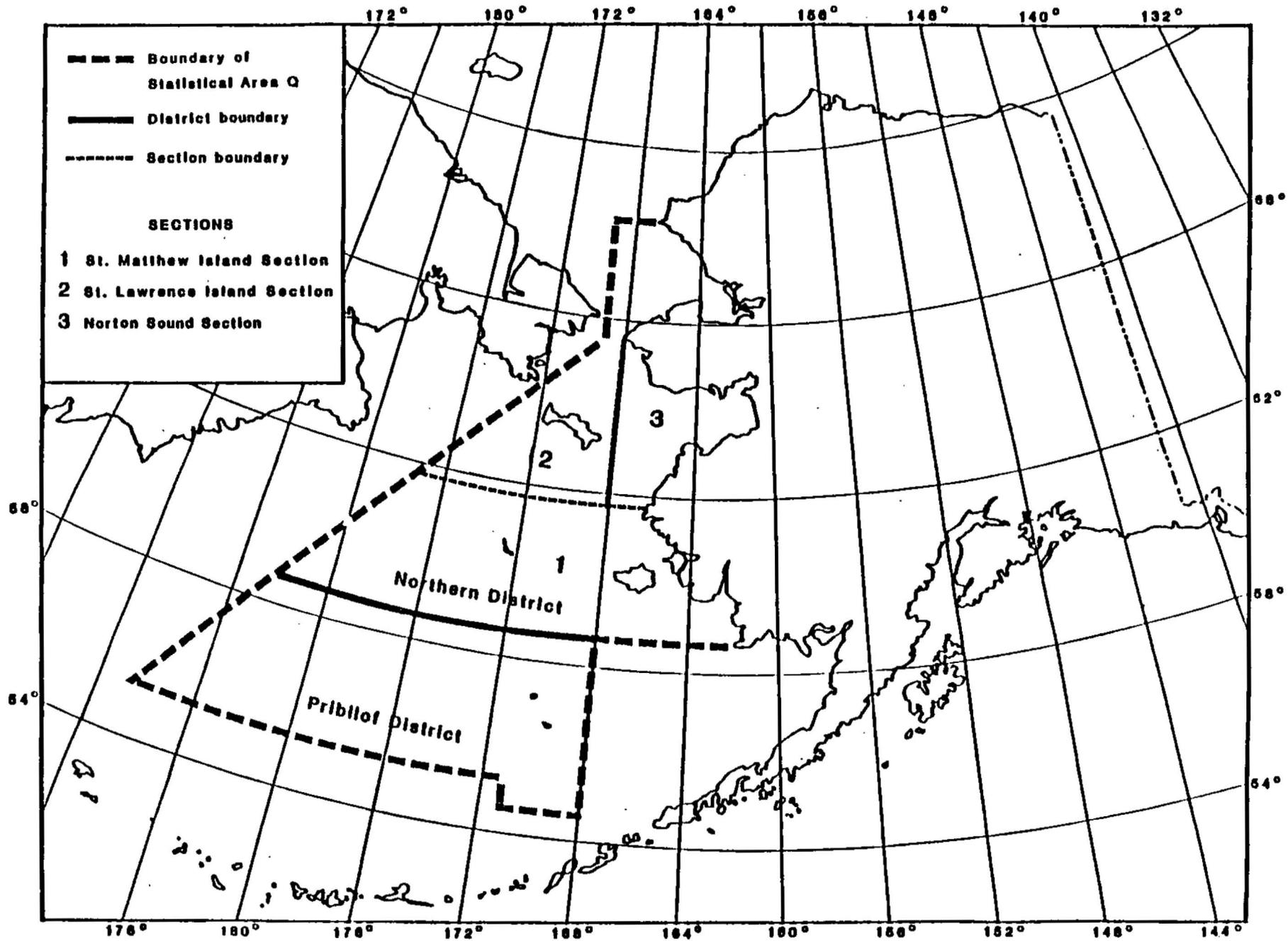


Figure 16. King crab fishing districts and sections of Statistical Area Q

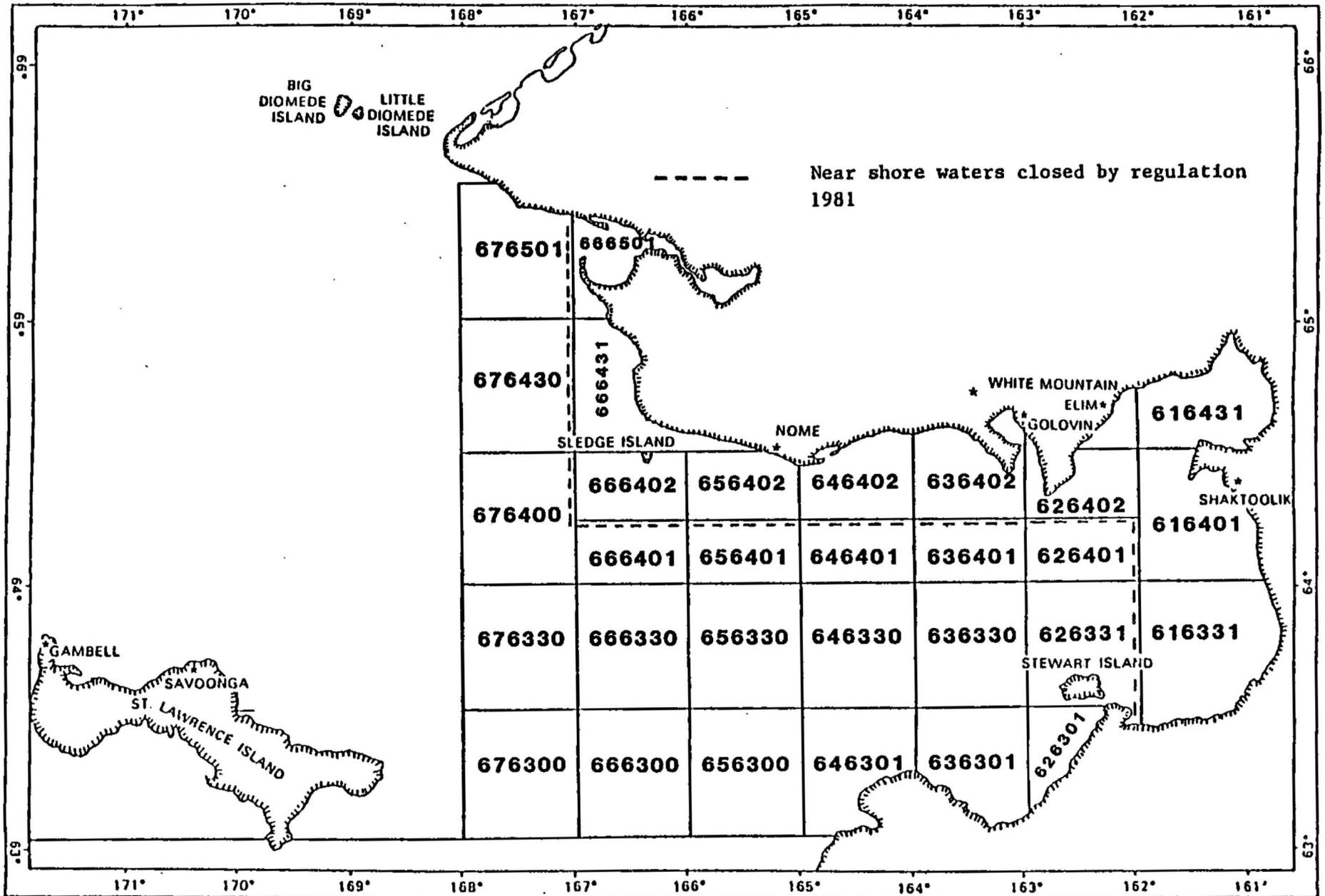


Figure 17. Statistical areas for the Norton Sound red king crab fishery.

N = 399

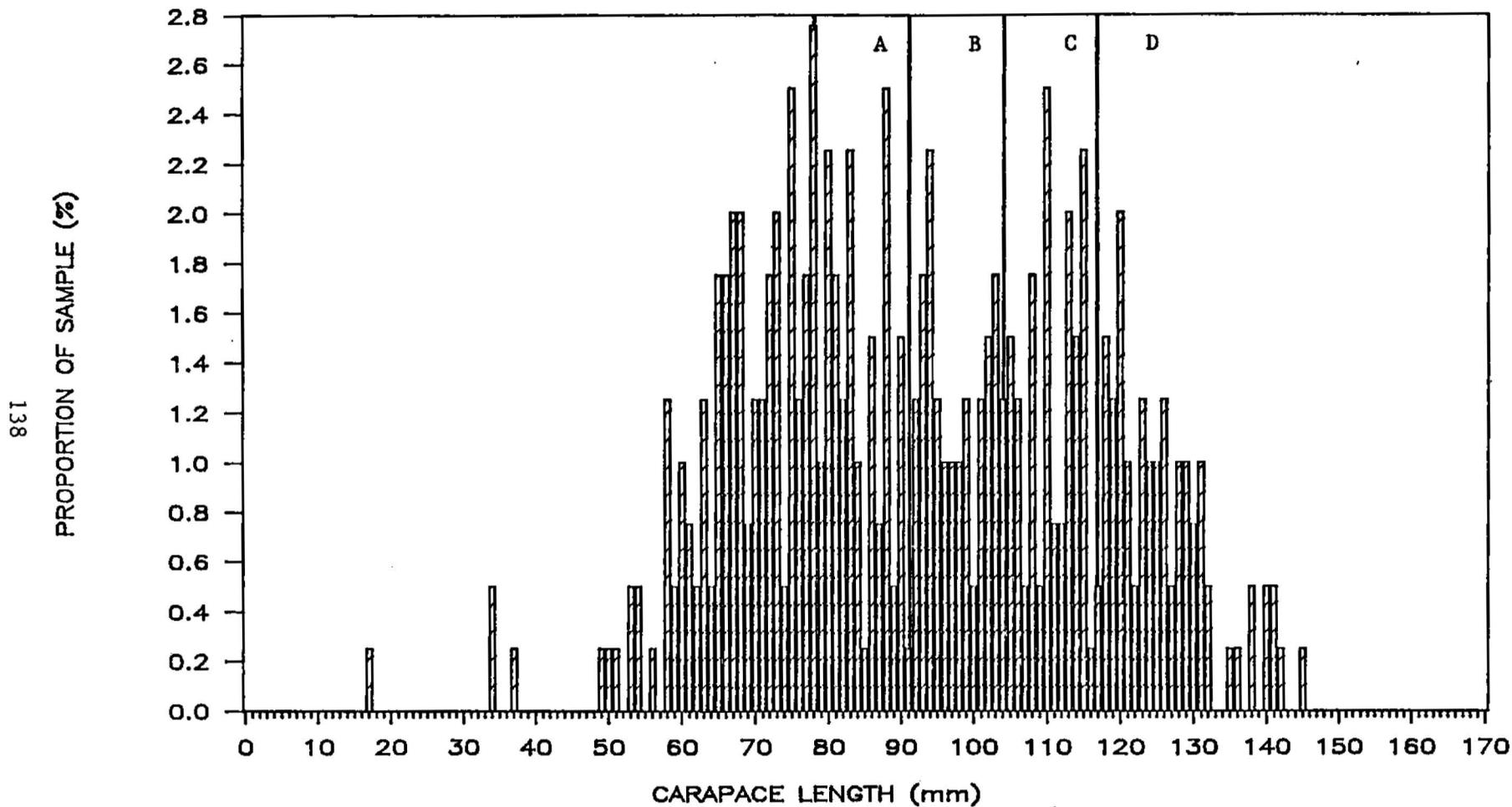


Figure 18. Size distribution of the 1988 Norton Sound male red king crab population from assessment trawl survey conducted by the National Marine Fisheries Service (NMFS). Portions of the graph labeled A are prerecruit two crab (1990 recruitment); B are prerecruit one crab (1989 recruitment); C are recruit crab; D are postrecruit crab.

