

Agenda D-3(c)
December 1990
Supplemental

PRELIMINARY FORECASTS OF CATCH AND ABUNDANCE FOR BERING SEA HERRING STOCKS IN 1991

A Report to the North Pacific Fisheries Management Council

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REGIONAL INFORMATION REPORT¹ NO. 5J90-09

Alaska Department of Fish and Game
Division of Commercial Fisheries
P.O. Box 3-2000
Juneau, Alaska 99802-2000

November 1990

¹ The Regional Information Report Series was established in 1988 to provide an information access system for all unpublished divisional reports.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.

ACKNOWLEDGEMENTS

This report is based on information contributed by Division of Commercial Fisheries biologists and biometricians located in offices throughout the state. Jim McCullough supplied the information about the Port Moller area, Kathy Rowell contributed the information about the Togiak stock, Charley Burkey supplied information about Kuskokwim area stocks, and Helen Hamner, Sue Merkouris, and Charles Lean contributed information about the Cape Romanzof and Norton Sound areas.

EXECUTIVE SUMMARY

Amendment 16A to the Bering Sea/Aleutians Groundfish Fishery Management Plan would establish Prohibited Species Caps (PSC) caps for Bering Sea groundfish trawl fisheries at 1% of the aggregate biomass of herring stocks that spawn at Port Moller, Togiak, Security Cove, Goodnews Bay, Cape Avinof, Nelson Island, Nunivak Island, Cape Romanzof, and Norton Sound. The total Bering Sea herring biomass is estimated to be 83,406 metric tons. The herring PSC cap under amendment 16A would be set at 1% of the Bering Sea-wide biomass, or 834 metric tons. Bering Sea herring biomass is projected to continue to decline due to the senescence of the strong 1977-78 year classes of herring which had previously been making substantial contributions to the biomass of each area. The declines in abundance due to this effect are somewhat offset by the increases in biomass in Norton Sound due to recruitment from the 1981 and 1986 year classes. Herring biomass is projected to be below thresholds for commercial harvests at Nelson and Nunivak Islands.

Herring biomass estimates will be updated during the 1991 sac roe season in areas where aerial survey conditions are good and rapid data summary is possible. If time permits the forecasts will be revised prior to the herring sac roe season for Cape Romanzof and Norton Sound where population dynamics studies are in progress.

INTRODUCTION

Amendment 16A to the Bering Sea/Aleutians Groundfish Fishery Management Plan identifies an aggregate of nine Bering Sea herring stocks that are taken as bycatch by groundfish trawl fisheries in the Bering Sea. These nine herring stocks, identified by their spawning grounds, are the Port Moller, Togiak, Security Cove, Goodnews Bay, Cape Avinof, Nelson Island, Nunivak Island, Cape Romanzof, and Norton Sound herring stocks (Figure 1). Amendment 16A specifies that 1% of the aggregate biomass of these stocks would be used to establish herring bycatch caps that, if exceeded, would trigger certain time-area closures for groundfish trawlers. The purpose of this document is to summarize the best currently available estimates of the biomass of these nine herring stocks. This summary is based on more detailed stock assessment documents which are prepared for each of the stocks. Summaries of stock assessment information for 1990 were given by Funk and Savikko (1990). All harvests and biomasses in this report are reported using the short ton (2,000 lbs) unit used extensively in the herring harvesting and processing industry, unless otherwise noted. The metric ton unit (2,204.62 lbs) is the standard unit used to manage the groundfish fishery.

A booklet describing regulations for all Alaska herring fisheries is available from ADF&G offices. The management of many herring fisheries is further described in fishery management plans. In some cases these management plans are regulations adopted by the Alaska Board of Fisheries and appear in the herring regulation booklet. In other cases, separate fishery management plan documents are available from the local ADF&G area management office(s) responsible for each fishery.

Herring harvest projections are based on a number of sources of information. For the major stocks harvested during spring sac roe fisheries, estimates of the spawning biomass and age composition of the stock are derived each spring. Spawning biomass is estimated either from spawn deposition surveys or from aerial surveys. The age composition of the spawning biomass is estimated by sampling the commercial catch and from test fishing conducted by the Department of Fish and Game. Herring stock assessment forecasts for 1991 consist of projecting the numbers and average weight of each age class of the population, as assessed in 1990, forward to 1991, allowing for an age-specific level of annual natural mortality and growth. Attempts are also made to predict the number of recruit age-class fish (age 3, 4, or 5, depending on the area) that will appear in the 1991 spawning population for the first time. In most cases these estimates are derived from the number of 2, 3, or 4 year old fish which appeared on the spawning grounds in 1990. These recruitment estimates contain a very large amount of uncertainty. In a few instances, additional growth and age composition information will be obtained from overwintering herring schools prior to the spring 1991 fishery. While hydroacoustic estimates of biomass are used to assess some populations harvested by food and bait herring fisheries, these methods are not used for quantitative assessment of herring stocks fished in spring roe fisheries at this time.

