

3A89-24

Pacific Herring Stocks and Fisheries in the
Arctic-Yukon-Kuskokwim Region of the
Northeastern Bering Sea,
Alaska, 1989

A Report to the Alaska Board of Fisheries
October 1989

By

Helen H. Hamner

Regional Information Report¹ No. 3A89-24

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

October 1989

¹The Regional Information Report Series was established in 1987 to provide an information access system for all unpublished divisional reports. These reports frequently serve diverse and ad hoc informational purposes or archive basic uninterpreted data. To accommodate timely reporting of recently collected information, reports in this series undergo only limited internal review and may contain preliminary data; this information may be subsequently finalized and published in the formal literature. Consequently, these reports should not be cited without prior approval of the author or the Division of Commercial Fisheries.

ACKNOWLEDGEMENTS

Data collection and reporting for the subsistence and commercial fisheries for Pacific herring in the northeastern Bering Sea were provided by the following AYK staff:

Security Cove, Goodnews Bay, Cape Avinof, Nelson Island, and Nunivak Island Districts

Kim Francisco, Area Manager, and Charles Burkey, Asst. Area Manager. Commercial Fisheries Division, P.O. Box 90, Bethel, Alaska. 99559-99901. 543-2648.

Cape Romanzof District

Dan Bergstrom, Area Manager, and Sue Merkouris, Asst. Area Manager. Commercial Fisheries Division, 333 Raspberry Rd., Anchorage, Alaska. 99518-1599. 344-0541.

Norton Sound and Port Clarence Districts

Charles Lean, Area Manager, and Sue Merkouris, Asst. Area Manager (previous). Commercial Fisheries Division, P.O. Box 1148, Nome, Alaska. 99762-1148. 443-5167.

AYK Region

Rich Cannon, Regional Management Coordinator, Commercial Fisheries Division, 333 Raspberry Rd., Anchorage, Alaska. 99518-1599. 344-0541.

Resource Assessment for AYK Herring

Helen Hamner, Biometrician, Commercial Fisheries Division, 333 Raspberry Rd., Anchorage, Alaska. 99518. 344-0541.

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INTRODUCTION

The objectives of this report are to: (1) summarize the results of the 1989 herring stock assessment programs for the Arctic, Yukon, and Kuskokwim (AYK) Region, (2) review and evaluate 1989 harvests and management strategies for all AYK commercial herring fishing districts and the Yukon-Kuskokwim River Delta subsistence fishery, and (3) present management strategies for the AYK herring fishing season in 1990. Commercial fishing districts included in this report are: Security Cove, Goodnews Bay, Cape Avinof, Nelson Island, Nunivak Island, Cape Romanzof, Norton Sound, and Port Clarence (Figures 1 and 2).

The 1989 herring harvest for the AYK Region was approximately 7,300 tons with a total estimated ex-vessel value of \$4,095,000 (Tables 1 and 2). Harvest identified as food and bait primarily occurs during the sac roe fishery when fish are sold with a roe content that is below buyer's acceptable minimums. Food and bait sales during the sac roe fishery totaled 595 tons, with the remaining harvest sold for sac roe product. There are small directed food and bait fisheries located in the Norton Sound and Port Clarence Districts that are currently in progress. A total of 1,074 fishermen participated in AYK sac roe herring fisheries during the 1989 season (Table 3). Two hundred forty three more fishermen fished in 1989 than in 1988.

Average roe recovery from harvested Pacific herring ranged from 8.0% in Cape Avinof District to 9.4% in the Security Cove and Nunivak Island Districts with a regional average of 9.0%. The percentage of the estimated biomass harvested ranged from no harvest in the Port Clarence District to 21.0% in the Cape Romanzof District (Table 2).

Based on limited data, it is estimated that subsistence fishermen from Yukon-Kuskokwim River Delta villages harvested at least 126 tons of Pacific herring (Table 4).

The total estimated herring biomass of 43,970 tons for the surveyed portion of the AYK herring districts was two-thirds of the 1988 estimate of 64,760 tons (Table 2). Ages 7, 8, and 10 herring dominated the AYK herring biomass. Older herring, age 9 and older, comprised 47% of the return. Younger age fish (ages 3, 4, and 5) accounted for 8% of the total biomass.

SEASON SUMMARY

Stock status

Assessment Methods

Aerial surveys were flown throughout the Pacific herring spawning season in all commercial fishing districts to determine relative abundance, timing, distribution, and biomass of Pacific 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 those used since 1978. Historically, it has been difficult to obtain biomass estimates from aerial surveys in the AYK area due to poor survey conditions caused by unfavorable weather, ice conditions or turbid water.

During 1989, a total of 70 aerial surveys were conducted in the AYK region; 9 in Security Cove, 9 in Goodnews Bay, 7 in Cape Avinof, 12 in Nelson Island, 10 in Nunivak Island, 4 in Cape Romanzof, 17 in Norton Sound, and 2 in Port Clarence. Fifty five of these were flown under poor to unacceptable survey conditions. Unfavorable weather, ice conditions or turbid water prevailed in all AYK districts during the 1989 season.

Ice conditions and unfavorable weather prevented obtaining a biomass estimate for the Cape Avinof District. Consequently, the preseason estimate was used to project the 1990 return. Aerial surveys were also unacceptable in Cape Romanzof due to turbid water. Therefore, the 1989 biomass estimate for Cape Romanzof was derived from a combination of spawn deposition and test fishing data.

Standard conversion factors of 1.52 tons (water depths of 16 ft or less), 2.58 tons (water depths between 16 and 26 ft) and 2.83 tons (water depths greater than 26 ft) per 538 ft² of surface area were used to convert estimated herring school surface areas from aerial surveys to biomass within all districts.

Herring from test fish and commercial catches were sampled in all but the Port Clarence District to estimate age, size, and sexual maturity of herring and to note occurrence of other schooling fishes. Over 18,000 herring from commercial and test catches were sampled from seven of the eight AYK herring districts during the 1989 fishing season. This is more than twice the number sampled in 1988. This increased sample effort was necessary to obtain sufficient samples for a stock identification study of Bering Sea herring requested by the North Pacific Management Council. The intent of this study is to identify stocks caught in the herring bycatch by the domestic trawl fleet in the southeastern Bering Sea. No commercial or test fishery samples were taken in the Port Clarence District since there was no fishery in 1989.

In most districts, fishermen, in cooperation with the Department, provided catch samples for roe quality evaluation by industry representatives. Participation of fishermen in collecting samples, processor evaluation of samples, and the flexibility of fishermen to fish on short notice aided in obtaining optimum roe

recoveries.

Ground surveys were conducted in some districts to obtain information on the distribution and density of kelp beds and herring spawn deposition.

Spawning Populations

Security Cove District

Historically, the estimated biomass of herring in the Security Cove District has ranged from 1,200 tons in 1980 to 21,500 tons in 1979. During 1989, nine aerial surveys were flown from May 8 to May 24 in the district to estimate herring biomass and spawning activity. Seven of these surveys were flown under poor or unacceptable survey conditions. Herring were first seen in the district on May 11 when the season's largest biomass of 2,830 tons was observed under fair conditions. Light spawning activity was first documented during an aerial survey on May 13. A total of 3.1 linear miles of spawn was documented during the season.

Department test fishing was conducted from May 10 to May 22 using variable mesh gill nets. Approximately 230 herring were sampled for age, sex, length, and weight data. Scales from an additional 1,440 herring were collected for the stock identification study. A sample of 225 herring was taken from the commercial catch.

In 1989, ages 8, 10, and 11 dominated the biomass of herring (Figure 4). Nearly 60% of the return consisted of age 9 and older herring. Recruits, ages 4 and 5 herring, represented only 6% of the run.

Goodnews Bay District

Historically, the estimated biomass of herring in the Goodnews Bay District has ranged from 400 tons in 1980 to 7,400 tons in 1979. These years also represent the lowest and highest herring biomass observed in Togiak and Security Cove. However in many years including 1979, there was no biomass estimate from aerial survey due to poor aerial survey conditions. Therefore the preseason projection was used to estimate herring biomass. In 1989, nine aerial surveys were flown from May 8 to May 24 in the Goodnews Bay District. Seven of these surveys were flown under poor to unacceptable conditions. An aerial survey on May 13 documented 2,077 tons of herring in the district. The peak inseason biomass estimate of 4,044 tons was observed on May 24. A total of 1.2 linear miles of milt was observed in three sightings during aerial surveys. The Department test fish crew first documented spawning activity on May 11.

A Department test fish crew caught 3,600 herring in variable mesh gill nets from May 6 to May 29. Approximately 640 of these were sampled for age, sex, length and weight data. Scales were collected from an additional 1,550 herring for the stock identification study. A total of 500 herring were sampled from the

Goodnews Bay commercial catch.