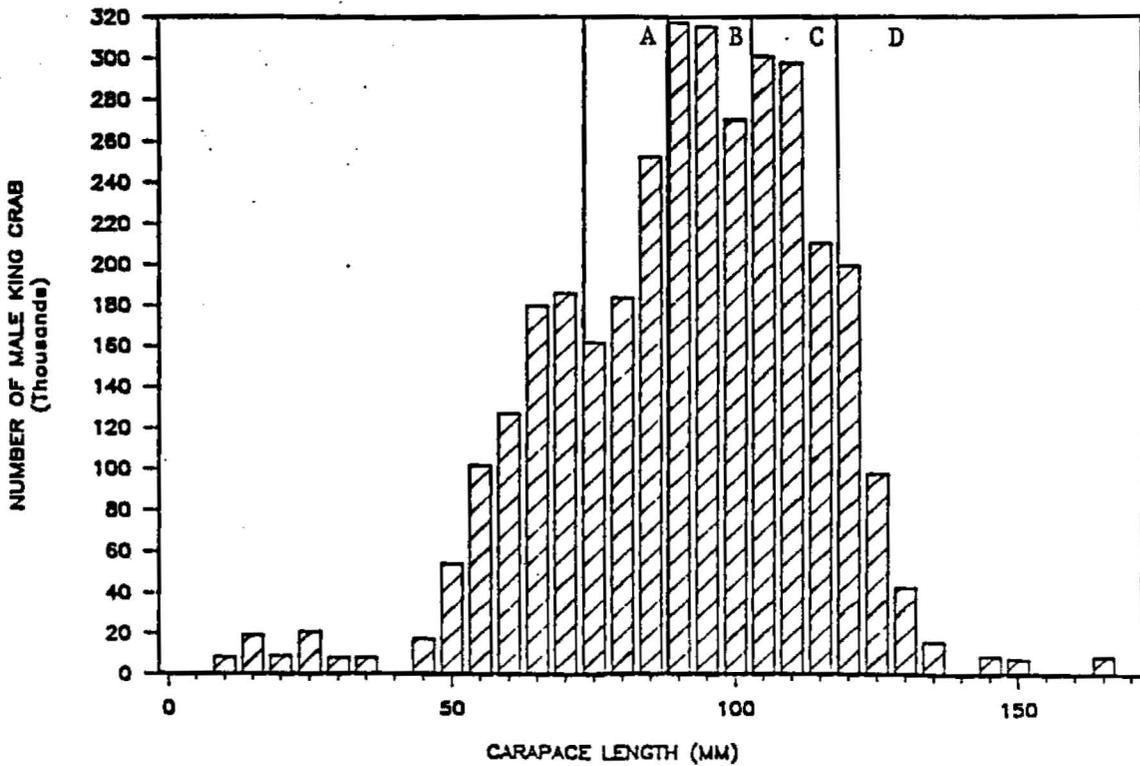
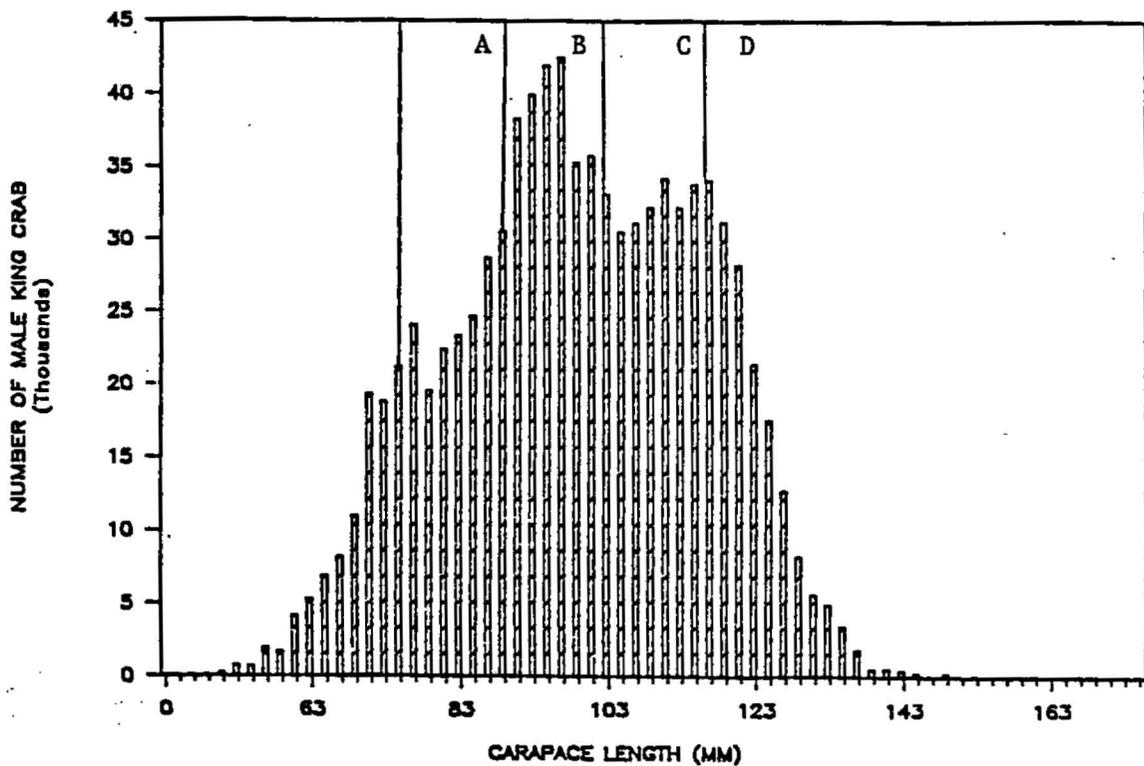


Figure 19. Size distribution of the 1985 Norton Sound male red king crab population from assessment surveys conducted by ADF&G (Top) and NMFS (Bottom). Portions of the graph labeled A are prerecruit two crab (1987 recruitment); B are prerecruit one crab (1986 recruitment); C are recruit crab; D are postrecruit crab.

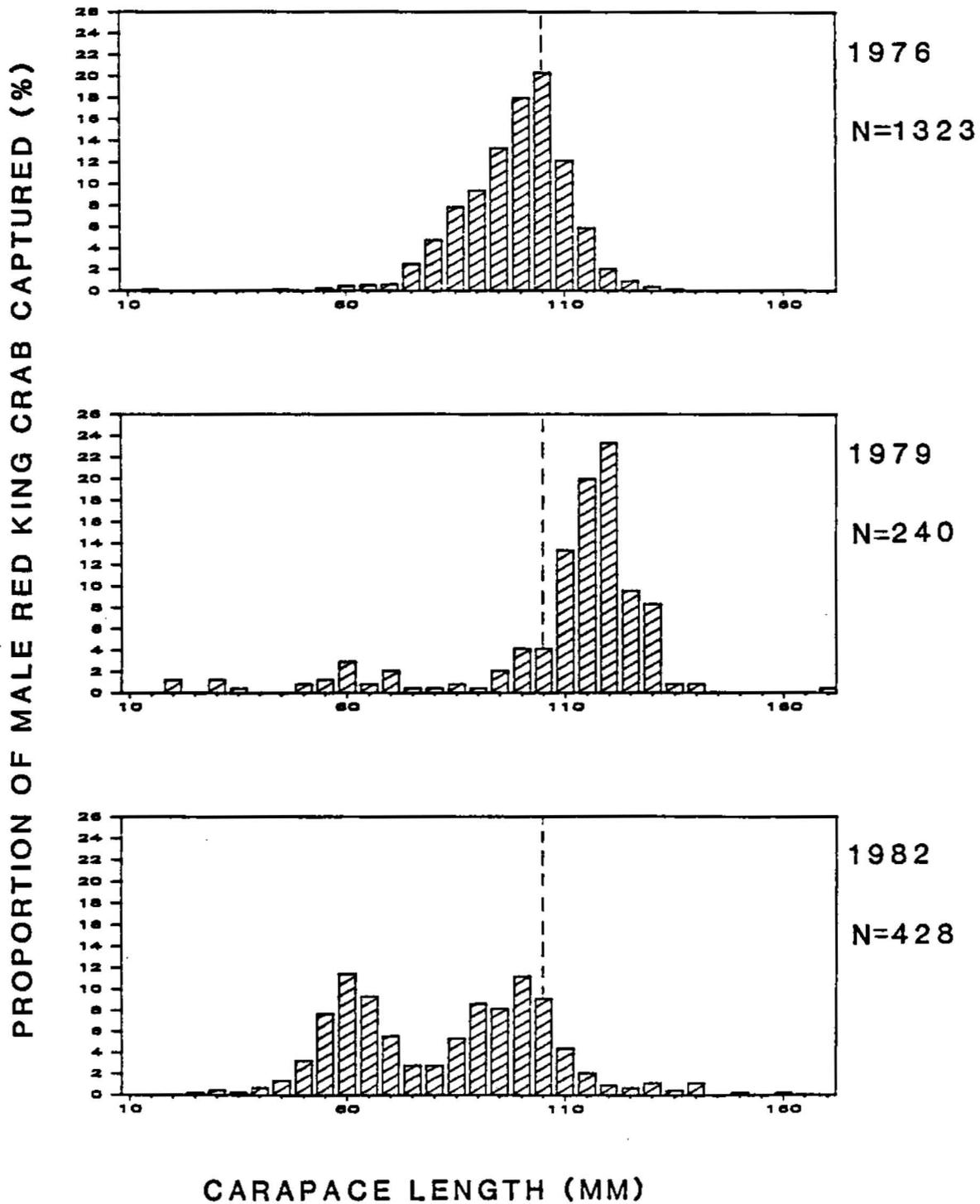


Figure 20. Size structure of the male red king crab population, Norton Sound, Alaska as determined by research fishing, NMFS. Dotted line represents present minimum legal size.

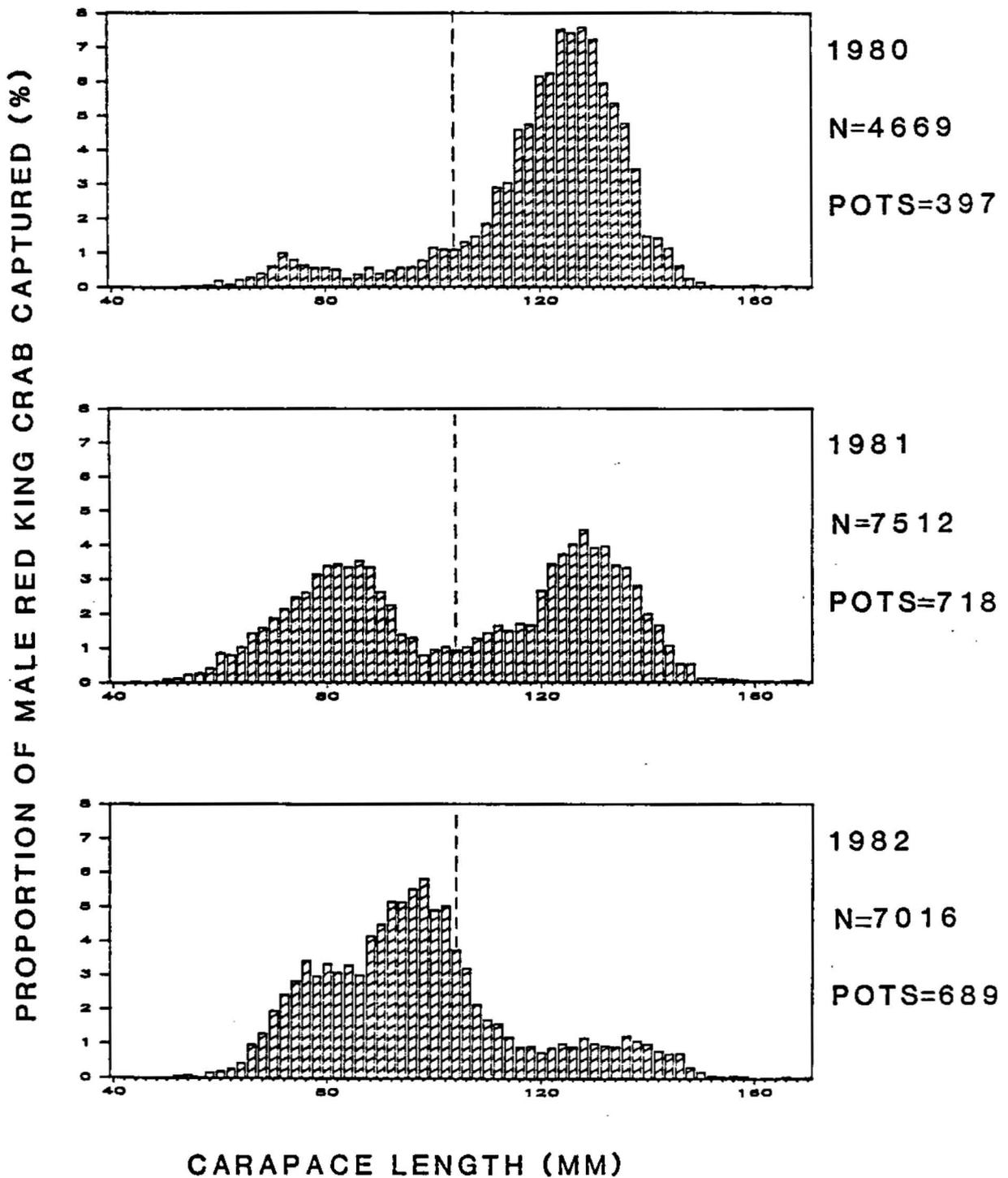


Figure 21. Size structure of the male red king crab population, Norton Sound, Alaska as determined by research fishing, ADF&G, 1980-1982. Dotted line represents present minimum legal size.