Herring biomass estimates will be updated during the 1991 sac roe season in areas where aerial survey conditions are good and rapid data summary is possible. Herring biomass estimates will be updated during the 1991 sac roe season in areas where aerial survey conditions are good and rapid data summary is possible. If time permits the forecasts will be revised prior to the herring sac roe season for Cape Romanzof and Norton Sound where population dynamics studies are in progress.

PORT MOLLER

Since 1986, herring sac roe harvests in the Port Moller fishery have ranged from 270-880 tons. In 1990, the Port Moller herring sac roe fishery was opened by emergency order on May 30. Herring appeared to be running late and most of the harvest occurred June 6-8. The entire harvest of 273 short tons was taken from Herendeen and Inner Moller Bay sections. Although 19 purse seine vessels indicated an interest in fishing at Port Moller, only 5 permit holders made deliveries. The average roe recovery was 7.35% with an average price of \$600 per ton for 10% roe recovery +/- \$60 for each percentage point above or below 10%, and the ex-vessel value of the fishery was worth \$123,251.

For 1991 the Port Moller forecasted herring catch is 300 tons. The forecast is based on the 1985-90 average catch of 572 tons adjusted for the lower than normal observed biomass in Port Moller aerial surveys during 1990. The fishery is being managed for 15% exploitation on the preseason forecast biomass of 2,000 short tons. Age class data from the 1990 catch indicates that in 1991 ages 4 and 7 herring should dominate North Peninsula catches.

TOGIAK

Summary of the 1990 Togiak Sac Roe Fishery

The peak aerial survey biomass estimate of 72,000 short tons was observed on May 8, and the fishery was managed on that inseason estimate. By Board of Fisheries directive, the fishery is to be managed with a maximum exploitation rate of 20 percent. Fifteen hundred short tons are reserved for the spawn-on-kelp fishery, and 7% of the remaining available harvest set aside for the Dutch Harbor food and bait fishery. The remainder of the harvestable surplus is allocated to the sac-roe fishery, of which 25 percent is allocated to the gill net fleet, and 75 percent to the seine fleet. Thus, the allocation by gear type of the harvestable surplus of 14,400 short tons was as follows:

Spawn-on-kelp equivalent:	1,500 short tons
Dutch Harbor Food/Bait:	900 short tons
Gill Net Fleet:	3,000 short tons
Seine Net Fleet:	9,000 short tons

TOTAL:	14,400 short tons

One seine opening occurred May 9, and 9,129 short tons were harvested throughout the district. The first of six gill net openings occurred on May 8. The gill net fishery did not conclude until May 21, when the gill net fleet completed their allocated harvest of 3,000 tons.

The spawn-on-kelp fishery harvested 415,418 pounds of product in one four hour opening on May 11. Most of the product was reported as good quality, and some as excellent quality. This was the first year that participation in the fishery was limited. Using the formula adopted in 1984 by the Board of Fisheries, the 415,418 lbs of spawn-on-kelp harvest was converted to an equivalent of 1,625 short tons of spawning adult herring for computing the exploitation rate.

Sac roe prices were estimated at \$550 per short ton for 10% mature roe, with +/- \$50 for each percentage change. Using the estimated roe recovery of 9.6% for the sac roe harvest yielded an overall exvessel price of \$530 per short ton. Spawn-on-kelp sold for \$0.87 per pound. The estimated exvessel value of product sold during the 1990 Togiak District herring and spawn-on-kelp fishery was as follows:

Seine/Gill Net Sac Roe Herring:	12,137 short tons @ \$530/s.t.=	\$6,432,610
Seine/Fill Net Food/Bait Herring:	170 short tons @ \$ 50/s.t.=	\$ 8,500
Spawn-on-kelp product:	415,418 pounds @ \$0.87/lb.=	\$ 361,414
1990 Total Exvessel Value:		= \$6,802,524

Togiak 1990 Stock Assessment Summary

Biomass estimates of herring in the Togiak District are attained by converting surface area estimates of herring schools into tons (Lebida and Whitmore 1985). The location, number, and size of herring schools observed during aerial surveys are recorded by index areas throughout the fishing district. Herring school surface areas are multiplied by depth specific conversion factors to attain a biomass estimates. Conversion factors are updated and aerial survey data calibrated each year by the following process. The biomass and surface area of a herring school is estimated from the air. Then the same school is captured by a purse seine, pumped aboard, and weighed to calibrate the original estimate.