In 1989, ages 10 and 11 contributed the major portion of the biomass (Figure 3). Nearly 70% of the total run by weight was age 9 and older herring. Recruits, ages 3, 4, and 5 herring, represented nearly 10% of the biomass.

Cape Avinof District

Aerial surveys have been conducted systematically in the Cape Avinof area since 1985. An estimated herring biomass of 2,000 tons, 1,225 tons, and 4,100 tons were observed in 1985, 1987, and 1988, respectively. Weather conditions precluded an aerial survey biomass estimate in 1986. In 1989, ice conditions hindered aerial survey efforts and delayed the start of test fishing until June 1. Only one of the seven aerial surveys of the Cape Avinof District was flown under acceptable conditions. During an aerial survey on May 31, Department biologists observed 689 tons of herring among ice floes. Spawning activity was first documented by the test fish crew on June 1. Samples brought to Kipnuk by commercial fishermen on June 4 had an average roe content of 5.7%. The peak biomass estimate of 689 tons was observed under unsatisfactory conditions on May 31. Only 0.04 linear miles of spawn was observed during aerial surveys.

Department test fishermen caught 2,030 herring in variable mesh gill nets from June 1 to June 12. Approximately 320 of these were sampled for age, sex, length and weight data. Scales were collected from the remaining 1,690 herring for the stock identification study. A total of 500 herring were sampled from the Cape Avinof commercial catch.

Age 10 herring from the 1979 year class represented 18% of the run by weight (Figure 3). Age 9 and older herring comprised nearly 50% of the biomass. Younger herring, ages 3, 4 and 5, represented approximately 17% of the return.

Nelson Island District

Since 1985, the biomass estimates of herring in the Nelson Island District have ranged from 3,316 tons in 1989 to 9,500 tons in 1985. During the 1989 herring season, twelve aerial surveys were flown from May 24 to June 12. Nine of these surveys were rated either poor or unacceptable. The peak biomass of 2,800 tons was seen under fair conditions on May 25. Heavy spawning was observed in the Cape Vancouver and Chinit Point areas on May 26. A total of 6.55 linear miles of spawn was observed in 16 sightings during aerial surveys with peak spawn observed on May 26. A second peak biomass of 517 tons was observed on June 1. The difference in age composition between Department test fish samples collected around May 25 and June 1 indicates that the fish observed on May 25 were different from those on June 1. Biomass observations made on May 25 and June 1 were added together to estimate a total biomass of 3,316 tons for the district.

A Department test fish crew caught approximately 2,140 herring in variable mesh gill nets from May 23 to June 8 and sampled 500 of these for age, sex, length and weight composition. Scales from an additional 1,640 herring were collected for the herring stock identification study. A sample of 388 herring was taken

from the commercial catch.

Age 10 and 11 herring dominated the 1989 biomass (Figure 3). Recruits, ages 3, 4 and 5, represented 16% of the biomass. Seventy percent of the biomass consisted of age 9 and older herring.

Nunivak Island District

Since 1985, the estimated biomass in the Nunivak Island District has ranged from 600 tons in 1989 to 6,000 tons in 1986. During 1989, ten aerial surveys were flown between May 19 and June 12 with peak biomasses of 480 tons and 137 tons observed on May 24 and June 2, respectively. Half of these were flown in poor to unacceptable survey conditions. Based on differences in age composition and the length of time between the two observed peaks, these fish were judged to be different groups of fish. Therefore, the estimated biomass of 617 tons for the Nunivak Island District is a combination of these two peaks. Spawning activity was observed in the district on May 27. Nearly 3 linear miles of milt was observed in the district during aerial surveys.

Ages 10 and 11 herring dominated the return (Figure 4). Seventy-five percent of the biomass consisted of age 9 and older herring. Younger fish, age 3, 4, and 5 herring, represented only 2% of the run.

A Department test fish crew caught approximately 1,320 herring in variable mesh gill nets from May 21 to June 12 and sampled 490 of these for age, sex, length and weight composition. Scales from an additional 830 herring were collected for the stock identification study. A total of 480 herring were sampled from the commercial catch.

Cape Romanzof District

Since 1975, the estimated biomass of herring in the Cape Romanzof District has ranged from 3,000 tons in 1978 to 7,500 tons in 1986. Due to excessive water turbidity, it is generally not possible to estimate herring biomass from aerial surveys. Therefore, biomass has been estimated using a combination of information from test and commercial catches, spawn deposition, and age composition. In 1989, aerial surveys were flown on May 24, 25, 26 and 30. A very small number of herring were observed under unsatisfactory survey conditions on May 24. Several large schools were observed in Scammon Bay on May 26, but no biomass estimate was obtained. It was not possible to estimate herring spawning biomass based on aerial surveys due to turbid water conditions during 1989. Evaluation of spawn deposition surveys, test fishing, and age composition data from test and commercial catches resulted in an estimate of 4,400 tons.

Department test fishing was conducted from May 22 to June 3 using variable mesh gill nets. A total of 2,003 herring were caught, of which 451 were sampled for age, sex, length, and weight data. Scales were collected from the remaining 1,552 herring for the stock identification project. A sample of 866 herring was taken from the commercial catch.

Ground surveys indicated that spawn deposition occurred from May 24 through the termination of the project on June 3 with the majority of spawn deposited from May 25 to June 2. Heavy snow fall, cold temperatures, and a large amount of ice in Kokechik Bay affected the timing of spawning. Shore ice, which covered many spawning areas also delayed deposition. The first indication of spawn deposition occurred on May 24, five days later than in 1988. A large storm on May 28 increased egg mortality by eroding eggs from rock and *Fucus* substrates. Spawn deposition occurred over an extended time period and averaged between 1 and 2 egg layers in primary spawning areas.

Approximately 20% of the 1989 biomass was composed of age 8 herring (Figure 4). Age 9 and older herring comprised 54% of the biomass. Recruits, age 3, 4, and 5 herring, represented 9% of the biomass.

Norton Sound District

The primary spawning areas within Norton Sound have been from Stuart Island to Tolstoi Point. Additional spawning areas have been documented along Cape Denbigh, and several bedrock outcroppings along the northern shore of Norton Sound between Bald Head and Topkok especially in years when seas ice has remained in the nearshore areas into June.

Herring biomass in the Norton Sound District has fluctuated from 5,300 tons in 1978 to nearly 34,000 tons in 1988. During 1989, seventeen surveys were flown on fourteen different days, from May 16 to June 7, for a total of 45 hours of aerial survey time. Fifteen of these surveys were rated poor or unacceptable. Two peak biomasses were observed during aerial surveys. These were judged to be different groups of fish based on age composition, the length of time between the peaks and knowledge of herring migratory patterns and residence time in Norton Sound. The first peak of 6,896 tons was observed May 27 and the second peak of 19,085 tons occurred on June 2. Both peaks were observed under unacceptable aerial survey conditions. The biomass seen on May 27 was added to that observed on June 2 to give a combined biomass estimate of 25,980 tons. Because of the exceptionally poor survey conditions in 1989, it is likely that this is an underestimation of the actual biomass that was present in Norton Sound. A total of 64 linear miles of spawn was observed during aerial surveys.

Two Department test fishing projects operated during the 1989 season. One project was located at Cape Denbigh and operated from May 25 to June 13. A second crew started fishing in Unalakleet on May 26 but moved to the Klikeitartik camp on May 27, and continued there until June 6. Test fish crews sampled 1,074 herring caught with variable mesh gill nets for age, sex, length and weight data. Scales from an additional 1,810 herring were collected for the stock identification project. A sample of 870 herring was taken from the commercial catch.

Twenty-eight percent of the 1989 biomass consisted of age 7 herring; age 8 comprised 19% of the run by weight (Figure 4). Recruits, ages 3, 4 and 5 represented approximately 7% of the biomass. A large number of three year olds were caught in the Cape Denbigh test net on June 13. However, these fish were

not included in age composition summaries of the population since there was no aerial survey estimate for this time period.

Port Clarence District

This district is characteristically not surveyable due to ice, water stain, or poor weather. In addition, it is difficult to identify herring due to the large numbers of saffron cod, whitefish, and other pelagic species in the area. The herring biomass in 1987 and 1988 was estimated to be 900 tons and 788 tons, respectively. These observations were made during poor to unacceptable aerial survey conditions. Two aerial surveys were flown in 1989. Conditions were unacceptable due to poor weather conditions and no fish were observed. Therefore, there is no age composition data available for the 1989 return. Age composition of Port Clarence herring in 1988 was different from any other AYK district for that year; one-half of the biomass consisted of age 6 or younger herring.