PERCENTAGE OF TOTAL SAMPLE

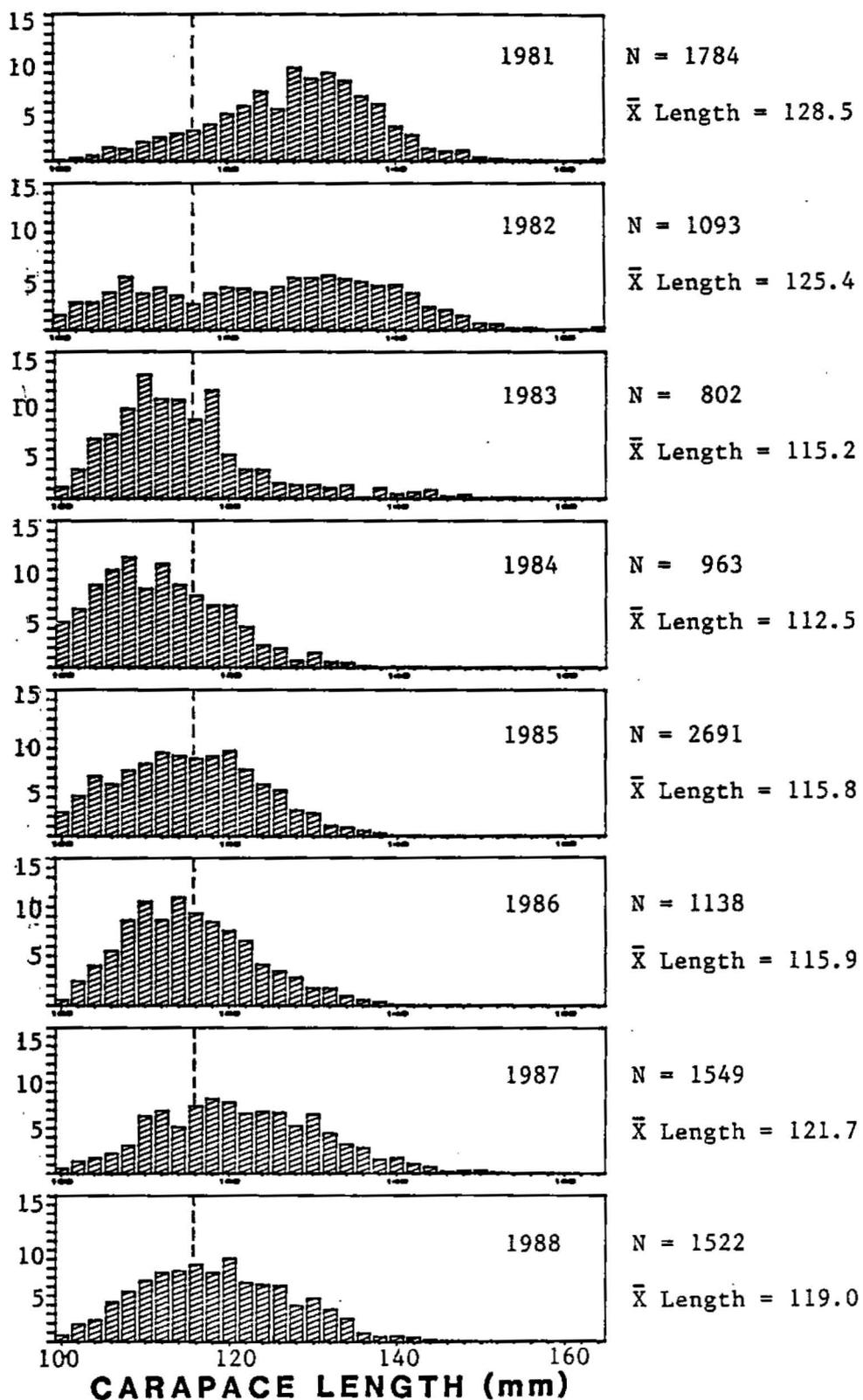


Figure 22. Red king crab commercial catch samples from the Norton Sound section summer fishery, 1981-1988. Crab to the left of dotted lines are recruits.

Appendix Table E1. Comparison of annual commercial harvest of red king crab from Norton Sound, Alaska by statistical areas, 1977-1988 (summer fishery only) (catch in pounds).

Statistical Area	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	Totals
656402	306,302	90,187	288,869	918	3,098	2,832			132,363				824,569
646402	80,969					748							81,717
626402	38,995												38,995
656401			138,011	121,147	253,387	60,480	11,422	183,119	246,200		194,408	165,644	1,373,818
646401			155,972		1,319	17,532							174,823
636401				12,398	61,823	32,246	5,880	41	891				113,279
626401	31,572			4,830	399								36,801
656330			323,518	72,735	395,662	3,983	24,246	83,479	7,632		79,006	36,129	1,026,390
646330					4,716								4,716
626331	40,020						22						40,042
616331	7,893												7,893
656300			161,699		15,174								176,873
666431			146,029										146,029
676501					36								36
666402	12,036	515,778	534,938	183,581		17,585			32,992				1,296,910
676430		3,811	12,309	-0-	373	3,513			1,171				21,177
666401		179,212	486,947	205,400	381,510	79,580	325,045	116,254	5,341	408,848	50,744	21,895	2,260,776
676400		667,130	33,856	274	92,026	1,315			32				794,880
666330		353,016	505,050	367,446	141,513	8,990	1,192		389	70,615	2,963	13,020	1,464,194
676330		51,304	81,798	6,762	18,734	-0-							158,598
686330			1,860										1,860
666300		162,795	60,816	84,874	9,167	95		4,534					322,281
676300		13,238		126,231									139,469
666230		55,490			77								55,567
Grand Totals	517,787	2,091,961	2,931,672	1,186,596	1,379,014	228,921	368,032	387,427	427,011	479,463	327,121	236,688	10,561,693

143

Appendix Table E2. Commercial harvest of red king crab in Norton Sound, summer fishery, 1977-1988.

Year	Legal male pop. est. 1/	Commercial harvest 3/	Number of vessels	Crab/ pot	Avg. wt.	Exvessel price	Fishery value millions \$
1976 ^{2/4/}	8.1	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
1977 ^{5/}	10.0	0.52	7	36	2.7	0.75	0.229
1978 ^{5/}	11.0	2.09	8	64	3.0	0.95	1.897
1979 ^{4/}	5.4	2.93	34	28	3.0	0.75	1.878
1980	6.6	1.19	9	29	3.6	0.75	0.890
1981	4.7	1.38	36	11	3.7	0.85	1.172
1982	1.3	0.23	11	6	3.6	2.00	0.405
1983	2.1	0.37	23	12	2.8	1.50	0.537
1984	2.7	0.39	8	14	2.8	1.02	0.395
1985	2.4	0.43	6	11	2.9	1.00	0.427
1986 ^{6/}	2.8	0.48	3	38	2.9	1.25	0.600
1987 ^{7/}	2.2	0.33	9	10	3.2	1.50	0.491
1988 ^{8/}	3.3	0.24	2	32	3.1	9/	9/

- 1/ Population estimate prior to fishery in given year in millions of pounds.
- 2/ No commercial fishery in 1976.
- 3/ Millions of pounds.
- 4/ Population estimate derived by National Marine Fisheries Service.
- 5/ Population estimate derived from catch per pot from commercial fishery.
- 6/ Population estimate derived from 1985 ADF&G assessment survey.
- 7/ Population estimate based on 1985 assessment survey data and recruitment of current assessment data; estimate probably low due to lack of recent data.
- 8/ Population estimate based on NMFS postseason trawl survey combined with summer fishery harvest; data is preliminary.
- 9/ Data unavailable

Appendix Table E3. Winter commercial and subsistence red king crab harvests, Norton Sound, 1978-1988.

Commercial			Subsistence						
Year 1/	Fisher- men	# Crab Harvested	Winter 2/	Permits Issued	Permits Returned	Permits Fished	Total Crab Caught 3/	Total Crab Harvested 4/	Average Harvest/fm
1978	37	9,625	1977-78	290	206	149	6/	12,506	84
1979	1	221	1978-79	48	43	38	6/	224	6
1980	1	22	1979-80	22	14	9	6/	213	24
1981	0	0	1980-81	51	39	23	6/	360	16
1982	1	17	1981-82	101	76	54	6/	1,288	24
1983	5	549	1982-83	172	106	85	6/	10,432	123
1984	8	856	1983-84	222	183	143	15,923	11,220	78
1985	9	1,168	1984-85	203	166	132	10,757	8,377	63
1986	5	2,168	1985-86	136	133	107	10,751	7,052	66
1987	7	1,040	1986-87	138	134	98	7,406	5,772	59
1988	10	425	1987-88	71	58	40	3,573	2,724	68

1/ Prior to 1985 the winter commercial fishery occurred from January 1-April 30; as of March 1985, the winter commercial harvest may occur from November 15-May 15.

2/ The winter subsistence fishery occurs during months of two calendar years (as early as December through May).

3/ The number of crab actually caught; some may have been returned.

4/ The number of crab "harvested" is the number of crab caught and kept.

5/ Data unavailable.

Appendix Table E4. Results of the population assessment surveys conducted for red king crab in Norton Sound since 1976.

Year	Date	Research Agency	Vessel	Effort	Number of Red King Crab Captured 1/			Population Estimates 3/ of Legal Male crab	
					Sublegal Males	Legal 2/ Males	Females	Numbers	Pounds
1976	9/02 - 9/05 9/16 -10/07	NMFS	Miller Freeman	Trawl 158 Tows	768	555	180	3,119,800	8,111,480
1979	7/26 - 8/05	NMFS	Miller Freeman	Trawl 71 Tows	46	194	40	837,241	2,511,723
1980	7/04 - 7/14	ADF&G	Altair	Pots 397 Lifts	443	3,290	158	1,900,000	6,600,000 4/
1981	6/28 - 7/14	ADF&G	Altair	Pots 718 Lifts	4,097	3,415	1,933	1,285,195	4,755,221
1982	7/06 - 7/20	ADF&G	Aleutian #1	Pots 689 Lifts	5,019	2,001	424	353,273	1,271,783
1982	9/05 - 9/11	NMFS	Miller Freeman	Trawl 50 Tows	322	107	265	970,646	2,620,744
1985	7/01 - 7/14	ADF&G	Arctic Sea	Pots 642 Lifts	6,086	4,645	181	907,579	2,414,644
1985	9/16 -10/01	NMFS	Argosy	Trawl 78 Tows	266	163	151	1,203,000	3,369,000
1988 ^{5/}	8/16 - 8/30	NMFS	Miller Freeman	Trawl 82 Tows	258	141	218	1,037,000	3,038,000

1/ Number of crab captured on ADF&G surveys represent data standardized for a 24 hour soak.

2/ Legal male red king crab were defined as at least 106 mm in carapace length for the 1976 NMFS survey; 105 mm for the 1979, 1985, and 1988 surveys and at least 121mm in carapace width for all ADF&G surveys.

3/ Population estimates are valid for the date of the survey, ie either before or after the summer commercial fishery.

4/ The 1980 estimate has been revised from the original estimate of 13.4 million pounds. The original estimate was thought inaccurate due to under-reporting of recovered tagged crab.

5/ Preliminary data.

Section 4: MISCELLANEOUS SPECIES

Section 4 - MISCELLANEOUS SPECIES

Introduction

Several species other than salmon, crab and herring are utilized for commercial and subsistence purposes in the Norton Sound, Port Clarence and Kotzebue Districts. Primary species include inconnu or "sheefish" (Stenodus leucichthys), whitefish (Coregonus laurettae, Coregonus pidschian, Coregonus sardinella, Coregonus nasus, and Prosopium cylindraceum). (Coregonus sp., Prosopium sp.), Arctic char (Salvelinus malma) and saffron cod (Eleginus gracilis).

The fish are taken by set gill nets, beach seines, "jigging" through the ice, and rod and reel. Subsistence catches taken during the summer months are normally sun-dried, while winter catches are stored frozen. Fish are utilized both for human consumption and for dog feed. Fish taken for commercial purposes are mainly sold locally, although some are shipped from the area.

Subsistence harvest of most species is not limited by regulation. Commercial harvest may be prohibited in some freshwater areas, but limited commercial endeavors are allowed in many areas under terms of a permit.

Inconnu (Sheefish)

The distribution of inconnu includes the Kobuk-Selawik River drainages, and Hotham Inlet of Kotzebue Sound and some Norton Sound drainages, but the largest populations and harvests occur within the former area (Figure 23). In the Kotzebue Sound area, adult fish migrate to upriver spawning areas after ice breakup and to wintering areas within the Hotham Inlet/Selawik Lake area during October-November. Although inconnu are capable of consecutive spawning, most fish spawn every two to three years. Inconnu mature slowly with males reaching maturity at 5-7 years of age and females at 7-11 years.