In 1990, aerial surveys began on April 22, and the first herring were sighted on May 1 (earlier sightings of fish, beginning on April 28, turned out to be smelt). Survey conditions were generally fair to good from April 22 through May 8, when the peak daily biomass estimate of 72,000 short tons was observed. Viewing conditions deteriorated after May 8, as high winds and rain caused turbid water and poor visibility. Although a shift in age composition was observed in the gill net harvest during this time, a new biomass estimate was not possible, and the fishery continued to be managed on the peak daily 72,000 short ton biomass estimate. Post-season aerial surveys were conducted until June 5, and confirmed the presence of late-season spawning activity and a significant amount of herring still present on the grounds. Preliminary spawn deposition surveys were conducted for the first time in 1990 to determine the feasibility of applying this method at Togiak to estimate spawning herring biomass.

Post-season analysis of the aerial survey and age composition data identified several distinct movements of herring onto the spawning grounds. Peak aerial survey biomass estimates from each of the distinct spawning events was summed to obtain the preliminary estimated inshore return of herring to the Togiak District in 1990 of 88,105 short tons. This estimate is above the forecast return of 56,020 short tons. It appears that survival of older aged fish was underestimated in the pre-season forecast and the aerial surveys may have underestimated herring biomass in earlier years.

Herring biomass is forecasted applying age-specific growth and survival rates to the age-specific biomass estimate from the preceding year. The forecasted 1991 herring biomass for the Togiak District is 54,772 tons. The 1977 and 1978 year classes which have dominated the biomass since 1985 have diminished in importance. These year classes will be returning as age 13 and 14 herring, and will comprise 21% of the biomass. Age 8, 10, and 7 (1983, 1981, and 1984 year classes) will represent 22%, 21% and 14% of the biomass. By number, the contribution of the 1983 year class (age 8), exceeds all others and will comprise 25% of the total population. Some age 3 herring (1987 year class) were present in the 1990 return for the first time in several years. Because this year class was only partially recruited in 1990, quantitative estimates of the strength of the 1987 year class will not be available until 1991.

In recent years, the forecasted biomass has been less than the observed return because of the inability to perform aerial surveys during poor weather periods in some years and because of the better than expected survival of older-aged herring which were dominating the population. For 1991, survival estimates were revised, reflecting the increased survival rates for older herring.

The continuing decline in abundance of the previously very strong 1977 and 1978 year classes, coupled with the lack of substantial recruitment, is the cause of the projected decline in abundance of the Togiak stock. The Alaska Board of Fisheries has established an abundance threshold of 35,000 short tons, below which commercial fisheries would not be allowed. Because some modest recruitment has been observed from the 1981, 1983, and 1984 year classes, the Togiak stock is expected to begin to stabilize at relatively low levels of abundance, near threshold, unless substantial new recruitment is observed.

Based on the 54,772 ton forecast biomass, a 10,954 ton harvest would be allowed at a 20% exploitation rate. The Bristol Bay herring management plan developed by the Alaska Board of Fisheries reserves 1,500 tons of the allowable exploitation to allow for losses to the spawning population from the spawn on kelp fishery. Of the remaining 9,454 tons, 7% (662 tons) is allocated to the Dutch Harbor food and bait fishery of which Togiak is the dominant stock. The remaining 93% is allocated 75% to the purse seine fleet (6,594 tons) and 25% to the gill net fleet (2,198 tons).

KUSKOKWIM AREA

The Kuskokwim area includes herring stocks that spawn in Security Cove, Goodnews Bay, Cape Avinof, Nelson Island and Nunivak Island. A total of 50 aerial surveys were flown throughout the herring spawning season in all 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.

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

Security Cove

The estimated biomass of herring in the Security Cove District has ranged from 2,300 tons in 1987 to 8,300 tons in 1981. The Alaska Board of Fisheries has established a commercial harvest threshold of 1,200 short tons for Security Cove. The 1990 commercial fishery was managed on the inseason biomass estimate of 2,650 short tons. The total 1990 harvest of 234 tons of herring was taken during two openings on May 12 and May 13. Nine processors and 52 fisherman were involved in this fishery. Fishermen received approximately \$500 per ton for 10% sac roe herring. The total ex-vessel value of the harvest was approximately \$94,000.