SUBSISTENCE FISHERY

Pacific herring are an important component of the diet of residents of many Yukon-Kuskokwim Delta villages. Surveys of subsistence harvests have been conducted annually in Yukon Delta villages and sporadically in Kuskokwim Delta villages since 1975. Annual harvests of Pacific herring have averaged 110 tons since 1975 (Table 4). Based on limited data, at least 126 tons of subsistence herring were harvested during 1989 in Nelson Island villages. Only a portion of the Tooksok Bay village was actually surveyed. The catch from this limited survey was expanded to estimate the 1989 catch for Tooksok Bay and the other Nelson Island villages. Nunivak Island and the Kuskokwim River Delta villages were not surveyed.

A preliminary subsistence harvest estimate of 2 tons of herring was reported to have been taken by 19 fishing families from Hooper Bay, Chevak, and Scammon Bay near the Cape Romanzof district. The subsistence harvest survey of these villages was conducted through the mail by a catch questionnaire. Approximately 50% of the fishermen that responded to questionnaires reported less herring were present during 1989, than during other recent years. This may have been a function of subsistence fishing occurring later in the run than usual. The subsistence catch figures represent only the harvest which was reported. Therefore, the reported catch is a minimum estimate since not all families were mailed questionnaires and not all families who received the questionnaires returned them.

COMMERCIAL FISHERY

Security Cove District

The commercial herring fishery in the Security Cove District has been regulated by emergency order since 1981 to provide for an orderly fishery and periodic reassessment of herring biomass. The total 1989 harvest of 554 tons of herring was taken during one four hour opening on May 17. The harvest included 544 tons of sac roe herring with an average roe percentage of 9.4% and 10 tons of bait quality herring. The harvest was 20% of the estimated biomass. Eight processors in Security Cove paid the 110 participating fishermen approximately \$450 per ton for 10% sac roe herring and \$50 per ton of bait quality herring. The total ex-vessel value of the harvest was approximately \$256,500.

Goodnews Bay District

The 1989 herring harvest in the Goodnews Bay District totaled 616 tons. Herring were observed spawning in the district on May 11 and over 2,077 tons of herring were observed during an aerial survey on May 13. Meetings with fishermen and processors were held daily from May 17 to May 22. Commercial fishermen brought catch samples to these meeting for evaluation by industry roe technicians. On May 22 the roe content of commercial test fish samples averaged 9.3%. The district was opened to commercial fishing on May 23. Eight fishing periods were scheduled from May 23 to May 29 for a total of 56 hours of fishing time. There was limited fishermen participation during two eight hour openings on May 26 and 27 due to bad weather. The initial harvest guideline of 460 tons was increased to 660 tons on May 24 when 4,044 tons of herring were sighted during an aerial survey. The harvest included 454 tons of sac roe herring with an average roe content of 8.4%, and 162 tons of bait quality herring. The harvest was 15.2% of the estimated spawning biomass. There were 138 fishermen who made 533 deliveries to six processors. Fishermen received approximately \$540 per ton for 10% sac roe herring and \$50 per ton for bait quality herring. The total ex-vessel value of the harvest was approximately \$335,000.

Cape Avinof District

At the request of the Kwigillingok IRA Council, the eastern boundary of the Cape Avinof District was extended to three miles east of the village of Kwigillingok by emergency order on May 1.

In 1989, the Cape Avinof District was opened to commercial fishing for eight hours on June 4 after an aerial survey documented 689 tons of herring in district and test fish crews observed spawning activity. Due to low catch rates from processor verbal reports, this opening was extended until further notice. Catch rates during the 1989 season remained low and on June 9 the last processor departed the district. Cape Avinof was closed to commercial fishing on June 12 when it became apparent that no processors were available. A total of 194 hours of fishing time resulted in a harvest of 129 tons of herring, which was 288 tons

short of the harvest guideline. The harvest was 18.7% of the peak observed biomass and 5% of the preseason projected biomass. The harvest included 90.4 tons of sac roe quality herring with an average roe recovery of 8.0% and 38.5 tons of bait. Three processors paid the 147 fishermen an average of \$410 per ton for 10% sac roe herring and \$50 per ton for bait quality herring for a total ex-vessel value of \$54,000.

Nelson Island District

The district was first opened to commercial herring fishing on May 28 after an aerial survey documented nearly 2,800 tons of herring in the district and roe samples from commercial fishermen indicated fish were ripe. In addition, heavy spawning was observed in the Cape Vancouver and Chinit Point areas on May 26. However, since the majority of the catch during the second opening on May 29 was bait quality herring, Toksook Bay fishermen recommended that no additional openings be scheduled for May. Five fishing periods were scheduled from May 28 to June 7 for a total of 15 hours of fishing time. The 233 ton harvest included 122 tons of sac roe herring with an average roe recovery of 8.5%, 100 tons of bait and 11 tons of herring that could not be sold and were discarded. The harvest was 7% of the estimated spawning biomass. During the May 27 opening, most herring were located within closed areas and therefore were unavailable to fishermen. Unfavorable ice conditions also complicated the fishery in 1989, especially for Toksook Bay fishermen. Four processors paid the 162 participating fishermen an average of \$500 per ton for 10% sac roe herring and \$50 per ton for bait quality herring. Total ex-vessel value of the harvest was \$57,000.

Nunivak Island District

The district was first opened to commercial herring fishing on May 25 after an aerial survey on May 24 documented 480 tons of herring and spawning activity. The fishery was opened until further notice on May 27 and closed on June 3. Catch rates during the 1989 season were low. A harvest of 116 tons was taken by 45 fishermen in 186 hours. This harvest included 79 tons of sac roe product with 9.4% roe and 37 tons of bait quality herring. Three processors paid 45 fishermen an average of \$500 per ton for 10% sac roe herring and \$50 per ton for bait quality herring. The total ex-vessel value of the Nunivak Island harvest was \$42,000.

Cape Romanzof District

The 1989 commercial herring season in the Cape Romanzof District opened on May 26. The total harvest of 926 tons was taken during four fishing periods, established by emergency order, from May 26 to May 31. A total of 13 hours of fishing time was allowed. The majority of the harvest was sac roe with an average roe recovery of 9.3%; only 1 ton was bought as bait quality herring. The harvest was 21% of the estimated available biomass. A total of 115 fishermen participated in the fishery; the second highest number on record. Six buyers in the Cape Romanzof District paid fishermen approximately \$560 per ton

for 10% sac roe herring and \$51 for bait quality herring. The total ex-vessel value of the harvest was approximately \$486,500.

In coordination with the Department, commercial fishermen provided catch samples for evaluation by industry representatives prior to each opening. Roe recovery information indicated that 100% of the herring sampled were mature. Roe recovery of fish captured in 3 inch mesh gill nets was in excess of 13%, while roe recovery from fish captured in 2 7/8 inch mesh gill nets ranged from 7.5% to 16.0%. The roe recovery from herring caught with 2 3/4 inch mesh gill nets ranged from 8.2% to 13.5%. Low roe recovery samples were the result of catches with high male ratios obtained primarily in offshore sets. Following evaluation of roe quality, the fleet was typically given 2 hours notice prior to the beginning of each scheduled fishing period. The first three periods were scheduled to start at approximately high tide. The last period was scheduled to begin approximately 1 hour before to high tide. This was the first season in which commercial fishery test samples were extensively used in managing the fishery.

Norton Sound District

The 1989 Norton Sound herring fishery opened by emergency order on May 27. A total of three gill net openings for 10 hours of fishing and four beach seine openings for 14 hours of fishing occurred this season. The entire district was closed on May 30. The harvest of 4,741 tons of herring was 18% of the estimated biomass. The harvest included 4,494 tons of sac roe herring with an average roe recovery of 9.2% and 247 tons of bait quality herring. In addition, approximately 30 tons were estimated to have been wasted in abandoned gill nets and a lost beach seine set. There were 357 fishermen, who made at least one delivery during the season, consisting of 351 gillnetters and 6 beach seiners. This is the second highest effort on record. The harvest by gill nets was 4,352 tons with 9.3% average roe recovery. Beach seiners landed 390 tons of herring with 8.5% roe. Nine companies registered 12 processing vessels and 53 tenders to operate in Norton Sound for the 1989 season. Fishermen received approximately \$555 per ton for 10% sac roe herring and \$51 per ton of bait quality herring. The total value of the herring harvest to fishermen was approximately \$2,322,274.

Waters from Wood Point to Shaktoolik were ice free during the fishery and aerial surveys. However, these waters were turbid due to strong winds during the ice free period prior to the fishery, and never cleared sufficiently for acceptable aerial surveys. Shore ice was present in all subdistricts prior to the opening of the fishery but sea ice had broken up and begun moving early in the season; the Cape Denbigh (Shaktoolik subdistrict), Unalakleet and St. Michael areas were predominantly ice free by the fishery opening. Winter weather conditions prevailed in the northern subdistricts until well after the fishery, which took place in the southern subdistricts.