The inconnu's spawning and overwintering migration behavior makes them available for harvest by the various fisheries throughout their life cycle, and increases their vulnerability to overharvest. In addition, the inconnu's slow maturation rate increases the time required to restore depleted populations.

During the 1960's, age, sex and length data indicated stocks were being overharvested by the commercial and subsistence fisheries in the Kotzebue district. Consequently, an annual

area commercial harvest quota of 25,000 pounds of inconnu was instituted, although subsistence catches remained unrestricted.

Commercial Fishery

Most of the commercial fishing effort occurs near Kotzebue in Hotham Inlet. Fishermen use gill nets ranging from 5 1/2 inch - 8 inch stretched mesh which are set under the ice. Recorded commercial catches have remained relatively small; however, undocumented catches are believed to be significant and therefore, harvest totals should be considered minimum estimates. During the winter of 1986-87, three commercial fishermen reported sales of approximately 670 inconnu weighing 5,414 pounds (Appendix Table F1). Restricted markets outside northwestern Alaska limits commercial activity greatly and most individuals who normally participate in the winter commercial fishery also fish for subsistence purposes. During some years, incidentally caught inconnu are also sold by commercial salmon fishermen when there is a market, but only in small amounts.

Preliminary catches to date during the fall months of the 1987-1988 fishery indicate a harvest of 327 inconnu weighing 3,389 pounds. The average price paid to the three participating fishermen has been 51 cents per pound.

Additionally, a small miscellaneous species commercial fishery exists in Selawik. However, during 1987 and 1988, no deliveries of sheefish were reported from Selawik.

Subsistence Fishery

Inconnu have long been utilized for subsistence purposes throughout the Kotzebue Basin. Fishermen along the upper Kobuk River fish for inconnu during June through October, while the lower Kobuk and Selawik River residents fish during April through June. Kotzebue and Selawik fishermen fish in the Hotham Inlet and Selawik Lake during the winter months.

The 1986-87 winter subsistence harvests of inconnu in Kotzebue Sound and Selawik Lake were not recorded because commercial fisheries staff are not available in Kotzebue during the winter months. Historical reported catches are presented in Appendix Table F2.

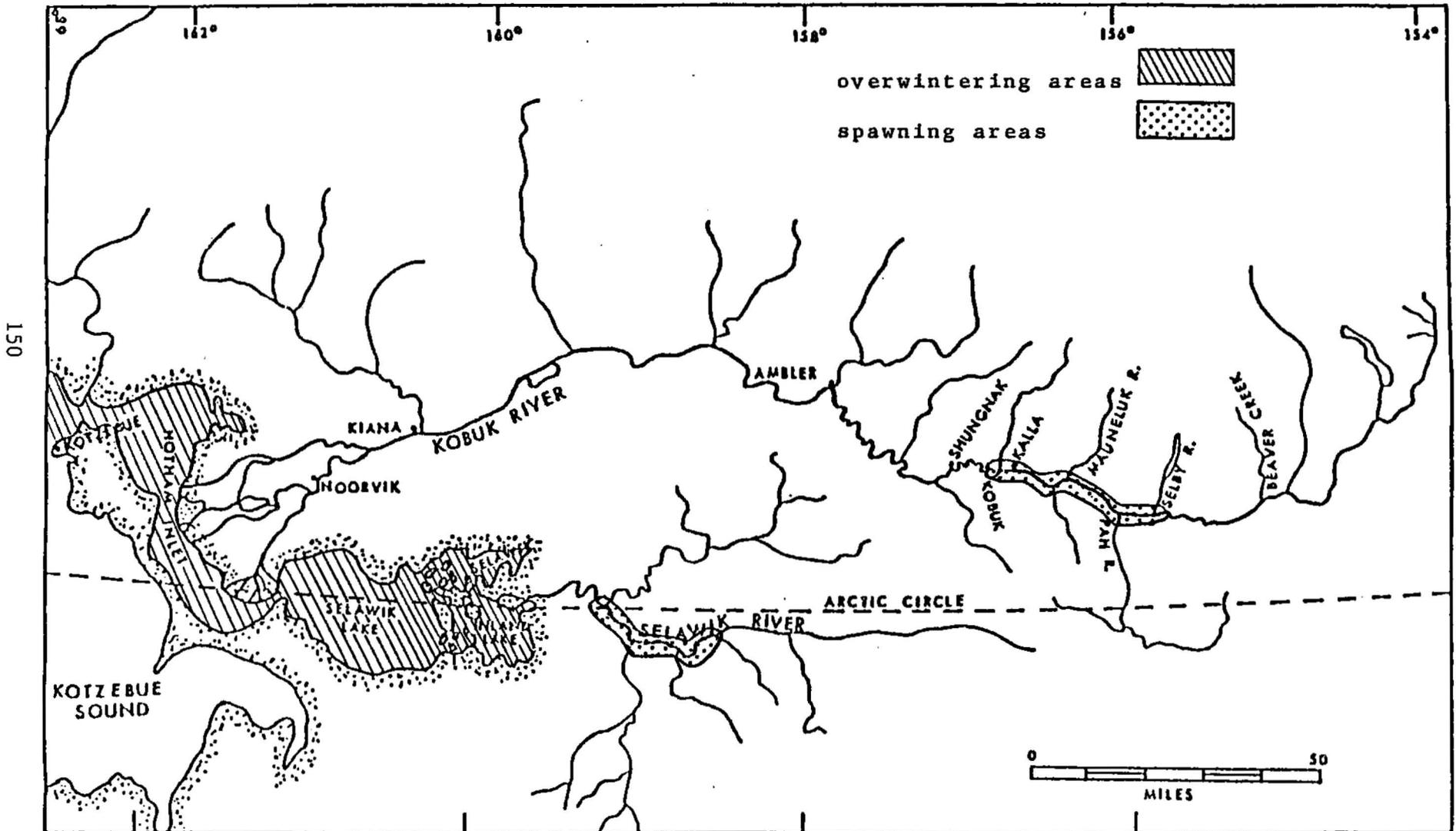
During the fall of 1988, household interviews were conducted to document subsistence finfish catches, primarily salmon, by residents of the Kotzebue District. Household surveys were conducted in Shungnak, and Noorvik. The survey of the village of Noatak, which is usually surveyed in the fall, was cancelled after several attempts due to poor weather. Other villages were not surveyed due to budget restrictions. Mail-in survey

calendars were not distributed so subsistence harvest information should be considered very minimal. Few inconnu had been harvested at the time of the survey; many fishermen were still fishing.

Escapement

In recent years aerial surveys have been conducted on key inconnu spawning areas incidental to the effort of enumerating salmon. These surveys have primarily been conducted along the upper Kobuk River in September. Survey conditions historically result in either very few or no inconnu being observed. During these surveys, species identification has been a problem in some years. A total of 250 inconnu were counted in September of 1981 in the Kobuk River. None were seen at all in 1982, primarily because of marginal survey conditions. During September of 1983, a total of 1,009 inconnu were counted. In surveys conducted in September of 1984, viewing conditions were unusually excellent and salmon and inconnu were easily distinguished. A total of 2,604 inconnu were counted in the upper Kobuk River. Surveys were not conducted during 1985 and 1986 due to high, turbid water conditions. Surveys were not conducted for inconnu in 1987 nor 1988 due to inclement weather and lack of personnel. Escapement counts throughout the period of 1980 through 1983 were probably low because of poor survey conditions, inexperienced observers, and a survey date that targets spawning chum salmon instead of inconnu. Historical escapement data is presented in Appendix Table F3. Incomplete escapement and catch data provide little basis for assessing the current population status of inconnu in the Kotzebue district, however there is some local concern that the inconnu stocks are declining.

Figure 23. Kotzebue and Kobuk River Valley villages and their spatial relationship with Inconnu spawning and overwintering areas.



Appendix Table F1. Winter commercial inconnu harvest statistics, Kotzebue, 1966-1988. 1/ 8/

Year	Number of Fishermen	Number of Fish	Pounds		Price (Per Pound)
			Total	Avg.	
1966-67	2/	4,000	26,000	6.5	1.40 3/
1967-68	10	992	6,000	6.1	1.50 3/
1968-69	17	2,375	15,438	6.5	.91 3/
1969-70	2/	2,206	2/	2/	1.30 3/
1970-71	4	350	3,407	9.7	1.43 3/
1971-72	5	456	4,071	8.9	1.43 3/
1972-73	11	2,326	15,626	6.7	.20
1973-74	6	1,087	6,265	5.8	.30
1974-75	2/	2,538	24,162	9.5	.30
1975-76	14	2,633	19,484	7.4	.30
1976-77	2	1,060	9,540	9.0	.30
1977-78	11	2,879	26,200	9.8	.40
1978-79 4/					
1979-80	4	1,175	8,225	7.0	.50
1980-81	1	278	1,836	6.6	.75
1981-82	11	2,632 5/	17,376	6.6 5/	.75
1982-83	8	1,424	13,395	9.4	.50
1983-84	5	927 6/	10,403	11.2	.55
1984-85	4	342 6/	3,902	11.4	.51
1985-86	2	26	312	12.0	.75
1986-87	3	670	5,414	8.1	.49
1987-88	3	943	7,373	7.8	.45
1988-89 7/	7	1,544	11,148	7.2	2/

- 1/ Data is not exact: e.g. in some instances total catch poundages were determined from average weight and catch data. Similarly, various price/pound figures were determined from price/fish and average weight data.
- 2/ Data unavailable.
- 3/ Price/fish.
- 4/ No reported commercial catches.
- 5/ Estimate based on historical average weight.
- 6/ Number of fish not always reported. Estimates were made based on average weight from reported sale which documented the number of fish.
- 7/ Preliminary data; fishery is ongoing.
- 8/ Fishery data corrected and updated in 1988 AMR for many of the early year fisheries.

Appendix Table F2. Reported subsistence inconnu catches, Kotzebue District, 1966-1988. 1/ 4/

Year	# of Fishermen Interviewed	Reported Harvest	Average Catch per Fisherman
1966-67	135	22,400	166
1967-68	146	31,293	214
1968-69	144	11,872	82
1970	168	13,928	83
1971	155	13,583	88
1972	79	3,832	49
1973	65	4,883	75
1974	58	1,062	18
1975	69	1,637	24
1976	57	966	17
1977	95	1,810	19
1978	95	1,810	19
1979	75	3,985	53
1980	74	3,117	42
1981	62	6,651	107
5/82-4/83 2/3/	130	4,704	36
5/83-4/84 2/3/	27	764	28
5/84-9/84 2/	30	2,803	93
1985 5/	2	60	30
1986 3/ 5/	72	721	10
1987 5/	46	276	6
1988 5/ 6/			

- 1/ To obtain individual village catches during years previous to 1982 refer to the 1982 Annual Management Report.
- 2/ Catch by village for these years are presented in separate tables in respective year annual management reports.
- 3/ Summer catches only; winter catches were not documented.
- 4/ Due to limited survey effort during many years total catch and effort should be regarded as minimum figures only and are not comparable from year to year.
- 5/ Villages were not surveyed for subsistence inconnu harvests from 1985 to present; figures shown are catches reported during the fall chum salmon subsistence surveys, and may include summer as well as winter catches.
- 6/ Subsistence inconnu catches not documented.

Appendix Table F3. Annual aerial survey counts of inconnu in the Kobuk and Selawik Rivers, 1966-1988.

Date	Kobuk River	Selawik River	Total
09/05/66	1,200	2/	1,200
09/22/67	1,025	2/	4,359
09/14/68	4,973	1,234	6,207
09/10/69	3,654	2/	3,654
09/05/70	3,220	2/	3,220
08/30/71	8,166	1,196	9,362
08/22/72	1/	2/	-
1973	2/	2/	-
08/21/74	1/	2/	-
08/24/75	1/	2/	-
09/02/76	73	2/	73
1978	2/	2/	-
09/12/79	2,824	2/	2,824
09/11/80	1,772	2/	1,772
09/15/81	250 3/	2/	250
1982	1/	2/	1/
09/19/83	1,009 3/	2/	1,009
09/05/84	2,604	2/	2,604
1985	2/	2/	-
1986	2/	2/	-
1987	2/	2/	-
1988	2/	2/	-

1/ No fish reported.

2/ Not surveyed.

3/ Probably more inconnu than listed; species identification problems.

Char

Introduction

Char (~~Salvelinus malma~~) are distributed throughout the Norton Sound, Port Clarence, and Kotzebue districts. Although taxonomists have disagreed on the distinguishing characteristics and distribution of Arctic char and Dolly Varden, most taxonomists now agree that char in this area are the northern form of Dolly Varden. In order to eliminate confusion, in this report these fish will be referred to as char, the common name for this species complex.