During 1990, six aerial surveys were flown in the district from May 9 to May 31 to estimate herring biomass and spawning activity. Half of these surveys were flown under poor or unacceptable survey conditions. Herring were first seen in the Security Cove District on May 9. The season's largest biomass of 1,561 tons was observed during an aerial survey flown under excellent conditions on May 10. A second peak of 1,089 tons was sighted during a May 31 survey. The total biomass of herring in the district was estimated to be 2,650 tons by combining these surveys. On May 19, 4.0 miles of spawn was observed which marked the peak in spawning activity for the district.

Department test fishing was conducted from May 9 to May 17 using variable mesh gill nets. Approximately 447 herring from test nets were sampled for biological analysis. A sample of 308 herring was also taken from the commercial harvest.

Herring in this area are near full recruitment by age 5. Substantial recruitment

in the Security Cove District was last observed in 1982 and 1983 when approximately 12 million and 6.4 million age 5 herring from the 1977 and 1978 year classes were estimated in the spawning population. In 1990, nearly 75% of the biomass consisted of age 9 and older herring. Recruits, ages 4 and 5 herring, represented only 0.5% of the run by weight.

Based on the 1990 aerial survey biomass estimate and recent averages of growth and survival, the 1991 projected return is 1,490 tons which at a 15% exploitation rate would result in a harvest of about 225 tons. Age 9 and older herring are expected to comprise 72% of the biomass.

Goodnews Bay

Since 1981, the estimated biomass of herring in the Goodnews Bay District has ranged from 2,000 tons in 1987 to 4,479 tons in 1988. The Alaska Board of Fisheries has established a commercial harvest threshold of 1,200 short tons for Goodnews Bay. The 1990 fishery was managed on the inseason biomass estimate of 2,577 short tons. The 1990 herring harvest in the Goodnews Bay district occurred from May 18-23 and totalled 455 tons. There were 126 fishermen who made 530 deliveries to three processors. Fishermen received approximately \$550 per ton for 10% sac roe herring. The total ex-vessel value of the harvest was approximately \$314,000.

In 1990, ten aerial surveys were flown in the Goodnews Bay district. Half of these surveys were flown under poor to unacceptable conditions. During a survey flown on May 16, 1,184 tons of herring were estimated to be present in the district. An additional 1,393 tons of additional herring were observed during an aerial survey flown on May 31. The total biomass estimate of 2,577 tons for Goodnews Bay was calculated by combining the biomass estimates from these two surveys. Only 0.5 linear miles of milt was sighted during the season.

The Department test fish crew first documented spawning activity on May 9. A total of 1,143 herring were sampled from variable mesh gill nets from May 8 to May 26. A total of 534 herring were sampled from the commercial harvest. Similar to Security Cove and Togiak Districts, the 1977 year class, which returned as 5 years old in 1982, represents the largest year class in the data series.

In 1990, ages 7 and 6 comprised 17% and 18% of the biomass, respectively. Nearly 54% of the total run by weight was age 9 and older herring. Recruits, ages 3, 4, and 5 herring, represented only 2.6% of the biomass.

The 1991 projected return is approximately 1,470 tons which at a 15% exploitation rate would result in a harvest of about 220 tons. Ages 7 and 8 herring are expected to contribute the most to the spawning biomass. Age 9 and older herring are expected to comprise approximately 59% of the biomass.

Cape Avinof

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 4,110 tons were observed in 1985, 1987, and 1988, respectively. Weather conditions in 1986 and ice conditions in 1989 precluded biomass estimates by aerial survey. The Alaska Board of Fisheries has established a commercial harvest threshold for Cape Avinof of 500 short tons. The 1990 fishery was managed on the preseason forecast biomass of 2,020 short tons. Only 50 tons out of the 300 tons guideline harvest was taken at Cape Avinof due to problems with product quality and the availability of processing vessels.

In 1990, two commercial openings were scheduled in the Cape Avinof District.

Fishermen harvested 10.1 tons during a one hour opening on May 29. Because of this low harvest, the district was reopened the same day for two hours. The harvest from both openings was 49.1 tons of sac roe herring with an average roe content of 12.1% and 0.6 tons of bait-quality herring. Only one tender was present in the district on May 29. After the opening the tender left the district. When a tender became available again on June 4, commercial test fishing failed to find herring with acceptable roe quality due to the presence of young and spent fish. The district was closed to commercial fishing on June 12 since Department test fish samples showed poor roe quality and no processors were available. The harvest was 2.4% of the projected biomass. One hundred-one fishermen made deliveries to one processor. Fishermen received approximately \$500 per ton for 10% sac roe herring. The value of the catch to fishermen was about \$35,000.

In 1990, only two of the seven aerial surveys of the Cape Avinof District were flown under acceptable conditions. No spawn was observed during these surveys. During an aerial survey May 22, Department biologists counted 152 tons of herring. Since unsatisfactory aerial survey conditions prevailed during the 1990 season, the projected biomass of 2,020 tons was assumed to be the biomass available in the district.

