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ALASKA PENINSULA AND ALEUTIAN ISLANDS MANAGEMENT AREAS SAC ROE HERRING REPORT AND THE ALEUTIAN ISLANDS MANAGEMENT AREA FOOD AND BAIT HERRING REPORT, 1993

By

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ABSTRACT

The 1993 Pacific herring *Clupea pallasi*, commercial sac roe season extended from April 15 through July 15 in the Alaska Peninsula and Aleutian Islands waters. However, the opening of the Sand Point, Pavlof, and King Cove Districts were from April 15 through July 15; the Unimak, Akutan, Unalaska, Umnak, and Adak Districts were open from April 15 through June 15; the Amak District was open from April 15 through June 30; and the Port Moller District was opened from May 7 through June 15. In 1993, the Port Heiden District was not open to commercial herring fishing. The Aleutian Islands Management Area "Dutch Harbor" food and bait herring fishery was open during July 16.

In 1993, commercial sac roe herring catches occurred in North Peninsula waters from May 8 through June 9 and in South Peninsula waters from May 27 to June 9. No sac roe herring harvest occurred in the Aleutian Islands Management Area. The North Peninsula catch was 535.9 tons and the South Peninsula catch was 97.0 tons, producing a total Alaska Peninsula catch of 632.9 tons. The 1993 Alaska Peninsula sac roe herring catch was less than half the 1988-92 average of 1,586.0 tons. During the sac roe herring fishery, 17 purse seine permit holders made 61 deliveries to 5 companies that purchased herring. The average roe recovery during the sac roe season was 9.9% for the North Peninsula, 10.8% for the South Peninsula, and overall 10.1%. The average price per ton was $300 for 10% roe recovery and $\pm$ $50 for each percentage point above or below 10%, giving a sac roe herring exvessel value of about $193,350 for the Alaska Peninsula fishery.

Aerial biomass survey estimates documented for the North Peninsula: 775 tons for Herendeen Bay, 2,878 tons for Moller Bay, and 33 tons along the Bering Sea coast. No herring were observed in the Port Heiden District. Fishermen and commercial pilots also reported herring in several locations where ADF&G personnel were unable to survey.

In 1993, commercial food and bait catches occurred in the Aleutian Islands Management Area during July 16. The Aleutian Islands "Dutch Harbor" commercial food and bait herring harvest was 2,789.8 tons (886.6 food and 1,903.2 bait), with an allocation of 2,193 tons, and a test fishery harvest of 34.0 tons. The average price per ton was $300, giving a food and bait exvessel value of about $836,940 for the Aleutian Islands Management Area commercial food and bait herring fishery. During the fishery, 13 purse seine permit holders made 32 deliveries to four companies that purchased herring.

KEY WORDS: Alaska Peninsula, Aleutian Islands, herring, catch, age, length, weight, sex, sac roe, food

INTRODUCTION

The Alaska Peninsula and Aleutian Islands Management Areas (Figures 1-2) are described as Management Area "M" and are divided into three subareas; (1) the South Peninsula, consisting of Pacific Ocean coastal waters extending west of Kupreanof Point to 163°30' W. long. (the south side of Unimak Island near Cape Lazaref); (2) the Aleutian Islands, consisting of Bering Sea waters extending west of Unimak Pass and Pacific Ocean waters extending west from 163°30' W. long. (the south side of Unimak Island near Cape Lazaref) to the United States-Russian Convention Line of 1867; and (3) the North Peninsula, consisting of Bering Sea waters extending west from Cape Menshikof to Cape Sarichef (Figures 3-9).

The North Peninsula is comprised of three districts and 23 statistical areas, the South Peninsula of three districts and 45 statistical areas, and the Aleutian Islands of five districts and 41 statistical areas. Commercial Pacific sac roe herring *Clupea pallasi*, fishing normally begins in the latter part of May in North Peninsula waters, and mid-May in South Peninsula waters. The Aleutian Islands had no reported sac roe herring harvest since at least 1979. The fishery for food and bait herring in the Aleutian Islands Management Area begins by regulation on July 16.

Commercial herring fisheries have been regulated by emergency order to achieve exploitation mandates by the Alaska Board of Fisheries (BOF) and address problems with wastage. Management plans (McCullough and Campbell 1993a, McCullough and Campbell 1993b) and other directives from the BOF set policies by which these fisheries are allowed to operate (ADF&G 1993).