Char in this area are primarily nonconsecutive spawners and spawn throughout the late summer and fall. Fry emerge in the spring and migrate to the ocean during early summer after spending from 1 to 6 (generally 2-5) years in freshwater. Since char are a late-maturing fish (generally age 6-7), they are susceptible to overfishing by commercial, subsistence, and/or sport fisheries. Consequently, commercial fisheries have been maintained at low levels or prohibited to both reduce the potential of overharvest and provide for reproductive and subsistence fishery needs.

Commercial Fishery

Char are taken incidentally to chum salmon in the Kotzebue commercial fishery. Regulation changes in 1976, which closed the commercial salmon fishery on August 31, have reduced the harvest of char since in most years char are primarily available for harvest during September. Char generally appear in commercial catches during the last three weeks of August. A total of 752 char were sold for 35 cents per pound in the 1988 fishery (Table 23). Three buyers purchased char this year. An average of 2,562 char were sold annually during 1978, 1979, 1980, and 1982. These are the only years of a significant char market in the recent history of the fishery. The 1988 char harvest was less than one-third of this average. Historically, most char are caught in commercial nets in the latter part of August. In addition, many fishermen keep the char they catch for personal use and commercial catch figures may not reflect the actual number of char caught. In the past, a higher percentage of the char have been caught on the Sisualik side (77% in stat areas 331-02 and 331-05 during 1988); a decrease in effort in this portion of the district may partially explain the low commercial catch of char in 1988. Char averaged 6.6 pounds.

Although small quota (2,500 pounds) freshwater fisheries exist within Norton Sound, no permits were requested during 1988. No

freshwater permits were requested in the Port Clarence district.

Subsistence Fishery

Char are an important component in the diet of subsistence users in the Norton Sound-Kotzebue Sound areas. Subsistence fishermen catch char with seines in the fall, hook and line through the ice in the winter, and gill nets in the spring. The fall seine fishery contributes the greatest number of fish to the annual subsistence char harvest. Since 1962, seine catches made by the residents of Kivalina, within the Kotzebue District, have ranged from 12,000 to 49,000 char annually (Appendix Table F5). Fall seine fishing is a group effort with several households comprising a fishing group. The catch is stored and allowed to freeze in willow cribs located near the seining site. These fish are used throughout the winter by the fishing group (DeCicco 1985).

Due to lack of funding and personnel, annual subsistence char surveys were not conducted in Kivalina in 1987 nor 1988. Reports of subsistence char harvests were few during the September subsistence salmon surveys in Shungnak and Noorvik, and were not quantified since most households had not completed fall seining activities. Historical subsistence char catches are summarized in Appendix Table F5. It should be pointed out that these are very minimal figures due to the timing of the surveys conducted. Most char harvest in the villages listed above takes place prior to or just after freeze-up. The village of Noatak usually fishes prior to freeze-up, while the Kobuk River villages of Shungnak and Noorvik fish for char throughout the winter. No subsistence surveys were conducted in Noatak this season.

Most villagers in the Norton Sound District report incidental catches of char in their subsistence salmon nets. However, the bulk of the catch is taken by seining in the late fall, after Department subsistence surveys have been completed, making it difficult to estimate subsistence catches in the Norton Sound District. Due to budget restrictions, no subsistence surveys were conducted in the fishing villages of Norton Sound in 1988.

Sport Fishery

Residents of the Kotzebue area and nonlocal residents on wilderness boating trips on the Kobuk and Noatak Rivers are the primary participants in the char sport fishery in the Kotzebue area watershed. Approximately 1,455 char are taken in this fishery annually (Sport Fish Division surveys).

Overwintering Counts

Aerial survey counts of overwintering char on the Wulik River have ranged from 297,257 char in 1969 to 30,923 char in 1984 (Appendix Table F6). Weather and water conditions have precluded flying aerial surveys during many years. When weather permits, Division of Sport Fisheries personnel conduct aerial surveys of the spawning grounds on the Noatak River in the summer and overwintering areas of the Kivalina and Wulik Rivers in the fall. No aerial surveys for spawning nor overwintering populations of char were flown in the Kotzebue District river drainages during 1987. During the fall of 1988, 80,000 overwintering char were counted on a partial survey of the Wulik River under poor to fair conditions (Sport Fish Division survey). An early and rapid freezeup prevented subsequent survey attempts.

Table 23. Incidental char catches in the Kotzebue District commercial salmon fishery by fishing period, 1988.

Period	Dates	Hours Fished	Number of 1/ Fishermen	Char 2/	
				Number	Pounds
09	8/08-8/10	48	165	3	20
11	8/15-8/16	36	134	4	11
12	8/18-8/19	36	124	284	1,808
13	8/22-8/23	36	92	310	2,017
14	8/25-8/26	36	58	131	975
15	8/29-8/30	36	36	20	136
Totals		228	193	752	4,967

1/ Reflects the total number of fishermen delivering during each salmon fishing period shown.

2/ Includes only the number and pounds of char actually sold.

Appendix Table F4. Char harvested incidentally during the commercial salmon fishery, Kotzebue District, 1966-1988.

Year	# of Fish Sold	Estimated Total Catch 7/	Pounds Sold 4/	Average Weight lbs.	Average Price/lb.
1966	3,325			7-10	.55 6/
1967	367		2,606	7.1	.11
1968	3,181		21,949	6.9	.14
1969	1,089 1/		-	-	2.84 6/
1970	2,095		-	-	-
1971	3,828 2/		23,353	6.4	.16
1972	7,746		56,545	7.3	.17
1973	640		4,608	7.2	.16
1974	2,605 3/		20,580	7.9	.16
1975	-		-	-	-
1976	-		-	-	-
1977	-		-	-	-
1978	1,229		9,094	7.4	.15
1979	2,523		12,523	5.0	.25
1980	3,049		17,015	5.6	.20
1981	3 5/		16	5.6	.17
1982	3,447		23,648	6.9	.20
1983	190 5/	845	1,108	5.8	.20
1984	347 5/	1,090	2,104	6.1	.25
1985	454	3,600	3,177	7.0	.25
1986	5 5/	2,373	34	6.8	.20
1987	1,261	8/	8,704	6.9	.30
1988	752	8/	4,967	6.6	.35

1/ Includes 269 taken by permit.

2/ Includes 179 taken by permit.

3/ Includes 234 taken during commercial inconnu fishery.

4/ Some data extrapolated from average reported weight.

5/ Limited char market; many fish used at home or dumped.

6/ Price per fish.

7/ Estimate includes fish caught but not sold based on interview of fishermen.

8/ Estimate of char caught (but not sold) not made.

Appendix Table F5. Fall subsistence catches of char documented in Kivalina and Noatak, 1959-1988.

Year	Kivalina		Noatak
	Number	Pounds	Number 4/
1959 1/	34,240	85,600	-
1960 1/	49,720	124,300	-
1962	-	-	27,623
1963	-	-	4,130
1968	49,512	120,214	5/
1969	64,970	152,750	32,350
1970	33,820	79,420	3,700
1971	29,281	68,518	5,320
1972	48,807	114,637	1,492
1973 2/			
1979	14,600 3/	-	9,060
1980	-	-	7,220
1981	15,000-18,000 3/	-	3,056
1982	18,438 5/	-	2,676 2/6/
1983	16,270 3/	-	4,545
1984	12,000 3/	-	2,542
1985	10,500 3/	-	7/
1986	7,436 3/	-	46 8/
1987	7/	-	1,376 8/
1988	7/	-	7/

1/ From Saario, Doris J. and Brina Kessel, Environment of Cape Thompson Region, Alaska, published by the U.S. Atomic Energy Commission, 1966.

2/ Storm and ice conditions prevented fall harvest.

3/ Harvest data from Sport Fish Division survey.

4/ No data available on poundage.

5/ Harvest data from Stephen Braund and Associates.

6/ Expanded estimate (see text on subsistence fishery in 1982 Annual Management Report).

7/ Not surveyed.

8/ Subsistence fishermen just beginning to seine at time of the survey.

Appendix Table F6. Aerial survey counts of overwintering char in the Kotzebue District watershed, 1968-1988.

Year	Noatak River Drainage Index Streams 1/	2/5/ Wulik River	2/5/ Kivalina River
1968	-	90,236	27,640
1969	2/ 21,000 3/	297,257	-
1976	-	68,300	12,600
1977	4/ -	-	-
1978	4/ -	-	-
1979	-	55,030	15,744
1980	45,185 3/	113,553	39,692
1981	5,873	101,826	45,355
1982	6,088	65,581	10,932
1983	4,144 3/	4/	4/
1984	7,444	30,923	5,474
1985	-	-	-
1986	2,025 6/	5,590	5,030
1987	7/	7/	7/
1988	7/	80,000 3/	7/

- 1/ Includes July spawner count on the Kelly and Kugururok Rivers, tributaries of the Noatak.
- 2/ Overwintering char counts conducted in September.
- 3/ Incomplete survey.
- 4/ Poor weather hampered/prevented survey.
- 5/ Surveys conducted by Sport Fish Division since 1979.
- 6/ Summer spawner count only from the Kelly River. No other Noatak River drainages were surveyed due to poor weather in 1986.
- 7/ Not surveyed.

Whitefish

Introduction

Although inconnu belong to the whitefish family, this section deals with several smaller species of the genera Coregonus and Prosopium. The genus Coregonus contains the "broad" and "humpback" whitefish or C. nasus and C. pidschian, respectively. In addition, three whitefish species known as "ciscoes" belong to this genera; ie., the least cisco (C. sardinella), Arctic cisco (C. autumnalis) and Bering cisco (C. laurettae). "Round" whitefish (Prosopium cylindraceus) are the sole representatives of the genus Prosopium in this area. All species normally spawn in the fall in freshwater.

Whitefish occur throughout most bodies of freshwater in the Norton Sound/Port Clarence/Kotzebue areas and can also be found in inshore marine waters at various times of the year.

Whitefish are harvested to a very limited extent by the commercial and sport fisheries within the area, but are uniformly important to the various subsistence fisheries. Recently, there has been increasing interest in commercial development of this resource, especially in the Kotzebue district.

Commercial Fishery

Limited commercial whitefish harvests have been allowed since statehood, normally under the auspices of a permit which delineated harvest levels, open areas, legal gear, etc. Commercial whitefish fisheries have generally been limited to large open water areas (e.g. Grantley Harbor in the Port Clarence district) or ocean waters. Beach seines have been stipulated as legal gear in some instances in order to reduce the number of incidental species taken. Little comparative commercial catch and effort data have been recorded, but harvest levels have historically been low. A majority of the commercial catches have been made in Golovin Bay within Norton Sound, in the Kuzitrin River of the Port Clarence district, and in Hotham Inlet and Selawik River in the Kotzebue district. The fish have been sold to local markets for human consumption, dog food, or more recently, crab bait.

During 1987 and 1988, no whitefish permits were requested in the Norton Sound nor Port Clarence districts.

In the Kotzebue district, a permit to harvest up to 15,000 pounds of whitefish and 3,000 pounds each of pike and burbot was issued to Selawik Fish Project in 1986. The season

extends from April to December. Fish sold during June and July of 1986 were purchased as dried fish with an assumed fresh weight of 3 pounds per whitefish (primarily broad and humpback whitefish). A total of 616 whitefish (1,848) pounds were landed by beach seine and gill net. Fishermen received \$11 per string of 8 whitefish. Nine permit holders participated in this fishery. Burbot and pike sales were also reported from the Kotzebue district, but will be discussed in the Miscellaneous Finfish Species section. The Selawik Miscellaneous Fish project did not operate during the 1987 nor 1988 seasons.

Subsistence Fishery

Whitefish have been taken mainly by beach seine or set gill nets. Catches are usually dried and used for human consumption or dog food. In some areas fish are "gutted" and dried early in the summer, while later in the summer the fish are filleted and dried with the eggs and viscera intact.

Subsistence catch enumeration is difficult since fishermen do not count fish individually, but by "tubs", "bags", "strings" or any other estimators of gross abundance. Additionally, many fish have been dried and consumed or stored in caches prior to the survey period. Reported subsistence harvests are the result of a limited and sporadic survey effort and should be regarded as minimum figures and not comparable from year to year. Although most households were still fishing at the time of the fall subsistence salmon survey in 1988, catches of 4,000 and 10,000 whitefish were reported from Noorvik and Shungnak, respectively. Recent and historical subsistence harvest figures for the Kotzebue district are presented in Appendix Table F7 by year.

Escapement

Whitefish escapements have not been monitored in the past, but there have been no indications from limited Department observations or fishermen interviews of declining populations.