Spawning activity was first documented by the test fish crew on May 31. A total of 728 herring were sampled from variable mesh gill nets for age, sex, length, and weight data. A total of 119 herring were sampled from the commercial harvest. Age 6 herring represented 26% of the run by weight. Age 9 and older herring comprised 24% of the biomass. Younger herring, age 3, 4 and 5, represented approximately 16% of the return.

Since the peak aerial survey estimate of biomass was observed under unacceptable survey conditions, the 1990 preseason projection of 2,020 tons was used to estimate the 1991 return. The return to the Cape Avinof District in 1991 is expected to be 1,708 tons, which at an exploitation rate of 15% would result in a 255 ton harvest. Age 7 herring are expected to be the largest age group in the return. Age 9 and older herring are expected to comprise 27% of the return.

Nelson Island

Since 1985, the biomass estimates of herring in the Nelson Island District have ranged from a low of 2,705 tons in 1990 to 9,500 tons in 1985. The Alaska Board of Fisheries has established a commercial harvest threshold of 2,500 short tons for Nelson Island. The fishery was managed using the inseason aerial survey estimate of 2,705 short tons.

No commercial openings occurred in the district in 1990. Fishermen were placed on 2 hour notice of a possible opening on June 2 when results of the May 31 aerial survey were known. The allowable harvest was set at 205 tons based on the difference in the estimated available biomass (2,705 tons) and the 2,500 ton threshold mandated in the Bering Sea Herring Fisheries Management Plan. Test fishing catches indicated that product quality was poor due to a high proportion of spawned out herring in the catch and no processors registered to buy herring in the district. The district was closed on June 12 without any commercial harvest due to the poor roe quality of the Department's test samples and lack of processor interest.

During the 1990 herring season, fifteen aerial surveys were flown from May 20 to June 6. Half of these surveys were rated either poor or unacceptable. On May 31, under fair to poor aerial survey conditions, 2,705 tons of herring were observed. Large amounts of unattached eggs were observed washed up on the beach at Cape Vancouver on May 23.

Age 6 herring represented 17% of the 1990 biomass. Recruits, ages 3, 4 and 5, comprised only 5% of the run by weight. Fifty-seven percent of the biomass consisted of age 9 and older herring.

The spawning biomass projected to return to the Nelson Island District during 1991 is 1,900 tons. This is below the 2,500 ton threshold required to open the fishery. However, processors and fishermen are advised that management of the 1991 fishery will be based on inseason observed biomass, if acceptable aerial survey conditions are achieved. If the observed biomass does not exceed the threshold of 2,500 tons of herring, the fishery will not be opened.

In 1991, age 7 herring are expected to be the dominant age group. Herring of age 9 and older are expected to comprise 54% of the biomass. The harvest level will be maintained at 10% unless available biomass significantly exceeds the 2,500 ton threshold level.

Nunivak Island

Since 1985, the estimated biomass in the Nunivak Island District has ranged from 422 tons in 1990 to 6,000 tons in 1986. The Alaska Board of Fisheries has established a 1,500 short ton commercial threshold for the Nunivak Island area.

During 1990, seven aerial surveys were flown between May 21 and June 1. Five of these surveys were flown in fair to excellent survey conditions. Spawning activity was first documented in the district on May 22 when approximately 4 linear miles of milt was observed during an aerial survey. The total biomass estimate for the district was calculated to be 422 tons based on an aerial survey flown on May 28. Since this biomass estimate was below the 1,500 tons threshold mandated in the Bering Sea Herring Fisheries Management Plan, no commercial herring fishery occurred in the district in 1990.

Department test fishing was conducted from May 15 to June 4 using variable mesh gill nets. Approximately 690 herring from test nets were sampled for biological analysis. Since 1985, the strongest year class as determined by the abundance of 5 year old in the spawning population was the 1981 year class which contributed 3.4 million recruits to the 1986 run. Age 11 herring comprised 28% of the 1990 return. Ninety-three percent of the biomass consisted of age 9 and older herring. Younger fish, age 3, 4, and 5 herring, represented only 0.2% of the run.

The biomass of herring projected to return to the Nunivak Island District during 1991 is 235 tons. This is below the threshold of 1,500 tons needed to open the fishery. However, as with Nelson Island, processors and fishermen are advised that management of the 1991 fishery will be based on observed biomass. If the observed biomass does not exceed the threshold of 1,500 tons of herring, the fishery will not be opened. Ages 10 and above are expected to dominate the spawning population in both biomass and numbers of fish. Age 9 and older herring are expected to comprise 94% of the return.