Because of poor aerial survey conditions, test fish data was heavily relied upon to determine when to open the fishery. A sample of herring caught in a 2 7/8 inch mesh subsistence gill net from St. Michael Bay on May 24 indicated a 50:50 male to female ratio with 6% mature roe. Herring samples taken from the

Department variable mesh test catch from near Blueberry Point on May 25 had a higher mature roe content. Samples from the Beeson Slough area (between Unalakleet and Shaktoolik) were tested by industry roe technicians at a beach party on May 25 and ranged from 5.9% to 8.6% mature roe. During a second beach party, nine samples from 2 7/8 inch and 3 inch mesh gill nets ranged from 4% to 10% mature roe. Low roe percentages were primarily due to large numbers of males in the samples rather than immature roe. Since spawned-out fish appeared in some samples and roe samples were primarily mature, the fishery was opened May 27. Subsequent openings were announced as soon as catch reports were available, and were timed in an attempt to optimize tide conditions for gill net fishermen and viewing conditions for beach seine fishermen. Beach seine openings were conducted during separate times from gill net openings to prevent gear conflicts and so the Department could more easily monitor the beach seine fishery.

A management action taken during the third and final gill net opening of May 29 restricted gear to a maximum of one net, not to exceed 50 fathoms in length. This was the first time use of a new regulation which allows the Department to limit legal gear length by emergency order. This restricted gear opening was an attempt to allow the gill net fleet to harvest the estimated remaining harvest guideline of 600 tons.

Port Clarence District

There was no commercial or test fishery in Port Clarence in 1989 since there was no buyer in the district.

ENFORCEMENT

In 1989, the Division of Fish and Wildlife Protection (FWP) was present in all but the Cape Avinof District. At least 12 people with FWP were involved in Kuskokwim Bay herring fisheries. Two troopers patrolled the Security Cove opening using a Department of Public Safety helicopter. The P/V Woldstad, a FWP Grumman Goose, C-180 fixed wing aircraft, and helicopter spent time in the Goodnews Bay, Nelson Island and Nunivak Island Districts during the commercial fishery. In the Kuskokwim area, citations for violating fishing regulations were issued in all four districts patrolled by FWP personnel.

Four FWP officers were present on the Cape Romanzof fishing grounds during the 1989 herring season. These officers were supported by the P/V Woldstad and two skiffs. A total of nine commercial fishing citations were issued. Seven of these citations were issued for fishing during closed periods and two were issued for lack of photo identification. One delivery of 1,443 lbs and one shackle of gear were confiscated. Poor weather conditions during the second opening prevented FWP officers from being present on the ground in skiffs; however the P/V Woldstad was present. No FWP support or personnel were present during the third and fourth openings. This lack of enforcement was an obvious

problem as evidenced by several observed violations during the last fishing period. Approximately eight gill nets were in the water in front of the Department's camp after the fishing period closed. One of these nets was fishing for 1/2 hour after the closure.

In the Norton Sound District, FWP presence consisted of three FWP personnel using one single engine aircraft and a skiff. FWP officers patrolled the grounds during each opening and closure. However with the limited personnel and equipment available to patrol the Norton Sound District, just one subdistrict was effectively covered following each period; many public complaints regarding lack of enforcement presence were fielded by Commercial Fisheries staff. A total of 17 citations were issued for the following: 2 citations, one for each count, buying prior to District registration; 3 citations fishing closed period (early); 7 citations fishing closed period (late); 4 citations for illegal beach seine sets; and 1 citation for lack of photo identification. In addition, investigations are pending on abandoned gill net gear, superexclusive use violations, and affidavits concerning eyewitness accounts of fishing extra gear during the last gill net opening. A total of 26 tons of herring was confiscated by the State of Alaska during the 1989 season in Norton Sound. Additional forfeitures are possible following further investigation.

OUTLOOK AND MANAGEMENT STRATEGY FOR 1990

Based upon apparent weak recruitment of younger age classes (ages 3-5) and reduced returns of the abundant 1977 and 1978 year classes due to high natural mortality of older aged herring, a decline in the total harvestable surplus of Pacific herring in the AYK region is expected for 1990. However, since methods to reliably forecast actual returns are still being developed, and reliable estimates of recruitment are not available, harvest levels will be adjusted during the season according to observed herring spawning biomass. If it is not possible to determine herring abundance using aerial survey methods, stock abundance will be assessed using information from test and commercial catches and spawn deposition observations.

Projections from post-season escapement estimates, using mean rates of natural mortality and growth for each age class, indicate that the 1990 minimal spawning biomass for the northeastern Bering Sea Pacific herring stocks (Security Cove to Norton Sound) should be approximately 27,210 tons (Table 6). A decrease in herring biomass compared to 1989 levels is expected for all fishing districts. Increased recruitment of ages 3 through 5-year-old Pacific herring could increase the 1990 observed biomass over the projected biomass estimates. However in accordance with AYK region harvest policy, newly recruited age classes (age 3, 4, and 5 year old herring) will not be targeted by the commercial fishery.

Security Cove District

The 1990 projected return is 1,560 tons which at a 15% exploitation rate would result in a harvest of about 235 tons (Table 6). Age 9 and older herring are expected to comprise 70% of the biomass.

Emergency order authority will be used to adjust the occurrence and length of fishing periods commensurate with stock strength, fishing effort, and spawning activity. Commercial fishing will not be allowed until total biomass reaches 1,200 tons or significant spawning activity is documented. The harvest level will be maintained at 15% or less, unless available biomass significantly exceeds the 1990 projection. If this occurs, an exploitation rate of up to 20% may be allowed.

Goodnews Bay District

The 1990 projected return is approximately 2,330 tons which at a 15% exploitation rate would result in a harvest of about 350 tons (Table 6). Ages 11, 6, and 12 are expected to dominate the biomass. Age 9 and older herring are expected to comprise approximately 65% of the biomass.

The management strategy for this district will be similar to that used for Security Cove. The season will be opened by emergency order. Commercial fishing will not be allowed until total biomass reaches 1,200 tons or significant spawning is observed. The harvest level will be 15% or less, unless available biomass exceeds the 1990 projection at which time a higher exploitation rate may be allowed.

Cape Avinof District

Since the peak aerial survey estimate of biomass was observed under unacceptable survey conditions, the 1989 preseason projection of 2,800 tons was used to estimate the 1990 return. The return to the Cape Avinof District in 1990 is estimated to be 2,020 tons, which at an exploitation rate of 15% would result in a 300 ton harvest (Table 6). Age 6 herring are expected to be the largest age group in the return. Age 9 and older herring are expected to comprised 50% of the return.

The 1990 Cape Avinof District commercial herring fishery will be regulated by emergency order. No commercial fishery will be allowed until the total biomass reaches 500 tons or significant spawning is observed. Commercial harvest of Pacific herring will be up to 15% of the total spawning biomass.

Nelson Island District

The spawning biomass projected to return to the Nelson Island District during 1990 is 2,050 tons (Table 6). This is below the 2,500 ton threshold required to open the fishery. However, processors and fishermen are advised that management of the 1990 fishery will be based on observed biomass. If the

threshold of 2,500 tons of herring or significant spawning activity is not observed, the fishery will not be opened.

Herring of age 9 and older are expected to comprise over 70% of the biomass in 1990. The harvest level will be maintained at 10% unless available biomass significantly exceeds the 2,500 ton threshold level.

As in 1989, the Nelson Island commercial fishery will be regulated by emergency order. To provide additional protection for the subsistence harvest of Pacific herring, the following guidelines will be followed:

1. The commercial fishery will be allowed to take up to 15% of the herring biomass, compared to up to 20% for most other fisheries having stocks of similar size and condition.
2. The commercial fishing season will be opened when a biomass of 2,500 tons or significant spawning activity is documented.
3. Periodic closures of the commercial fishery will be scheduled, during which time only subsistence fishing will be allowed.
4. Several important subsistence use areas occur throughout the district, including the waters north of Cape Vancouver. Specific areas may be closed to commercial fishing to insure the adequacy of subsistence harvests.
5. The Department will by all available means, including input from local residents, insure the adequacy of subsistence herring harvests during the commercial fishing season.

Nunivak Island District

The biomass of herring projected to return to the Nunivak Island District during 1990 is 320 tons (Table 6). This is below the threshold of 1,500 tons needed to open the fishery. However processors and fishermen are advised that management of the 1990 fishery will be based on observed biomass. As in 1989, the Nunivak Island District commercial herring fishery will be regulated by emergency order. Commercial harvest of Pacific herring will be up to 15% of the observed spawning biomass. If the threshold of 1,500 tons of herring or significant spawning activity is not observed, the fishery will not be opened.

Ages 11 and 12 year old herring are expected to dominate the biomass. Age 9 and older herring are expected to comprise 74% of the return.

Cape Romanzof District

The projected return for 1990, based upon limited data, is 2,410 tons which at a 15% exploitation rate would result in a 360 ton harvest (Table 6). Age 9 herring are expected to comprise the largest age group in biomass.