Appendix Table F7. Subsistence whitefish catch and effort data, Kotzebue District, 1970-1988. 1/

Year	Fishermen Interviewed	Number of Fish
1970		58,165
1971		36,012
1974-1976	2/	2/
1977		30,810
1978		77,474
1979	123	43,653
1980	67	49,106
1981	71	37,746
1982	2/	2/
1983	47	16,389
1984	79	28,614
1985 3/	46	5,229
1986 4/	72	11,854
1987 4/	46	20,020
1988 5/	38	14,000

- 1/ Data unavailable prior to 1970. Systematic whitefish catch surveys have never been conducted in the area. This information was collected incidentally with late summer salmon surveys and probably represents only a small fraction of the catch made on a year round basis.
- 2/ Data unavailable.
- 3/ Data was expanded based on limited interviews and represents the approximate harvest of fishermen contacted in Kiana and Shungnak only. These figures should be considered very minimal.
- 4/ Data represents harvest reported from interviews of subsistence fishermen in Shungnak, Noorvik, and Noatak only. Since not all fishermen were contacted and fishing was still occurring at the time of the survey, these figures should be considered minimal.
- 5/ Data represents harvest reported during fall chum subsistence surveys in Noorvik and Shungnak only; most families still fishing.

Saffron Cod

Saffron cod, or tomcod as they are called locally, are extensively utilized as a subsistence resource in the Norton Sound, Port Clarence and Kotzebue districts. Tomcod are taken through the ice by jigging as well as with gill nets in open water.

There has never been an extensive commercial fishery on tomcod in the Norton Sound, Port Clarence or Kotzebue areas. During 1980, one fisherman caught and sold 89 pounds (98 tomcod) in the Nome subdistrict. There were no commercial landings during 1982. In 1983, one Nome area fisherman caught and sold 2,548 pounds (4,348 tomcod) locally. These fish were used for dog food, crab bait and human consumption. No commercial deliveries were reported in during 1984-1988.

The Alaska Native Foundation undertook a feasibility study for the development of a dried saffron cod fishery in the Port Clarence/Shishmaref area in 1980. Samples taken to prospective buyers and various markets proved that an economically viable commercial fishery does not exist for this species in this area. If marketing conditions improve and if local residents are willing to participate in a labor intensive dried saffron cod fishery, a commercial fishery for saffron cod could develop.

Miscellaneous Finfish Species

Other finfish species taken for subsistence in the Norton Sound-Port Clarence-Kotzebue area include: rainbow smelt (boreal smelt), capelin, northern pike, starry flounders, yellow fin sole, arctic flounder, Alaska plaice, grayling, and burbot (Appendix G1).

Subsistence utilization of these species has been documented although effort and catch vary widely in scale and importance with locality. Some of these species are important to the subsistence community in certain localities during specific seasons of the year.

Until 1984, sale of any of these species had never been documented in this area, although unreported sales had occurred. The City of Selawik Cooperative Whitefish Project was issued a permit allowing a harvest and sale of up to 1,000 pounds each of burbot and pike as an incidental part of their commercial harvest of whitefish. A total of 1,232 pounds of pike were reported sold locally as dried fish. An amendment to the existing permit was granted allowing up to 1,332 pounds of pike to be harvested so a shipment of an additional 100 pounds could be allowed for a frozen fish market test. No sales of burbot from the Selawik area were reported in 1984. In 1985, the City of Selawik was issued a permit allowing a harvest of up to 3,000 pounds each of burbot and pike as an incidental part of their commercial whitefish harvest. The total reported harvest of burbot was 81 fish weighing 607 pounds for which the fishermen received \$.85 per pound. Pike were sold as fresh or dried fish. A total harvest of 1,228 pike was reported; 196 fish weighing 918 pounds were sold for \$.85 per pound; 1,031 pike were sold as dried fish for which fishermen received \$12.00 per string of 6 fish (no weights given). The dollar value of the dried pike was thus \$2,064.00; the total dollar value of burbot and pike combined was \$3,360.00 during 1985.

In 1986, the City of Selawik was granted a permit to harvest 3,000 pounds each of pike and burbot. A total of 546 pike (approximately 4,368 pounds) were landed by beach seine and gill net and sold. Fishermen received \$12 per string of 6 pike. An assumed weight of 8 pounds per pike was used since these fish were sold as dried fish. No burbot sales were reported. The City of Selawik did not request permits to harvest miscellaneous fish in 1987 nor 1988.

Additionally, 65 burbot (294 pounds) were reported sold from (\$.75 per pound) the Noatak River by catcher-sellers in 1986.

No freshwater fishery permits for pike and burbot were

requested in 1986 nor 1987 in the Norton Sound or Port Clarence districts.

There is little information available on the population status and dynamics of many of these species, but there has been no evidence based on limited Department observations and interviews with fishermen, that any of these species are declining in numbers.

Appendix G1. List of common and scientific names of finfish species of the Norton Sound-Port Clarence-Kotzebue Districts.

Arctic lamprey	<i>Lampetra japonica</i>
Arctic char	<i>Salvelinus alpinus</i>
Arctic cod	<i>Boreogadus saida</i>
Arctic flounder	<i>Liopsetta glacialis</i>
Arctic grayling	<i>Thymallus arcticus</i>
Alaska plaice	<i>Pleuronectes quadrituberculatus</i>
Burbot	<i>Lota lota leptura</i>
Bering cisco	<i>Coregonus laurettae</i>
Bering poacher	<i>Ocella dodecaedria</i>
Bering wolffish	<i>Anarhicas orientalis</i>
Blackfish	<i>Dallia pectoralis</i>
Boreal smelt (rainbow-toothed)	<i>Osmerus epselanus</i>
Broad whitefish	<i>Coregonus nasus</i>
Capelin	<i>Mallotus villosus</i>
Dolly Varden	<i>Salvelinus malma</i>
Pond smelt	<i>Hypomesus olidus</i>
Humpback whitefish	<i>Coregonus pidschian</i>
Inconnu (sheefish)	<i>Stenodus leucichthys</i>
Lake trout	<i>Salvelinus namaycush</i>
Least cisco	<i>Coregonus sardinella</i>
Longhead dab	<i>Liranda proboscidea</i>
Ringtail snailfish	<i>Liparis rutteri</i>
Northern pike	<i>Esox lucius</i>
Longnose sucker	<i>Catostomus</i>
Pricklebacks	<i>Stichaeidae</i>
Pacific herring	<i>Clupea harengus pallasii</i>
Rock flounder	<i>Lepidosetta bilineata</i>
Rock greenling (terpug)	<i>Hexagrammus lagocephalus</i>
Round whitefish	<i>Prosopium cylindraceum</i>
Sculpins	<i>Cottidae</i>
Pink salmon	<i>Oncorhynchus gorbuscha</i>
Chum salmon	<i>Oncorhynchus keta</i>
Coho salmon	<i>Oncorhynchus kisutch</i>
Sockeye salmon	<i>Oncorhynchus nerka</i>
Chinook salmon	<i>Oncorhynchus tshawytscha</i>
Saffron cod	<i>Eleginus gracilis</i>
Starry flounder	<i>Platichthys stellatus</i>
Sandlance	<i>Amrodytes hexapterus</i>
Sturgeon poacher	<i>Agonus acipenserinus</i>
Threespine stickleback	<i>Gasterosteus aculeatus</i>
Ninespine stickleback	<i>Pungitius</i>
Tubenose poacher	<i>Pallasina barbata</i>
Whitespotted greenling	<i>Hexagrammus stelleri</i>
Yellowfin sole	<i>Limanda aspera</i>

Appendix G2. Studies conducted within the Norton Sound-Port
Clarence-Kotzebue Districts, 1988.

1. Kwiniuk River salmon counting tower

- a) Location:
About five miles upstream from the mouth of
the Kwiniuk River in Norton Sound.
- b) Objectives:
Determine daily and seasonal timing and
magnitude of chum and pink salmon runs.
Determine age, sex and size of chinook and
chum salmon of the commercial harvest in
Moses Point subdistrict.
- c) Results:
An expanded total of 321 chinook, 187,904
pink and 13,301 chum salmon was counted
past the tower. The chum salmon sampled in
the commercial catch were 1.0% 0.2 (age 3)
68.0% 0.3 (age 4), 28.0% 0.4 (age 5), 1.0%
0.5 (age 6), and 1.0% 0.6 (age 7).

2. Unalakleet salmon escapement studies

- a) Location:
Unalakleet River
- b) Objective:
1) To maintain an index of salmon migration
up the Unalakleet River using test gill
nets.
- c) Results:
1) The mean day of catch for chinook, chum,
pink, and coho salmon was 6/24, 7/22, 7/04,
and 8/12, respectively. The peak daily
catch of chinook, chum, pink, and coho
salmon occurred on 6/22, 7/27, 7/11, and
8/08, respectively.

2) The predominant age class in the test
fish catch by the European aging method, by
species was: chinook salmon 1.3 (age 5),
chum salmon 0.3 (age 4) and coho salmon 2.1
(age 4).

3) The predominant age class in the

commercial catch by the European aging method, by species was: chinook salmon 1.4 (age 6), chum salmon 0.3 (age 4) and coho salmon 2.1 (age 4).

3. Noatak River test fish project

a) Location:
Lower Noatak River

b) Objectives:

1) To evaluate the feasibility of indexing chum salmon escapement in the Noatak River using systematic drift gill net catches.

2) Begin historical database of chum salmon escapement:

a. Index escapement abundance on a daily and seasonal basis for the Noatak River chum salmon return.

b. Describe the migratory timing of chum salmon in the Noatak River.

c. Estimate the age composition of the Noatak River chum salmon escapement.

c) Results:

1) Fishing began on July 19 and continued through August 25. The data collected was of minimal use for inseason management since just one other year (1987) of data from this fishing site exists for comparison.

2) A total of 1,409 chum salmon were caught in a total of 83 drift time periods.

3) Scale sample analysis from 1,259 chum salmon caught in test drift nets indicated an age composition of 11.5% 0.2 (age 3), 71.9% 0.3 (age 4), 14.9% 0.4 (age 5), 1.5% age 0.5 (age 6), and 0.2% 0.6 (age 7).

4. Subsistence fishing surveys

a) Location:

Norton Sound and Kotzebue Districts.

- b) Objectives:
Determine subsistence utilization of salmon for formulating management procedures and goals. House-to-house surveys were conducted in the Kotzebue district Kobuk River villages of Shungnak and Noorvik. Subsistence salmon permit returns in the Nome subdistrict was the only data collected in the Norton Sound district. The remaining fishing villages of the Norton Sound and Kotzebue districts, and the Port Clarence district, were not surveyed due to budget limitations.
- c) Results:
 - 1) A total of 41 households were surveyed in the Kotzebue district villages of Shungnak and Noorvik. The total reported chum salmon harvest was 13,723 fish.
 - 2) A total of 159 permits of 177 issued for the Nome subdistrict of Norton Sound were returned in 1988. Their reported catches totaled 63 chinook, 169 sockeye, 2,159 pink, 5,952 chum, and 1,076 coho salmon.

5. Commercial catch sampling

- a) Locations:
Norton Sound, Port Clarence and Kotzebue Sound.
- b) Objective:
Obtain age, sex, and size information for commercially caught salmon, king crab, and herring.
- c) Results:
Approximately 10,500 salmon, king crab, and herring were sampled in 1988. These data are being analyzed and will be presented in separate reports.

6. Nearshore winter king crab tagging study

- a) Location:
Ocean waters of Norton Sound 1 to 2.5 miles

south of Nome.

- b) Objective:
To observe the abundance and distribution of red king crab in nearshore Nome waters. To study migration and estimate the number of repeat crab captures. Also to evaluate the effectiveness of the "15 mile summer commercial crab closure" in protecting inshore crab; to obtain basic life history data.
- c) Results:
A total of 3 pots were set during the 1988 study in two attempts. All pots were lost due to shifting ice before being checked. Poor weather and the early arrival of spring break up thwarted further attempts to set gear, and resulted in no crab being caught during this winter study.

7. Herring test fishing

- a) Location:
Norton Sound ocean waters; one camp located at Cape Denbigh; a second test fish crew was mobile.
- b) Objectives:
To determine age class composition of the Norton Sound herring return through test fishing with variable mesh gill nets.
- c) Results:
Gill nets were operated from May 21 through June 12. Scale analysis of test fish catches has been completed; results are listed in Figure 13.

Appendix G3. Emergency orders issued during 1988.

Emergency Order Number Norton Sound	Effective Date	Action Taken	Comments
3-Z-01-88	May 27, 1988 8:00 a.m. ADT	Opened Norton Sound sub-districts 1, 2, and 3 to commercial herring gill net fishing.	The current peak biomass in Norton Sound was 34,000 st, which would allow a commercial harvest of 6,785 st. The results of a beach party on May 26 revealed few immature herring in the samples. However, with a buyer capacity of less than 2,000 st expected to be on the grounds by the morning of May 27, the announced opening was held to just 2 hours in length to avoid wastage.
3-Z-02-88	May 27, 1988 2:00 p.m. ADT	Opened Norton Sound sub-districts 1, 2, and 3 to commercial beach seine fishing. Rescinded 3-Z-01-88.	The beach seine fishery allocation was 474 st for 1988. Roe quality and biomass present both indicated the necessity of an immediate harvest to maximize the value of the product. Although the buying fleet capacity was limited, it was determined to be adequate to accept the limited harvest to be allowed of the beach seine fleet.
3-Z-03-88	May 27, 1988 6:00 p.m. ADT	Re-opened Norton Sound sub-districts 1, 2, and 3 to commercial gill net fishing. Rescinded 3-Z-02-88.	Preliminary catch reports from the first gill net opening indicated a harvest rate of one st per boat. Effort was <200 boats. With roe percentages ranging from 4%-11% during the a.m. opening, it was apparent that catches of spawned out fish would now increase over time. The buying fleet was continuing to expand as the day progressed. For these reasons, a rapid re-opening was warranted. Fishermen were advised to test their catches soon after setting gear to avoid large catches of spawned out fish.