CAPE ROMANZOF

The Cape Romanzof herring population spawns primarily in Kokechik Bay, just south of Cape Romanzof. Since 1975 the estimated biomass of herring in the Cape Romanzof District has ranged from a low of 2,400 tons in 1990 to 7,500 tons in 1986.

Because the Department was not able to update the forecast biomass estimate inseason, the forecast biomass of 2,410 tons was used to manage the fishery in

1990. The 1990 commercial herring sac roe season at Cape Romanzof consisted of one three hour period on May 23-24. A total harvest of 329 short tons (st) was taken by 95 fishermen utilizing 90 fishing vessels. Approximately 318.2 short tons was purchased as sac roe and 10.8 short tons was purchased as bait herring. The average sac roe recovery was 8.4%. Wastage was not a problem during the 1990 season. The estimated value of the total harvest to the fishermen was \$154,940. Average price for Pacific herring sac roe was \$566 st at 10% roe recovery, plus or minus \$49 per percentage point of roe recovery.

Due to excessive water turbidity in the Cape Romanzof area, it is generally not possible to estimate herring biomass from aerial surveys. Biomass has been estimated using a combination of information from test and commercial catches, spawn deposition, and age composition. In 1990, five aerial surveys were flown from mid-May to early June. All surveys flown during May were unacceptable due to poor weather and/or turbid water conditions. Department test fishing was conducted from May 17 to June 6 using variable mesh gill nets. A total of 2,220 herring were caught, of which 1,112 herring were sampled for biological data. A total of 308 herring were sampled from the commercial harvest. Daily spawn deposition surveys in the Kokechik Bay began May 15. On May 19, the first observations of spawn were recorded and spawn deposition peaked on May 29.

Projected biomass estimated for 1991 is 2,983 short tons. Twenty-one percent of the biomass was composed of age 9+ herring, with 23% of the biomass being age 6. Recruit fish, aged 3,4, and 5 comprised only 4% of the biomass. At a 15% exploitation rate, the commercial harvest is projected to be 447 short tons. The threshold for the Cape Romanzof area is 1,500 short tons.

Many residents of the villages near Kokechik Bay utilize the Cape Romanzof stock both for commercial and subsistence harvests. Subsistence herring harvest survey questionnaires were mailed to known fishing families in the villages of Hooper Bay, Chevak, and Scammon Bay. Based on the results of this survey, the minimum subsistence harvest from the area is estimated at 9 short tons. Subsistence catches should be considered minimum estimates because not all fishing families are contacted and not all questionnaires are completed and returned.

NORTON SOUND

Herring biomass in Norton Sound has fluctuated from a low of 5,300 short tons in 1978 to 39,000 tons in 1990. 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 occasionally along the north shore of Norton Sound.

The 1990 commercial fishery opened on May 28 and was managed on the peak aerial estimate of 35,522 short tons which was observed on May 27. A total of 357 gill net fishermen harvested 6,380 short tons during four openings from May 28-31, while an additional 347 short tons was landed by 8 beach seine fishermen. Fishermen received \$686 per ton for 10% roe content herring. The total value of the harvest is estimated to be \$3,605,597.

During 1990, 23 aerial surveys were flown in Norton Sound on 18 different days. Two biomass peaks were observed during the aerial surveys. The first peak was observed on May 27 and the second peak was observed on June 7. Approximately one-fourth of the fish in the second peak were young fish, primarily age 4, indicating that the 1986 year class is of at least moderate strength. Better assessment of the strength of the 1986 year class will be possible in 1991 when the year class becomes more fully recruited.

Department test fishing crews sampled 1,831 herring with variable mesh gill nets

for age, sex, length, and weight, and an additional 1,217 herring from the commercial catch. Unlike herring fisheries to the south, year classes after the 1977 and 1978 year classes are contributing substantially to the Norton Sound herring fishery.

For 1991 the projected biomass is 25,371 short tons with a projected harvest of 5,075 short tons allowed at a 20% exploitation rate. The biomass is projected to be dominated by age 10 fish (29%), followed by age 5 fish (1986 year class) at 18% of the biomass.

BERING SEA-WIDE BIOMASS

Summaries of the projected harvests and biomass for each area are given in Table 1. The total Bering Sea herring biomass is estimated to be 91,939 short tons (83,406 metric tons). The herring Prohibited Species Catch (PSC) cap under amendment 16A would be set at 1% of the Bering Sea-wide biomass, or 834 metric tons.

The biomass of Bering Sea herring is projected to decline (Figure 2) due to the senescence of the strong 1977-78 year classes of herring which had previously been making substantial contributions to the biomass of each area. The declines in abundance due to this effect are somewhat offset by the increases in biomass due to recruitment of younger year classes in Norton Sound.