Herring have been reported throughout the South Peninsula, most areas in the North Peninsula, and in Unalaska Island waters of the Aleutian Islands Management Area. Major concentrations of herring and fishing effort occurs in North Peninsula waters in Port Heiden, Port Moller, and Herendeen Bays, and along the Bering Sea coast in near shore waters from Entrance Point to Cape Seniavin. Known herring stocks and most fishing effort occurs in South Peninsula waters in the Shumagin Islands, and Stepovak, Pavlof, and Canoe Bays. Fishing effort in the Aleutian Islands Management Area has been limited to Unalaska and Akutan Islands waters.

From 1981 through 1993, the Alaska Department of Fish and Game (ADF&G) has deployed field crews in the Alaska Peninsula for the purpose of collecting data and to monitor the fishery. Crews have been successful in collecting herring samples and documenting spawning areas and substrate. Aerial surveys have been used with limited success to monitor the fishery, primarily due to the large area involved, poor weather, turbidity of the water, and the sporadic and unpredictable appearance of the herring. In the 13 years that ADF&G has been conducting aerial surveys in the Alaska Peninsula, only surveys flown in 1989, 1991, and 1992 may have provided an accurate assessment of the total spawning biomass in North Peninsula waters.

Aerial surveys of the Port Moller area by ADF&G personnel in 1976 reported numerous schools of herring in Herendeen Bay (Warner and Shafford 1979). The first commercial catches of sac roe herring in North Peninsula waters occurred in 1982 when 505.5 tons were harvested (Table 1). From 1988-92, an average of 1,315.6 tons have been harvested during the North Peninsula sac roe herring fishery. Until 1992, the majority of the harvest was taken from Herendeen and

Moller Bays, while the remaining balance of the catch was taken off the Bering Sea coast between Entrance Point and the Seal Islands (Table 2). In 1992, more than 40% of the North Peninsula harvest came from Port Heiden Bay.

Prior to 1982, fishing vessels destined to or returning from the Togiak herring fishery, frequently looked for herring in the Port Moller and Port Heiden Districts but made no deliveries. In the Port Moller District, during the 1986-88 seasons, there was an average of 52 vessels present, although only a few permit holders actually made landings. In 1986, fishing effort increased on the earlier arriving stocks. In order to shift fishing pressure from the earlier arriving stocks to the later more abundant stocks, the Port Moller District opening was initially delayed until May 30 from 1989 to 1992. However, the fishery could open prior to May 30 by emergency order if a large biomass of herring was documented in the area. The later opening date in the 1989-91 seasons started a trend of decreasing effort. Fishers returning from Togiak tended to pursue halibut or salmon fisheries rather than wait for the Port Moller herring fishery to open. The Port Moller District opened prior to May 30 in 1991 and 1992 due to herring biomass sufficient to warrant commercial harvests. The run timing of the North Peninsula stocks appears to be two to three days after the peak observed biomass in the Togiak fishery.

The South Peninsula sac roe herring fishery continues to develop since it began in 1979. During years in which commercial sac roe herring harvests occurred, landings have been reported from 18 geographical locations; of these, only Canoe Bay produced an annual harvest (Tables 1, 3; Figure 8).

In South Peninsula waters, significant landings occurred in 1980 (453.8 tons), and peaked in 1981 (797.4 tons; Table 1). The BOF closed the South Peninsula sac roe herring fishery in 1983, allocating all catches to a food and bait herring fishery that failed to develop. From 1984 through 1991, the BOF allocated the catch between the sac roe fishery (75% of the allowable harvest) and the food and bait fishery (25% of the allowable harvest). In 1992, the BOF allocated the entire harvest to the sac roe herring fishery (McCullough and Campbell 1993a).

In South Peninsula waters effort and harvests have generally decreased since 1981. Most bays have small harvestable quantities of herring but the cost of having fishing vessels, tenders, and airplanes on call for the harvesting of each bays quota makes fishing halibut or North Peninsula herring more attractive (Table 4). South Peninsula herring also appear to spawn later than North Peninsula herring, this prevents many halibut and salmon fishers from participating in the South Peninsula herring fishery.

The Aleutian Islands Management Area food and bait herring season is from July 16 through February 28. Although the entire Aleutian Islands Management Area is usually open during this season, fishing effort has been limited to the vicinity of Unalaska and Akutan Islands due to processing capabilities and herring concentrations. The Unimak, Akutan, and Unalaska Districts and that portion of the Umnak District located east of Samalga Pass is commonly referred to as the "Dutch Harbor" food and bait herring fishery (Figures 2-5). Two management plans: (1) the Bering Sea herring fishery management plan (Appendix B), and (2) Aleutian Islands Management Area herring food and bait management plan, 1992 (McCullough and Campbell 1993b) and various regulations (ADF&G 1993) are used to manage the fishery.