-continued-

Appendix G3. (p. 2 of 10).

Emergency Order Number Norton Sound	Effective Date	Action Taken	Comments
3-Z-04-88	May 28, 1988 10:00 a.m. ADT	Re-opened Norton Sound subdistricts 1, 2, and 3 to commercial beach seine fishing. Rescinded 3-Z-03-88.	Roe percentages of fish caught during the night were varied. The buyer fleet had nearly reached hold and processing capacity from the previous gill net opening; adequate shallow draft tenders were available for another beach seine opening. With the decreasing amounts of marketable herring due to continued spawning activity, it was imperative to re-open the fishery to beach seines as soon as possible to provide opportunity for harvest of high quality herring.
3-Z-05-88	May 28, 1988 7:00 p.m. ADT	Re-opened Norton Sound subdistricts 1, 2, and 3 to commercial beach seine fishing. Rescinded 3-Z-04-88.	Overall roe percentages in recent openings were above 8%. Aerial surveys spotted ample herring in areas suitable for beach seining, however, visibility was deteriorating due to wind induced water turbidity and the approaching evening. In an effort to recover marketable herring while still available and observable, another beach seine opening was allowed since adequate shallow draft tender capacity was available.
3-Z-06-88	May 29, 1988 6:00 a.m. ADT	Re-opened Norton Sound subdistricts 1, 2, 3, and 5 to commercial gill net herring fishing. Rescinded 3-Z-05-88.	Verbal catch reports to date indicated that less than one-half of the allowable harvest had been taken. A buyer/processor hold capacity of 2,600 st was expected to be available by the morning of May 29. The opening was timed to coincide with the next incoming tide, when marketable herring appeared to be most available. Since only limit-amounts of herring were left in subdistricts 1, 2, and 3, subdistrict 5 was also opened. Fishermen were again advised to check their catches early to avoid catches of spawned out herring.

-continued-

Appendix G3. (p. 3 of 10).

Emergency Order Number Norton Sound	Effective Date	Action Taken	Comments
3-Z-07-88	May 29, 1988 2:00 p.m. ADT	Re-opened Norton Sound subdistricts 1, 2, and 3 to commercial beach seine fishing. Rescinded 3-Z-06-88.	Roe percentages were above 8.5% in recent openings. May 28 aerial surveys observed sufficient biomass in areas suitable for beach seining. The cumulative harvest to date for this gear type was ~125 st based on processor verbals, or just 26% of their allowable harvest. Since shallow draft tender capacity was available, the beach seine fishery was re-opened to recover marketable fish.
3-Z-08-88	May 29, 1988 midnight ADT	Re-opened Norton Sound subdistricts 1, 2, 3, and 5 to commercial gill net herring fishing. Rescinded 3-Z-07-88.	Verbal processor reports indicated a cumulative gill net harvest to date of approximately 3,200 st. Decreased herring abundance and quality of herring biomass available to the fleet had resulted in a slow, selective harvest of marketable fish. Since some fishermen were still finding and setting on quality fish, the fishery was re-opened to gill net fishing. The opening was again timed to coincide with the incoming tide. Fishermen were again advised to check their catches early to avoid harvest of unmarketable fish.

-continued-

Appendix G3. (p. 4 of 10).

Emergency Order Number Norton Sound	Effective Date	Action Taken	Comments
3-Z-09-88	May 30, 1988 2:00 p.m. ADT	Re-opened Norton Sound subdistricts 1, 2, and 3 to commercial beach seine herring fishing. Rescinded 3-Z-08-88.	The cumulative reported beach seine harvest to date was 192 st at 10.6% roe recovery. The continued decline of biomass in the district had resulted in a slow, selective harvest of marketable herring. The May 29 opening had yielded a harvest of 48 st at 11.4% fish. With adequate shallow draft tender capacity available, another opening was allowed for the beach seine fleet.
3-Z-10-88	May 31, 1988 midnight ADT	Re-opened Norton Sound subdistrict 1 to commercial gill net herring fishing. Rescinded 3-Z-09-88.	Verbal gill net catch reports from the previous opening indicated ~800 st had been harvested; roe percentages and catch rates had varied widely among subdistricts, with higher abundance and quality fish found in s.d. 1. Increasing amounts of spawned out fish were sighted in all areas fished. In order to maximize remaining effort to obtain marketable fish s.d. 1 (only) was re-opened to gillnet fishing. Further openings to this gear type were not anticipated due to decreasing effort and herring biomass.
3-Z-11-88	May 31, 1988 10:00 a.m. ADT	Re-opened Norton Sound subdistricts 1, 2, 3, and 5 to commercial beach seine herring fishing. Rescinded 3-Z-10-88.	Average roe quality for five previous beach seine openings was 10.6% for 200 st reported harvested. The amount of spawning to date and declining roe quality suggested that the bulk of the peak biomass observed (34,000 st) on May 25 had spawned and left the district. Although the scarcity of high quality herring had resulted in a slow, selective harvest, the beach seine fleet had been able to find good herring in some locations. For the aforementioned reasons, one more beach seine opening was allowed.

-continued-

Appendix G3. (p. 5 of 10).

Emergency Order Number Norton Sound	Effective Date	Action Taken	Comments
3-S-Z-01-88	June 20, 1988 6:00 p.m. ADT	Opened Norton Sound sub-districts 2, 3, and 4, to commercial salmon fishing to the regular schedule of two 48 hour periods a week until further notice.	Reports of increasing subsistence chum salmon harvests for the past 7 days indicated chum salmon were entering the district. The Department counting tower on the Kwiniuk River indicated chum salmon were beginning their upstream migration. A commercial market was expected to be in place by midnight, June 20. For these reasons, subdistricts 2, 3, and 4 were opened to the regular fishing schedule.
3-S-Z-02-88	June 20, 1988 6:00 p.m. ADT	Opened Norton Sound sub-districts 5 and 6 to a 24 hour commercial salmon fishing period.	Commercial fishing regulations state that the fishery will open between June 8 and 20 in the Shaktoolik and Unalakleet subdistricts. Subsistence harvests of chinook salmon had been below average in both fresh and ocean waters during the past two weeks, but had increased significantly in recent days. For these reasons, a single 24 hour opening was allowed to test relative abundance of chinook and chum salmon in eastern Norton Sound.
3-S-Z-03-88	June 23, 1988 6:00 p.m. ADT	Re-opened Norton Sound subdistricts 5 and 6 for another 24 hour commercial salmon fishing period. Rescinded 3-S-Z-02-88.	Chinook catches during the first test opening were below average; chum catches were average; pink catches were high. The Unalakleet test net indicated a weak chinook return to date, a near normal chum return, and a strong pink salmon return. Although subsistence interviews indicated fishers were meeting, or had met chinook salmon needs, the Department was concerned that chinook escapement goals were not being met. For these reasons, subdistricts 5 and 6 were re-opened to another conservative fishing period, 24 hours in length.

-continued-

Appendix G3. (p. 6 of 10).

Emergency Order Number Norton Sound	Effective Date	Action Taken	Comments
3-S-Z-04-88	June 27, 1988 6:00 p.m. ADT	Re-opened Norton Sound subdistricts 5 and 6 for another 24 hour commercial salmon fishing period. Rescinded 3-S-Z-03-88.	Chinook salmon catches remained low in subdistricts 5 and 6 in each of the previous 24 hour openings; chum salmon catches remained slightly below average while pink catches were relatively high. Although the Unalakleet test net indicated normal escapement levels for chum and pink salmon, chin-salmon escapements appeared to be low. With the relatively strong pink salmon run developing, and likelihood of additional small mesh openings within a few weeks, a conservative commercial fishing schedule was adhered to in anticipation of incidental captures of larger salmon species in future small mesh openings.
3-S-Z-05-88	June 30, 1988 6:00 p.m. ADT	Opened the Shaktoolik and Unalakleet subdistricts to the regular commercial salmon fishing schedule of two 48 hour periods a week. Rescinded 3-S-Z-04-88	Commercial catches of chum and pink salmon increased dramatically during the third 24 hour period. Chum salmon migration appeared average while pink salmon migration appeared strong. Chinook salmon remained below average. Since the bulk of the chinook migration had passed through the commercial fishery, and chum and pink salmon migration appeared at least normal, the standard commercial fishing schedule was implemented.
3-S-Z-06-88	July 3, 1988 12:00 noon ADT	Established two additional commercial salmon fishing periods a week in Norton Sound subdistricts 2, 3, 4, 5, and 6, with a gill net mesh size restriction of 4 1/2". These openings added 36 hours of fishing time per week to harvest more of the abundant pink salmon return.	Tower counts, test net catches, and commercial catch data all indicated a strong return of pink salmon was underway in these subdistricts. Chum salmon escapements appeared to be meeting average goals as indicated by tower counts and test net catches to date. Therefore, additional small mesh openings were allowed, to harvest a portion of the strong pink salmon return while the fish were in their most marketable condition. This "pink gear" could be set or drifted.

-continued-

Appendix G3. (p. 7 of 10).

Emergency Order Number Norton Sound	Effective Date	Action Taken	Comments
3-S-Z-07-88	July 1, 1988 6:00 p.m. ADT	Opened the Nome subdistrict to commercial salmon fishing to two 24 hour periods.	Regulations state that the commercial salmon season will begin in subdistrict 1 of Norton Sound on or after July 1. Chum and pink salmon returns appear to be average in the subsistence catches. The Alaska Board of Fisheries has requested that the commercial harvest be maintained at the lower end of the regulatory guideline harvest of 5-15,000 chum salmon, until escapement goals and Nome area subsistence needs are met. Fishermen were advised that if the harvest by July 5 was less than 5,000 chum salmon, the season would be extended.
3-S-Z-08-88	July 7, 1988 6:00 p.m. ADT	Placed the Nome subdistrict on the standard commercial fishing schedule of two 24 hour periods a week. Rescinded 3-S-Z-07-88	The total commercial harvest to date of chum salmon in subdistrict 1 of Norton Sound was <1,200 fish. Catch rates had been slow. With a harvest goal of the lower end of 5-15,000 chum salmon, and a slow catch rate, the Nome subdistrict was placed on the regular schedule of two 24 hour periods a week until further notice.
3-S-Z-09-88	July 14, 1988 6:00 p.m. ADT	Implemented a district-wide mesh restriction of 6" or less in the Norton Sound commercial salmon fishery.	As of July 9, a total of 3,604 chinook salmon were harvested in the Norton Sound District. Comparative catch statistics, test net catches, and tower counts all indicated a below average chinook salmon return. In an attempt to cease further targeting of chinook salmon in the commercial fishery, in order to bolster chinook salmon escapement, the use of large mesh gill net gear was disallowed for the remainder of the season.

-continued-

Appendix G3. (p. 8 of 10).

Emergency Order Number Norton Sound	Effective Date	Action Taken	Comments
3-S-Z-10-88	July 14, 1988 6:00 p.m. ADT	Removed the additional "pink gear" periods in the Norton Bay, Shaktoolik, and Unalakleet subdistricts. Placed the Golovin and Moses Point subdistricts on a schedule of two 48 hour periods a week with a mesh restriction of 4 1/2" or less.	Aerial survey counts of Nome, Golovin and Moses Point subdistrict streams, as well as Kwiniuk River tower counts, indicated chum escapements were roughly 1/2 to 2/3 of escapement goals. Since pink salmon escapements appeared strong, commercial fishing in subdistricts 2 and 3 was allowed to continue, but with a mesh restriction of 4 1/2" or less, to minimize targeting of chum salmon. "Pink gear" periods were eliminated in subdistricts 4, 5, and 6 due to lack of interest or lack of a market.
3-S-Z-11-88	July 15, 1988 12:01 a.m. ADT	Closed the Nome River to the sport harvest of chum salmon for the remainder of the year.	By this date, approximately 75% of the returning chum salmon should have entered fresh water. Aerial surveys on July 9 and 11, and boat surveys on June 30 and July 7 and 9 indicated poor chum salmon escapement (<30% of chum goal of 2,000 fish). To protect chum salmon in the river and enhance further escapement, the Nome River was closed to the sport harvest of chum salmon.
3-S-Z-12-88	August 1, 1988 6:00 p.m. ADT	Returned the Golovin and Moses Point subdistrict commercial salmon fishery to "regular" mesh gear periods, up to 6" in stretched measure. Rescinded 3-S-Z-10-88	The chum salmon migration was nearly over, and the coho return was beginning to strengthen. Since little could now be done to further enhance chum salmon escapements, and the coho salmon return expected to be above average in these subdistricts, the legal gill net mesh size was enlarged to a maximum of 6" to allow targeting of coho salmon.