Emergency order authority will be used to adjust the occurrence and length of fishing periods. A minimum level of biomass cannot be used to determine the timing and duration of commercial fishing periods since turbid water conditions usually preclude aerial biomass assessments. Therefore, spawn deposition observations and test and commercial catch rates will be used to determine timing and duration of commercial fishing periods and relative stock abundance.

Norton Sound District

The projected return is 16,520 tons which at a 20% exploitation rate would result in a harvest of 3,300 tons (Table 6). The 1990 spawning population is expected to be dominated primarily by 8 year olds.

Inseason assessment of herring biomass will supercede projected biomass for management of the Norton Sound herring fishery except where weather prevents obtaining an inseason estimate. The beach seine fishery is already set by regulation at 10% of the projected biomass. The actual return of herring in 1990 may exceed the projection due to the return of younger fish which were not included in the projection and the conservative 1989 biomass estimate from unacceptable aerial survey conditions.

The 1990 herring fishery will be opened by emergency order. The fishery will close by emergency order when up to 20% of the available Pacific herring biomass has been harvested. Varied harvest rates may be applied to individual subdistricts based on biomass distribution, roe quality, weather, and sea ice conditions. The beach seine guideline harvest level will be 330 tons.

Port Clarence District

The Department does not generally project an outlook for the Port Clarence fishery due to the lack of data on Port Clarence herring and the very limited scope of the fishery. The guideline harvest of 165 tons as set by the Board of Fisheries in 1981 will determine the allowable harvest in 1990. This harvest guideline is based on 2 years research by the department in both the Port Clarence and Kotzebue Districts. Even though this guideline has not appeared in the regulation book since 1984, it still represents the best estimate of harvestable biomass at this time. In 1989, 6 and 7 year old herring were expected to dominate the returning biomass of fish. Therefore ages 7 and 8 are expected to dominate the 1990 return.

Table 1. Pacific herring harvests by domestic commercial fishermen in the northeastern Bering Sea, Alaska, 1909-1989.

Year	Herring (st) ^a									Spawn on Kelp (st)	
	Security Cove	Goodnews Bay	Cape Avinof	Nelson Island	Nunivak Island	Cape Romanzof	Norton Sound	Port Clarence	Total Harvest	Norton Sound	Total Harvest
1909-1916	-	-	-	-	-	-	- ^b	-	-	-	-
1916-1928	-	-	-	-	-	-	1,881	-	1,881	-	1,881
1929	-	-	-	-	-	-	166	-	166	-	166
1930	-	-	-	-	-	-	441	-	441	-	441
1931	-	-	-	-	-	-	86	-	86	-	86
1932	-	-	-	-	-	-	529	-	529	-	529
1933	-	-	-	-	-	-	31	-	31	-	31
1934	-	-	-	-	-	-	4	-	4	-	4
1935	-	-	-	-	-	-	15	-	15	-	15
1936	-	-	-	-	-	-	-	-	-	-	-
1937	-	-	-	-	-	-	6	-	6	-	6
1938	-	-	-	-	-	-	10	-	10	-	10
1939	-	-	-	-	-	-	6	-	6	-	6
1940	-	-	-	-	-	-	14	-	14	-	14
1941	-	-	-	-	-	-	3	-	3	-	3
1942-1944	-	-	-	-	-	-	-	-	-	-	-
1945	-	-	-	-	-	-	-	-	-	-	-
1946	-	-	-	-	-	-	-	-	-	-	-
1947-1963	-	-	-	-	-	-	-	-	-	-	-
1964	-	-	-	-	-	-	20	-	20	-	20
1965	-	-	-	-	-	-	-	-	-	-	-
1966	-	-	-	-	-	-	12	-	12	-	12
1967	-	-	-	-	-	-	-	-	-	-	-
1968	-	-	-	-	-	-	-	-	-	-	-
1969	-	-	-	-	-	-	2	-	2	-	2
1970	-	-	-	-	-	-	8	-	8	-	8
1971	-	-	-	-	-	-	20	-	20	-	20
1972	-	-	-	-	-	-	17	-	17	-	17
1973	-	-	-	-	-	-	35	-	35	-	35
1974	-	-	-	-	-	-	2	-	2	-	2
1975	-	-	-	-	-	-	-	-	-	-	-
1976	-	-	-	-	-	-	9	-	9	-	9
1977	-	-	-	-	-	-	11	-	11	<1	11
1978	286	-	-	-	-	-	15	-	301	4	305
1979	424	90	-	-	-	-	1,292	-	1,806	13	1,819
1980	697	448	-	-	-	611	2,452	-	4,208	24	4,232
1981	1,173	657	-	-	-	720	4,371	-	6,921	47	6,968
1982	813	486	-	-	-	657	3,933	-	5,889	38	5,927
1983	1,073	435	-	-	-	816	4,582	-	6,906	29	6,935
1984	335	717	-	-	-	1,185	3,662	-	5,899	19 ^c	5,918
1985	733	724	-	977	358	1,299	3,548	-	7,639	-	7,639
1986	751	557	-	886	511	1,865	5,194	-	9,764	-	9,764
1987	313	321	-	923	414	1,342	4,082	146	7,541	-	7,541
1988	324	483	348	775	-	1,119	4,672	80	7,801	-	7,801
1989	554	616	129	233	116	926	4,771	-	7,345	-	7,345

^a Pre-1964 harvest primarily in summer and fall for food; post 1964 harvest primarily in spring for sac roe.

^b Wastage included.

^c Fishery occurred some years but harvest data unavailable.

^c Additional 3 st harvested from imported kelp (*Macrocystis* sp) not included.

Table 2. Estimated biomass and commercial harvest of Pacific herring in northeastern Bering Sea fishing districts, Alaska, 1982-1989.

Year	District	Estimated Biomass (st)	Harvest (st)			% Harvest by Gear			Roe %	Estimated Value (\$ x1,000)	Exploitation Rate (%)
			Catch	Waste	Total	Gill Net	Purse Seine	Beach Seine			
1989	Security Cove	2,830	554	0	554	100	0	0	9.4	265	19.6
	Goodnews Bay	4,040	616	0	616	100	0	0	8.4	335	15.2
	Cape Avinof	2,780 ^a	129	0	129	100	0	0	8.0	54	18.7
	Nelson Is.	3,320	222	11	233	100	0	0	8.5	57	7.0
	Nunivak Is.	620	116	0	116	100	0	0	9.4	42	18.8
	Cape Romanzof	4,400	926	0	926	100	0	0	9.3	1,020	21.0
	Norton Sound	<u>25,980</u>	<u>4,741</u>	<u>30</u>	<u>4,771</u>	<u>91</u>	<u>0</u>	<u>9</u>	<u>9.2</u>	<u>2,322</u>	<u>18.3</u>
	Total	43,970	7,304	41	7,345	94	0	6	9.0	4,095	16.7
1988	Security Cove	4,910	324	0	324	100	0	0	9.3	362	6.6
	Goodnews Bay	4,480	483	0	483	100	0	0	8.0	463	10.7
	Cape Avinof	4,110	348	0	348	100	0	0	8.6	264	8.5
	Nelson Is.	7,150	775	0	775	100	0	0	9.2	713	10.8
	Nunivak Is.	2,800 ^a	-	-	-	-	-	-	-	-	-
	Cape Romanzof	6,600	1,119	0	1,119	100	0	0	9.1	1,018	17.0
	Norton Sound	33,920	4,672	0	4,672	96	0	4	9.0	3,864	13.8
	Port Clarence	<u>790</u>	<u>80</u>	<u>0</u>	<u>80</u>	<u>30</u>	<u>70</u>	<u>0</u>	<u>8.2</u>	<u>43</u>	<u>10.2</u>
Total	64,760	7,801	0	7,801	97	<1	2	9.0	6,727	12.0	
1987	Security Cove	2,300	313	0	313	100	0	0	9.7	242	13.4
	Goodnews Bay	2,000 ^a	321	0	321	100	0	0	7.3	133	16.0
	Nelson Is.	8,100	923	0	923	100	0	0	9.2	661	11.4
	Nunivak Is.	4,400 ^a	414	0	414	100	0	0	7.8	231	9.2
	Cape Romanzof	7,200	1,342	0	1,342	100	0	0	8.9	1,000	18.6
	Norton Sound	32,400	4,082	0	4,082	92	0	8	8.6	2,613	12.6
	Port Clarence	<u>900</u>	<u>146</u>	<u><1</u>	<u>146</u>	<u><1</u>	<u>100</u>	<u>0</u>	<u>6.6</u>	<u>77</u>	<u>15.6</u>
	Total	57,300	7,541	<1	7,541	94	2	4	8.6	4,957	13.1
1986	Security Cove	3,700 ^a	751	0	751	100	0	0	11.2	535	20.3
	Goodnews Bay	3,000 ^a	557	0	557	100	0	0	10.4	325	18.1
	Nelson Is.	7,300 ^a	886	0	886	100	0	0	10.3	428	12.1
	Nunivak Is.	6,000	511	0	511	100	0	0	10.1	213	8.5
	Cape Romanzof	7,500	1,865	0	1,865	100	0	0	9.2	1,142	24.9
	Norton Sound	<u>28,100</u>	<u>5,194</u>	<u>0</u>	<u>5,194</u>	<u>96</u>	<u>0</u>	<u>4</u>	<u>9.6</u>	<u>2,900</u>	<u>18.5</u>
Total	55,600	9,764	0	9,764	98	0	2	9.7	5,543	17.6	
1985	Security Cove	4,900 ^a	703	30	733	100	0	0	10.1	355	15.0
	Goodnews Bay	4,300 ^a	724	0	724	100	0	0	8.7	309	16.8
	Nelson Is.	9,500 ^a	977	0	977	100	0	0	10.6	527	10.3
	Nunivak Is.	5,700 ^a	358	0	358	100	0	0	8.9	146	6.3
	Cape Romanzof	7,000	1,299	0	1,299	100	0	0	8.3	550	18.6
	Norton Sound	<u>20,000</u>	<u>3,548</u>	<u>0</u>	<u>3,548</u>	<u>95</u>	<u>0</u>	<u>5</u>	<u>9.9</u>	<u>1,438</u>	<u>17.7</u>
Total	51,400	7,609	30	7,639	98	0	2	9.6	3,325	14.8	
1984	Security Cove	5,100	325	10	335	100	0	0	11.8	110	6.6
	Goodnews Bay	4,100	667	50	717	100	0	0	10.1	168	17.5
	Cape Romanzof	6,100	1,185	0	1,185	100	0	0	8.6	306	19.4
	Norton Sound	<u>23,100</u>	<u>3,572</u>	<u>90</u>	<u>3,662</u>	<u>91</u>	<u>0</u>	<u>9</u>	<u>10.3</u>	<u>888</u>	<u>15.9</u>
Total	38,400	5,749	150	5,899	95	0	5	10.0	1,472	15.4	
1983	Security Cove	6,400	1,073	0	1,073	100	0	0	9.4	443	16.8
	Goodnews Bay	3,200	435	0	435	100	0	0	9.4	185	13.6
	Cape Romanzof	5,500	816	0	816	100	0	0	9.0	367	14.8
	Norton Sound	<u>28,100</u>	<u>4,582</u>	<u>0</u>	<u>4,582</u>	<u>100</u>	<u>0</u>	<u><1</u>	<u>8.6</u>	<u>1,519</u>	<u>16.3</u>
Total	43,200	6,906	0	6,906	100	0	<1	8.8	2,514	16.0	