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Table 1. Forecast harvest and biomass of Bering Sea herring stocks for 1991. Harvests and biomasses are in the short ton (2,000 lbs) units used to manage herring sac roe fisheries, unless otherwise noted.

<u>Fishery/Stock</u>	<u>Forecast Harvest (st)</u>	<u>Biomass (st)</u>	<u>Exploitation Rate</u>	<u>Threshold (st)</u>	<u>Percent of Bering Sea Biomass</u>
Dutch Harbor ^a	662	a	a	a	
Port Moller	300	2,000	15%	1,000	2.2%
Togiak	10,293	54,772	20%	35,000	59.6%
Security Cove	225	1,490	15%	1,200	1.6%
Goodnews Bay	220	1,472	15%	1,200	1.6%
Cape Avinof	260	1,722	15%	500	1.9%
Nelson Island	0	235	0%	2,500	0.3%
Nunivak Island	0	1,897	0%	1,500	2.1%
Cape Romanzof	447	2,980	15%	1,500	3.2%
Norton Sound	5,075	25,371	20%	7,000	27.6%
Total (short tons)	17,481	91,939	19%	51,400	100.0%
Total (metric tons)	15,859	83,406		46,629	
Herring PSC Cap (1% of Biomass):		834 metric tons			

^aThe Dutch Harbor food and bait fishery harvests stocks from other areas, primarily Togiak.