-continued-

Appendix G3. (p. 9 of 10).

Emergency Order Number Norton Sound	Effective Date	Action Taken	Comments
3-K-Z-1-88	August 11, 1988	Closed the Norton Sound summer commercial crab season.	The 1988 summer king crab harvest guideline was set at 200,000 pounds. The guideline harvest was expected to be met by the morning of August 11, based on the reported harvest to date and current catch rates.

Emergency Order Number Port Clarence	Effective Date	Action Taken	Comments
3-PC-01-88	June 7, 1988	Closed the Port Clarence District to commercial herring beach and purse seine fishing.	The Port Clarence herring were ripening rapidly as indicated by daily gill net test catch samples. In the interest of minimizing fish handling mortality as well as providing all gear types an adequate opportunity to harvest the resource, the fishery was closed to the very efficient seine gear types until the roe quality was judged to be marketable.
3-PC-02-88	June 10, 1988	Placed the Port Clarence herring seine fishermen on notice that each seine set must be approved by Area Management Biologist before attempted.	The observable Port Clarence herring biomass was concentrated near Pt. Spencer. The estimated biomass did not warrant a harvest above the preseason guideline of 165 st. The Alaska Board of Fisheries had specified purse and beach seine gear and gill nets as legal gear types for this fishery. Since the seine gear is so efficient, and the Department's intention was to give each gear type the opportunity to harvest herring, the seine sets were to be closely monitored by Department personnel and followed by at least a 4 hour closure to allow gillnetters to harvest a portion of the biomass.

-continued-

Appendix G3. (p. 10 of 10).

Emergency Order Number Kotzebue	Effective Date	Action Taken	Comments
3-X-S-01-88	July 11, 1988 6:00 p.m. ADT	Opened the Kotzebue District to commercial salmon fishing on the standard schedule of two 24 hour periods a week.	The commercial salmon season in the Kotzebue District opens by regulation on or after July 10. The chum harvested in the Kotzebue District are bound primarily for the Kobuk and Noatak Rivers. To ensure adequate escapement of fish bound for the Kobuk River, which is generally a smaller, earlier return and supports a number of village subsistence fisheries, periods were initially held to 24 hours, twice a week, until further notice.
3-X-S-02-88	July 25, 1988 8:00 a.m. ADT	Extended fishing periods in the Kotzebue commercial salmon fishery to two 36 hour periods a week. Rescinded 3-S-X-01-88.	The first three fishing periods were well above the recent 7 year average. The fourth period catch of 30,000 chum was well above the fourth period average catch of 23,900 fish. CPUE statistics also indicated a strong return. For these reasons, commercial fishing time was extended until further notice.
3-X-S-03-88	August 4, 1988 6:00 p.m. ADT	Extended fishing periods in the Kotzebue commercial salmon fishery to two 48 hour periods a week. Rescinded 3-S-X-02-88.	Catches and catch rates continued to be above average in the Kotzebue District. Subsistence fishermen on the Kobuk River were reporting moderate success. Concern for escapements in Kobuk River tributaries was the basis for maintaining the current fishing schedule through August 2. The intent of this E.O. was to allow the fishery to target the stronger Noatak chum salmon return while allowing a higher level of escapement on the Kobuk River salmon stocks.

Appendix G4. Norton Sound-Port Clarence-Kotzebue Sound processors and associated data, 1988.

<u>Commercial Operator</u>	<u>Product</u>	<u>District</u>
ANPAC, Inc. P.O. Box 92520 Anchorage, AK 99509-2520	Fresh Salmon Chinook Chum Coho Sockeye	Norton Sound Kotzebue Sound
Arctic Fish P.O. Box 706 Kotzebue, AK 99752	Fresh Char Frozen Herring	Norton Sound
Deep Sea Fisheries, Inc. 400 Fisheries Building 4241 21st Avenue W Seattle, WA 98199 p/v Polar Command m/v Arctic Discovery m/v Marla Jo	Fresh Salmon Chinook Chum Fresh Char	Kotzebue Sound
Icicle Seafoods, Inc. P.O. Box 79003 Seattle, WA 98199 p/v Bering Star p/v Sno Pac m/v Chighagof m/v Deception m/v Grace C m/v Lady Anne m/v Pacific Clipper m/v Pintail m/v Tanie Rae m/v Viking Queen	Frozen King Crab	Norton Sound
Kemp Pacific Fisheries, Inc. P.O. Box 790 Dillingham, AK 99576 m/v Balena m/v Ben B m/v Debra D m/v Obsession	Frozen Herring	Norton Sound Port Clarence

-continued-

Appendix G4. (p. 2 of 4).

<p>Kotzebue Commercial Fishermen P.O. Box 193 Kotzebue, AK 99752</p>	<p>Fresh Salmon Chinook Chum Fresh Char</p>	<p>Kotzebue Sound</p>
<p>Lafayette, Inc. 4259 22nd Avenue W Seattle, WA 98199 p/v Lafayette p/v Pribilof m/v Bull Harbor m/v Chatam m/v Chevak m/v Dragnet I m/v Northwind m/v Sea Trek III m/v Tracy D m/v Zingaro</p>	<p>Frozen Herring</p>	<p>Norton Sound</p>
<p>NANA Seafoods P.O. Box 49 Kotzebue, AK 99752</p>	<p>Fresh Salmon Chinook Chum Fresh Char</p>	<p>Kotzebue Sound</p>
<p>NPL Alaska, Inc. 207 E. Northern Lights Blvd. Suite 210 Anchorage, AK 99503 p/v Anyo Maru # 22 p/v Hatsue Maru #68</p>	<p>Frozen Salmon Chinook Chum Coho Pink Sockeye</p>	<p>Norton Sound</p>
<p>New West Fisheries, Inc. 1100 11th St. Bellingham, WA 98225 p/v New West m/v Barge m/v Lois Anderson m/v Seldovia</p>	<p>Frozen Herring</p>	<p>Norton Sound</p>
<p>Pan Pacific Seafoods, Inc. 150 Nickerson S. Suite 108 Seattle, WA 98109 p/v Pacific Producer m/v Exito m/v Pavilof</p>	<p>Frozen Herring</p>	<p>Norton Sound</p>
<p>Seward Marine Services Box 87 Seward, AK 99664</p>	<p>Frozen Herring -continued-</p>	<p>Norton Sound</p>

Appendix G4. (p. 3 of 4).

m/v Kona

Trident Seafoods Corp. 5303 Shilsho Avenue N.W. Seattle, WA 98107	Frozen Herring Frozen King Crab	Norton Sound
---	------------------------------------	--------------

p/v Alaska Packer p/v Neptune	Frozen Herring	Norton Sound
----------------------------------	----------------	--------------

m/v Alaska Eagle
m/v Alaska Shores
m/v Arctic Sun
m/v Bristol Monarch
m/v Cachalot
m/v Dristik
m/v Echo
m/v Express
m/v Low Boy
m/v Pankof
m/v Prince William Sound
m/v Tamar
m/v Westling

Western Fish Producers, Inc. P.O. Box 1159 Port Roberts, WA 98281	Frozen Herring	Norton Sound Port Clarence
---	----------------	-------------------------------

p/v Nicole N
m/v Hak I
m/v Hi Pac
m/v Kona
m/v Tiger

Whitney Foods 4401 W. Intl. Airport Rd. Anchorage, AK 99502	Fresh Salmon Chinook Chum Coho Sockeye Fresh Char	Norton Sound Kotzebue Sound
---	--	--------------------------------

Woodbine Alaska Fish Co. P.O. Box 218 Naknek, AK 99633 p/v Woodbine m/v Botany Bay m/v Captain Banjo m/v Tonto	Frozen Herring	Norton Sound
--	----------------	--------------

YAK, Inc. 4019 21st Ave. W. #202 Seattle, WA 98199	Frozen Herring	Norton Sound
--	----------------	--------------

Appendix G4. (p. 4 of 4).

-continued-

LITERATURE CITED

- ADF&G. (Alaska Department of Fish and Game). 1988. Norton Sound- Port Clarence - Kotzebue Sound Annual Management Report, 1987. AYK Regional Informational Report 3N88-27.
- ADF&G. 1988. 1988 Norton Sound Herring Preliminary Report. Division of Commercial Fisheries. AYK Regional Informational Report 3N88-26.
- ADF&G. 1988. 1988 Port Clarence Herring Preliminary Report. Division of Commercial Fisheries. AYK Region unpublished document.
- ADF&G. 1988. 1988 Preliminary Kotzebue District Salmon Report. Division of Commercial Fisheries. AYK Region unpublished document.
- ADF&G. 1988. 1988 Kotzebue District Salmon Report to the Alaska Board of Fisheries. Division of Commercial Fisheries. AYK Regional Informational Report 3N88-39.
- ADF&G. 1988. 1988 Norton Sound District Salmon Report to the Alaska Board of Fisheries. Division of Commercial Fisheries. AYK Regional Informational Report 3N88-36.
- Bue, F. 1988. Unalakleet, Elim, St. Michael Herring Test Fishing Crewleader Report, 1988. Alaska Department of Fish and Game, Division of Commercial Fisheries. AYK Region Unpublished Document.
- Gephard, J. and Lean, C. 1988. Norton Sound Commercial Red King Crab Fishery Observer Project Summary Report, 1988. Alaska Department of Fish and Game, Division of Commercial Fisheries. AYK Regional Informational Report 3N88-32. Anchorage.
- Hamner, H.H. 1989. Expected returns to the 1989 Kotzebue commercial fishery. Memorandum to Charlie Lean from Hamner. Alaska Department of Fish and Game, Division of Commercial Fisheries, Nome. February, 1989.
- Hamner, H.H. In press. Abundance, age, sex, and size of Norton Sound and Kotzebue Sound salmon catch and escapement, 1986-1987. Alaska Department of Fish and Game, Division of Commercial Fisheries. Juneau.
- Knuepfer, Gary. 1988. 1988 Lower Noatak test fishing project. Alaska Department of Fish and Game, Division of Commercial Fisheries. AYK Regional Informational Report 3N88-__.

p/v Yardarmknot
m/v Blue Fin
m/v Jamie D
m/v Yankee Clipper

- Knuepfer, Gary. 1988. 1988 Cape Denbigh Herring Project Report. Alaska Department of Fish and Game, Division of Commercial Fisheries. AYK Regional Informational Report No. 3N88-28, Anchorage.
- Knuepfer, Gary. 1988. Postseason activities by fisheries monitoring staff. Memorandum to Charlie Lean from Knuepfer. Alaska Department of Fish and Game, Division of Commercial Fisheries, Nome. October 20, 1989.
- Lean, C.F. 1987. Catch rates, size, composition, and growth of red king crab taken in Norton Sound near Nome during the winter of 1987. Alaska Department of Fish and Game, Division of Commercial Fisheries. Norton Sound Shellfish Report No. 12, Anchorage.
- Lean, C.F. 1988 Kwiniuk River salmon counting tower. Alaska Department of Fish and Game, Division of Commercial Fisheries. AYK Regional Informational Report 3N89-11.
- Lean, Charles and Fred Bue. Unalakleet River Test Net Project, 1988. Alaska Department of Fish and Game, Division of Commercial Fisheries. AYK Regional Information Report No. 3N89-14.
- Lean, C.F. and J.A. Hartle. 1989. Norton Sound - Port Clarence - Kotzebue Sound aerial stream survey catalogue, 1958-1988. Alaska Department of Fish and Game, Division of Commercial Fisheries. AYK Region unpublished document. Nome.
- Merkouris, S.E. 1988. 1988 Norton Sound Salmon Season Summary. Memorandum to Rich Cannon from Merkouris. Alaska Department of Fish and Game, Division of Commercial Fisheries, Nome. October 25, 1988.
- Merkouris, S.E. 1988. Preliminary Report: Norton Sound red king crab fishery. Memorandum to Rich Randall from Merkouris. Alaska Department of Fish and Game, Division of Commercial Fisheries, Nome. August 24, 1988.
- Raymond, J. 1988. 1988 Chum salmon returns to Sikusuilaq hatchery. Alaska Department of Fish and Game, F.R.E.D. Division. AYK Region unpublished document.
- Stevens, Bradley G. 1989. Analysis of Crab Data from the 1988 NMFS Survey of Norton Sound and the Northeast Bering Sea. Northwest and Alaska Fisheries Center, National Marine Fisheries Service, Kodiak. Preliminary Report. February, 1989.