^a Inseason biomass estimate from poor aerial survey, therefore projected biomass used.

Table 3. Number of buyers and fishermen participating in northeastern Bering Sea Pacific herring fisheries, Alaska, 1982-1989.

Year	District	Number of Buyers	Number of Fishermen		
			Gill Net	Seine ^a	
				Purse	Beach
<u>1989</u>	Security Cove	8	110	-	-
	Goodnews Bay	6	138	-	-
	Cape Avinof	3	147	-	-
	Nelson Island	4	162	-	-
	Nunivak Island	3	45	-	-
	Cape Romanzof	6	115	-	-
	Norton Sound	9	351	-	6
<u>1988</u>	Security Cove	4	31	-	-
	Goodnews Bay	6	60	-	-
	Cape Avinof	1	98	-	-
	Nelson Island	7	174	-	-
	Nunivak Island	0	0	-	-
	Cape Romanzof	6	113	-	-
	Norton Sound	11	343	-	6
	Port Clarence	1	6	1	-
<u>1987</u>	Security Cove	8	65	-	-
	Goodnews Bay	4	117	-	-
	Nelson Island	9	235	-	-
	Nunivak Island	4	61	-	-
	Cape Romanzof	9	157	-	-
	Norton Sound	12	559	-	22
	Port Clarence	2	1	3	-
<u>1986</u>	Security Cove	11	88	-	-
	Goodnews Bay	5	104	-	-
	Nelson Island	4	163	-	-
	Nunivak Island	5	36	-	-
	Cape Romanzof	5	97	-	-
	Norton Sound	10	319	-	4
<u>1985</u>	Security Cove	6	107	-	-
	Goodnews Bay	5	83	-	-
	Nelson Island	6	143	-	-
	Nunivak Island	5	37	-	-
	Cape Romanzof	2	73	-	-
	Norton Sound	11	274	-	4
<u>1984</u>	Security Cove	4	38	-	-
	Goodnews Bay	4	130	-	-
	Cape Romanzof	3	66	-	-
	Norton Sound	8	189	-	10

^a Gear prohibited in all districts except Norton Sound and Port Clarence.

Table 4. Pacific herring subsistence harvest (st) and effort data from selected northeastern Bering Sea areas, Alaska, 1975-1989.^a

Village	Year												
	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
<u>Nelson Island</u>													
Tununak	57	38	34	65	40	48	94	-	43	63	48	48	47
Umkumiut	3	11	8	3	10	0	-	-	-	-	- ^c	-	-
Toksook Bay	21	37	51	29	14	35	-	-	46	70	51	57	52
Nightmute	-	-	-	-	-	-	-	-	3 ^a	21	15	16	15
Newtok	-	-	-	-	-	-	-	-	7 ^a	13	10	12	10
Total	81	86	93	97	64	83	94	-	99	167	124	133	124
Number of Fishing Families	90	83	54	70	93	65	43	-	65 ^b	72 ^b	96	104	- ^b
<u>Nunivak Island</u>													
Mekoryuk	-	-	-	-	-	-	-	-	<1	<1	-	-	-
Number of Fishing Families	-	-	-	-	-	-	-	-	11	6 ^b	-	-	-
<u>Other Kuskokwim Delta</u>													
Chefornak	-	-	-	-	-	-	-	-	13 ^b	-	14	-	-
Kipnuk	-	-	-	-	-	-	-	-	9	-	14	-	-
Kongiganak	-	-	-	-	-	-	-	-	3	2 ^b	-	-	-
Kwigillingok	1	-	8	13	-	13	-	-	5	-	-	-	-
Total	1	-	8	13	-	13	-	-	30	2	28	-	-
Number of Fishing Families	9	-	22	19	-	21	-	-	55 ^b	12 ^b	49	-	-
<u>Yukon Delta</u>													
Scammon Bay	-	1	6	3	8	4	3	4	2	2	1	2	1
Chevak	<1	-	2	4	2	2	1	3	2	1	1	2	<1
Hooper Bay	2	4	3	4	4	5	5	4	4	4	1	3	1
Total	<3	5	11	11	14	11	9	11	8	7	3	7	2
Number of Fishing Families	30	29	84	61	46	43	37	47	44	41	39	30	19

^a Subsistence survey results are believed to accurately reflect harvest trends, however, reported catches reflect minimum figures since all fishermen cannot be contacted.

^b Fishing families were not interviewed or only a portion of fishing families were interviewed as catch was enumerated while on drying racks.

^c Umkumiut effort included with Tununak.

Table 5. Summary of Pacific herring commercial harvest by fishing period for northeastern Bering Sea fishing districts, Alaska, 1989.

District	Subdistrict Section/Area	Gear	Period	Date	Time	Total hours	Harvest (st)
Security Cove	Entire	GN	1	5/17	0630-1030	4.0	553.6
					Total	4.0	553.6
Goodnews Bay	Entire	GN	1	5/23	0630-1230	6.0	28.1
				5/23	2000-2400	4.0	11.6
				5/24	0730-1330	6.0	114.9
				5/25	0800-1600	8.0	278.9
				5/26	0900-1700	8.0	3.7
				5/27	0930-1730	8.0	5.8
				5/28	1030-1830	8.0	33.7
				5/29	1130-1930	8.0	139.1
Total	56.0	615.6					
Cape Avinof	Entire	GN	1	6/04-6/12	1000-1200	194.0	128.8
Nelson Island	Entire	GN	1	5/28	0600-0900	3.0	66.2
				5/29	1900-2200	3.0	102.9
				6/01	2000-2300	3.0	31.0
				6/03	1130-1530	4.0	32.0
				6/07	1600-1800	2.0	- ^a
Total	15.0	232.2					
Nunivak Island	Entire	GN	1	5/22	1330-1530	2.0	1.4
				5/25	1200-1600	4.0	11.7
				5/27-6/03	1200-2400	180.0	103.1
Total	186.0	116.2					
Cape Romanzof	Entire	GN	1	5/26	1930-2330	4.0	381.9
				5/27	2100-0000	3.0	153.5
				5/29-5/30	2200-0100	3.0	181.2
				5/30-5/31	2200-0100	3.0	209.3
Total	13.0	925.9					
Norton Sound	SD 1, 2, 3	GN	1	5/27	1100-1500	4.0	1,530.2
				5/28	1100-1500	4.0	1,947.0
				5/29	1100-1300	2.0	863.9
Total	10.0	4,351.3 ^b					
Norton Sound	SD 1, 2, 3	BS	1	5/27	1800-2100	3.0	54.0
				5/28	1800-2100	3.0	48.5
				5/29	1600-2100	5.0	135.2
				5/30	1100-1400	3.0	152.0
Total	14.0	389.7					

^a No buyers present.