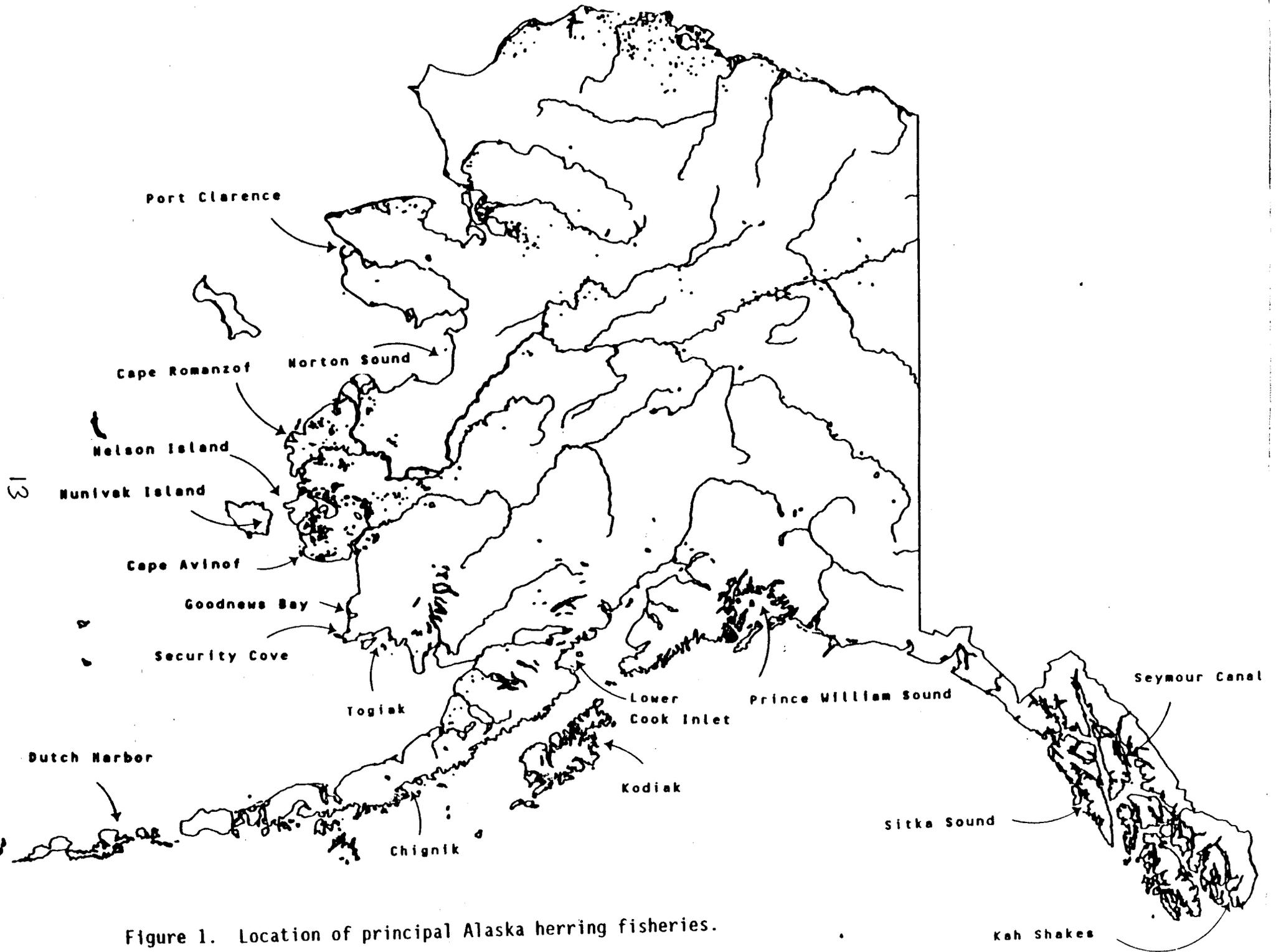


Figure 1. Location of principal Alaska herring fisheries.

Eastern Bering Sea Herring Biomass (Pt. Moller to Norton Sound)
(Showing difference between forecast biomass and observed
biomass to date)

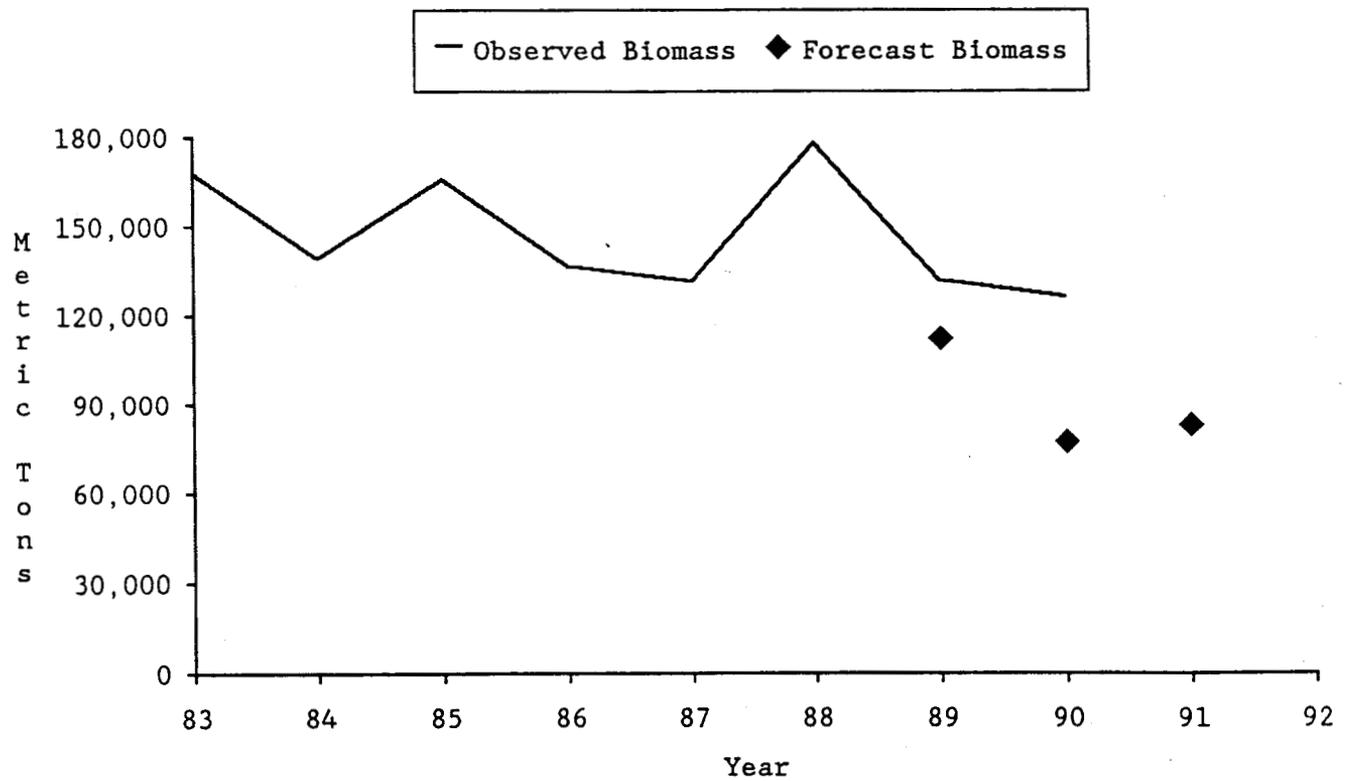


Figure 2. Biomass of eastern Bering Sea herring stocks (Port Moller to Norton Sound), from 1983-90, with the forecast biomass for 1991.