^b Harvest of 10.3 st taken 5/30-5/31 with educational permit.

Table 6. Projections of Pacific herring spawning biomass and harvest for commercial fishing districts in the northeastern Bering Sea, Alaska, 1990.

District	1990 Projection ^a		
	Biomass (st)	Harvest (st)	Exploitation Rate (%)
Security Cove	1,560	235	15
Goodnews Bay	2,330	350	15
Cape Avinof	2,020	300	15
Nelson Island	2,050	- ^b	10
Nunivak Island	320	- ^b	15
Cape Romanzof	2,410	360	15
Norton Sound	16,520	3,300	20
Port Clarence ^c	-	165 ^d	-
Total	27,210	4,710	

^a Preseason projection. Biomass and harvest may be adjusted based on inseason estimates.

^b Projected biomass is below minimum for commercial harvest; fishery will be opened if threshold biomass is observed.

^c No biomass estimate for 1989.

^d Harvest guideline of 165 st (150 mt).

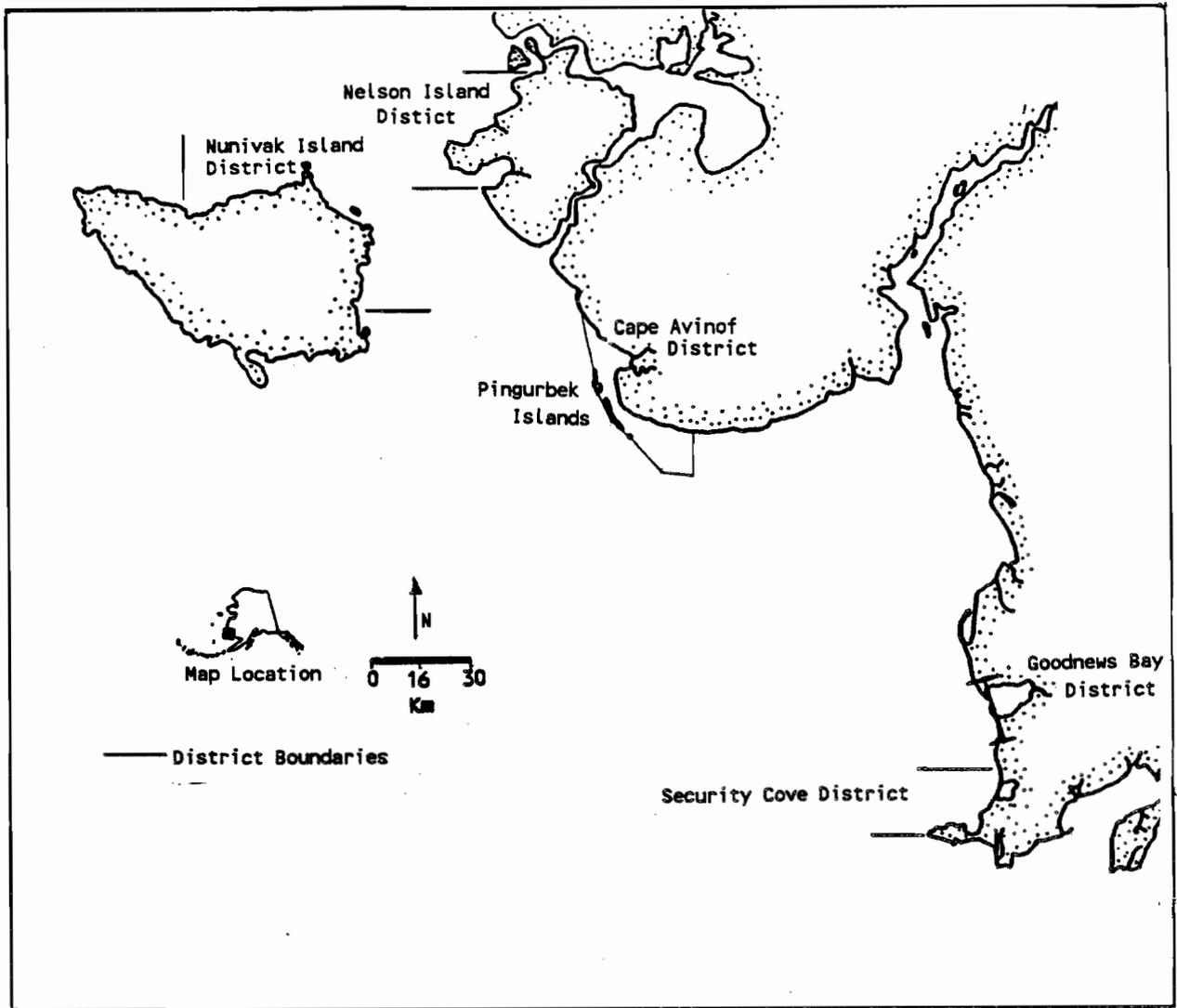


Figure 1. Security Cove, Goodnews Bay, Nelson Island, Nunivak Island, and Cape Avinof Pacific herring commercial fishing districts in the northeastern Bering Sea, Alaska

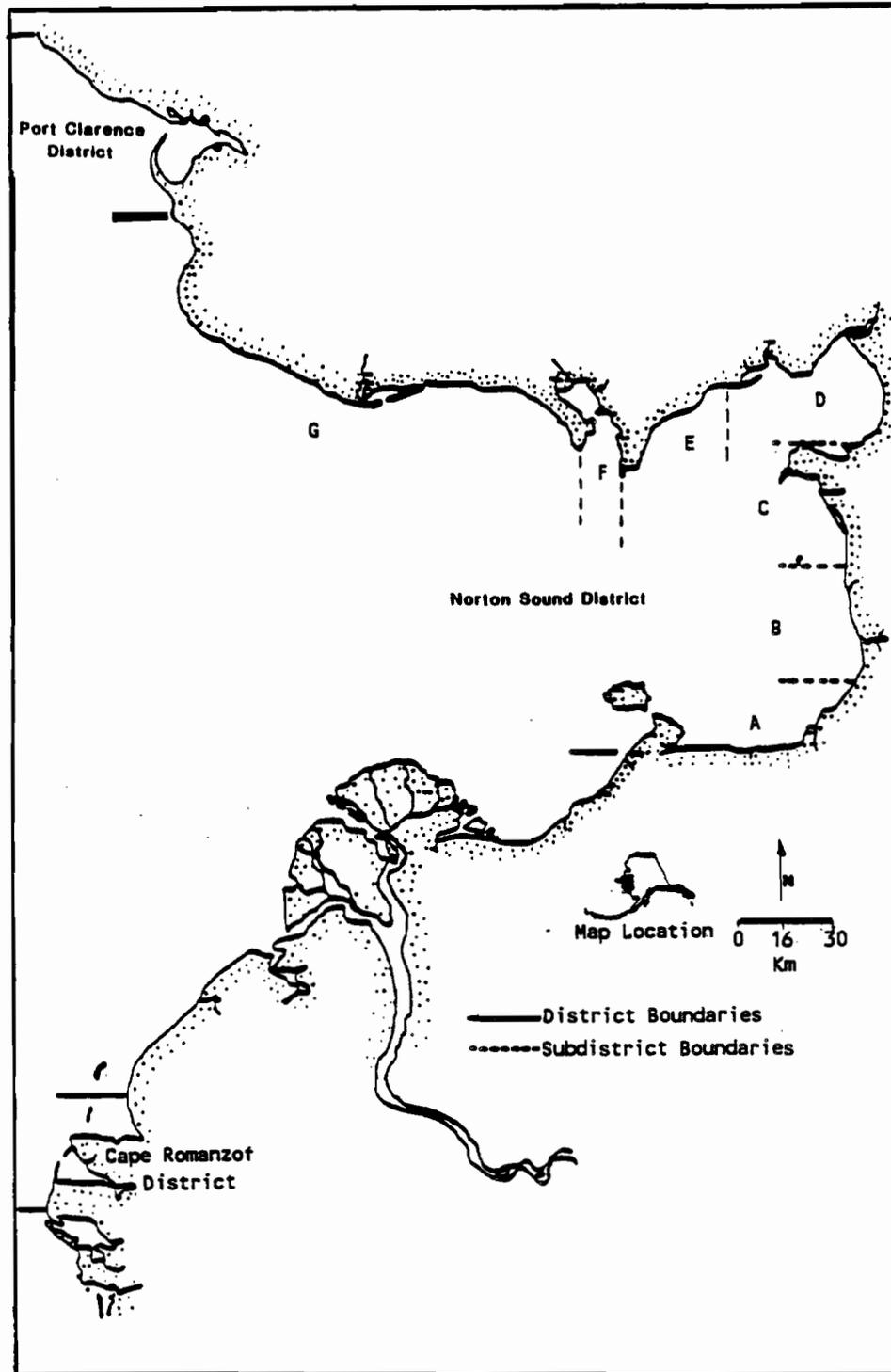


Figure 2. Cape Romanzof, Norton Sound, and Port Clarence Pacific herring commercial fishing districts, in the northeastern Bering Sea, Alaska

Percent of Total Run by Weight

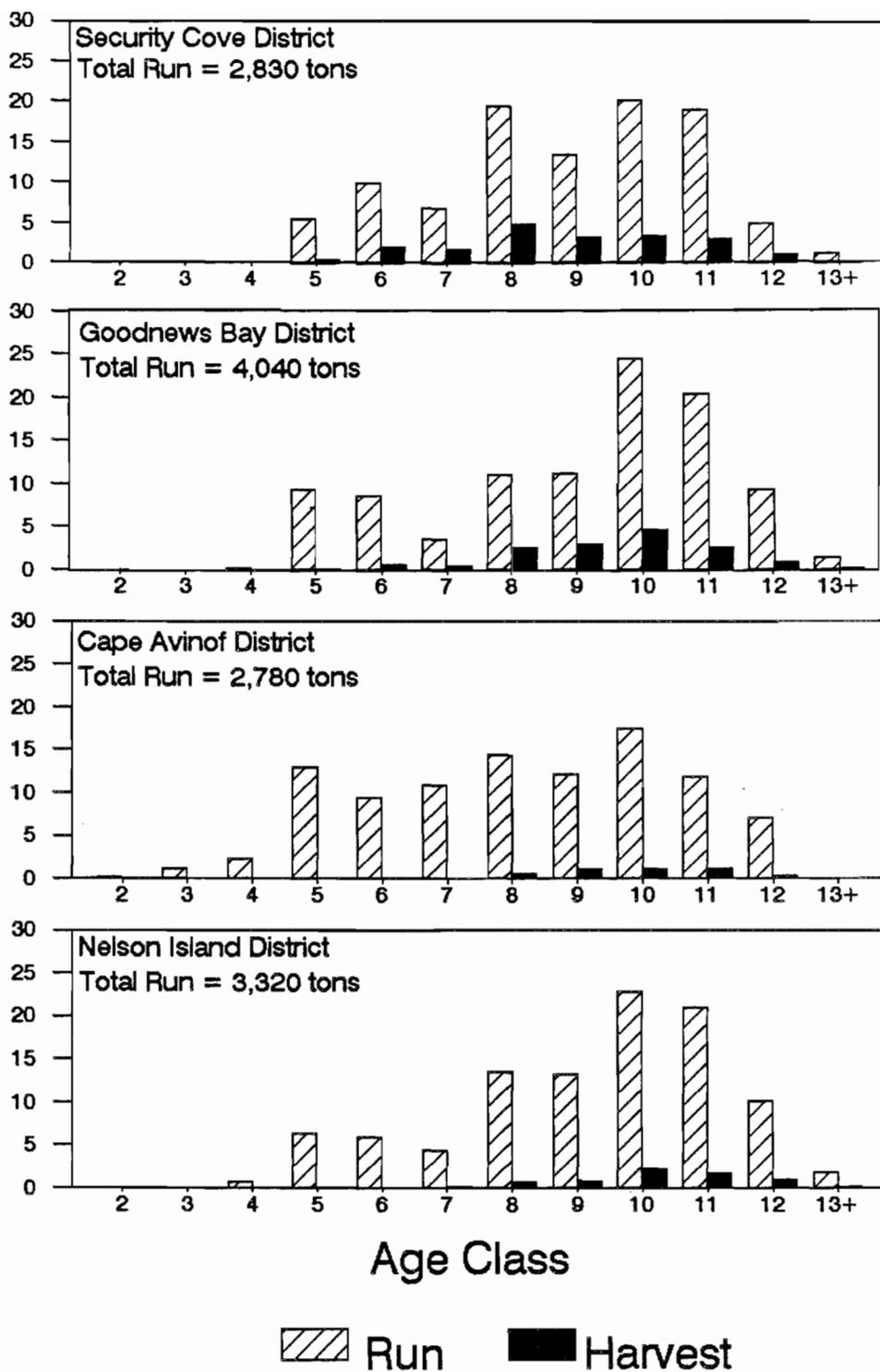


Figure 3. Age composition of Pacific herring in spawning populations and commercial harvests in Security Cove, Goodnews Bay, Cape Avinof and Nelson Island commercial herring fishing districts in the northeastern Bering Sea, Alaska, 1989.

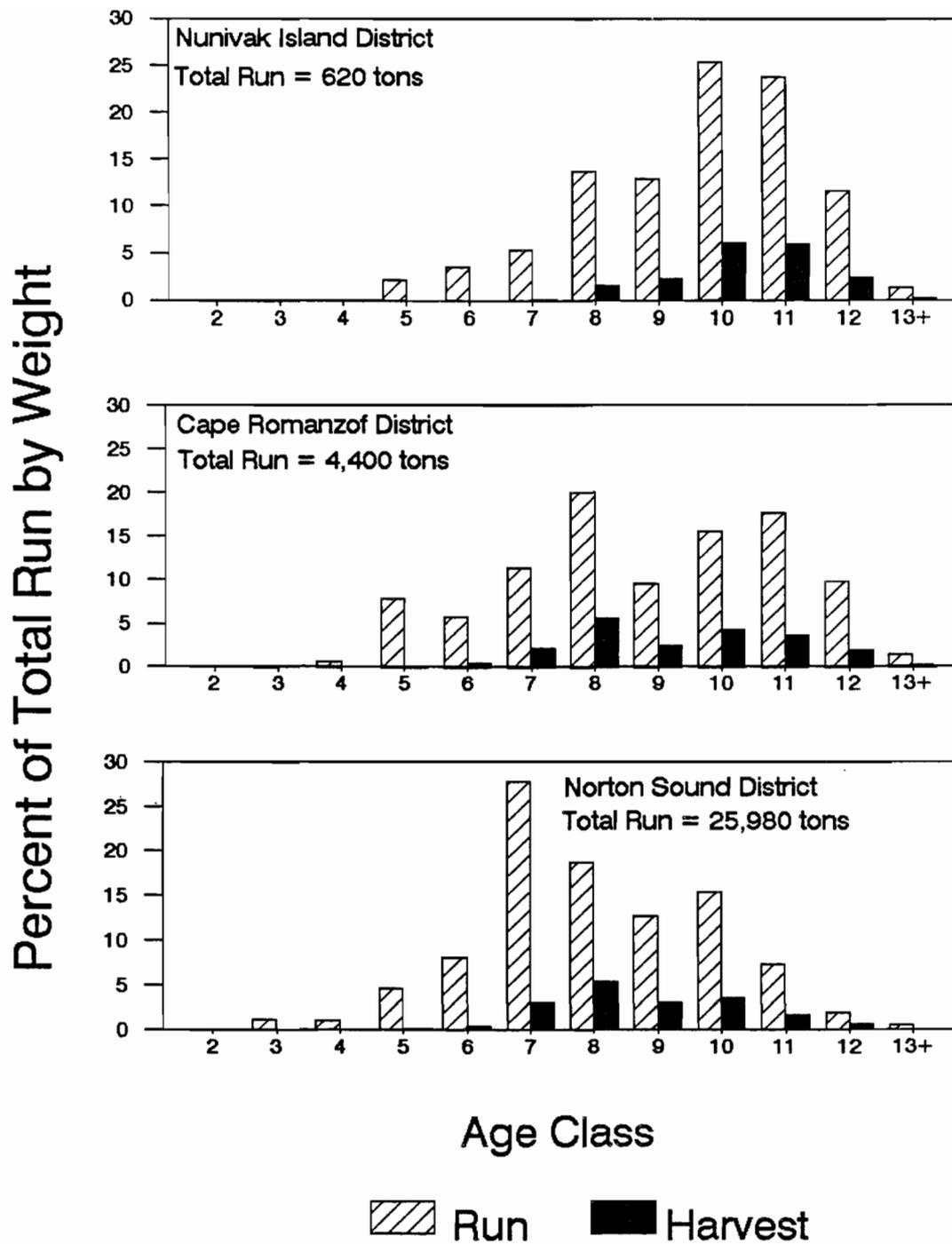


Figure 4. Age composition of Pacific herring in spawning populations and commercial harvests in Nunivak Island, Cape Romanzof, and Norton Sound commercial herring fishing districts in the northeastern Bering Sea, Alaska, 1989.