Historically, the "Dutch Harbor" food and bait fishery occurred from 1929 through 1938 and in 1945 (Table 5). This fishery was a mixture of gillnet and purse seine catches, holding pounds, and numerous small, shorebased hand packing operations. A large portion of the catch was brined for either food or bait purposes while some product was frozen. Purse seine gear provided the bulk of the harvest.

Recently, the "Dutch Harbor" food and bait herring fishery occurred from 1981 through 1993 (Tables 5, 6). Currently, fishing gear consists of purse seine vessels, which use large seines, up to 250 fathoms in length and 25 to 35 fathoms in depth. The entire 1981-86 and 1990-92 harvest was caught with purse seine gear. One gillnet permit holder participated in the 1987 and 1988 seasons, and two gillnet permit holders fished in 1989. Gillnet vessels used in the fishery are typically 32 feet in length, and there is no restriction on gear length. Purse seine vessels used in the fishery average about 50 feet in keel length and the majority also participate in Management Area "M" salmon fisheries. Prior to 1992, fishing occurred at night and sonar aboard the vessels was critical to the fishing operation, much as the airplane is critical to sac roe herring fisheries. Since 1991, the fishery has occurred during day light hours and airplane use is becoming more common.

Generally, permit holders freely exchange information concerning the location of herring schools. When herring concentrations leave traditional fishing areas, fishers will conduct organized "sonar searches" over fairly large areas until concentrations of herring are located. During the past two seasons, aircraft have also been used to spot concentrations of herring. When catcher vessels leave the immediate area of shorebased processing facilities, industry follows with floating processors and tenders. Processing efficiency and product quality may decline when this occurs. Harvest locations have extended over approximately 90 miles, from Tigalda Island to Makushin Bay on Unalaska Island. The majority of the harvest occurred within a five mile radius of shorebased processing facilities in Unalaska and Akutan Bays.

A similarity between the recent and historical fisheries is the quality problem associated with feeding herring. Feed problems were overcome in the historical fishery by the use of holding pounds, where seine caught herring were held until their stomachs became empty. Gillnet caught herring required special handling to prevent spoilage. In the current fishery, the use of ice and chilled seawater in conjunction with rapid processing alleviates most of the feed related problems. When feeding conditions are severe, processors will suspend buying.

One difference between the current and historical (1929-38 and 1945) fisheries is the availability of herring. Historically, herring were categorized into an early summer run (late June to late July) and a late summer run (late August to early September). This pattern does not seem to apply to the current (post 1980) fishery. Herring now appear in the Dutch Harbor area about July 1 and are available through mid-September.

Shorebased processors purchase the majority of the herring harvested. Floating processors have been used most years; however, they are limited by daily handling capacities. In 1988 and 1990-92, some herring were tendered to the King Cove shore plant, in 1989 and 1990-92 to the Sand Point shore plant, and in 1988-92 to the Akutan shore plant.

Generally, the exvessel value for bait herring has exceeded that for food herring, although during the past few seasons the same price has been paid for both food and bait herring. While Aleutian food herring are a suitable and desirable product, an ample and more reliable supply of food herring from other countries currently dominates the market. Food herring must be processed quickly from fresh herring; when the allocation is harvested quickly (less than a day) processors can only produce a limited amount of food herring before the flesh is no longer fit for human consumption. The bait product from this fishery has a more stable market. Bait is used locally and in other Alaskan fishing ports for the longline groundfish and pot crab fisheries. Bait demands have been increasing in recent years, and a premium price is placed on quality bait which is fresh and has high oil content. Overall, the market for bait herring has remained more stable than that for food.

The harvest strategy of the "Dutch Harbor" food and bait herring fishery has evolved since it was re-established in 1981. During the 1981 and 1982 seasons, there were no harvest restrictions. From 1983 to 1985, the BOF implemented a harvest ceiling of 3,527 tons per year due to biological concern over multiple exploitation on Eastern Bering Sea spawning stocks, specifically the Bristol Bay, Nelson Island, and Port Moller stocks. Scale pattern analysis studies identified herring harvested during the Aleutian Islands herring fishery to be comprised of the Eastern Aleutian herring biomass (Rogers and Schnepf 1985). The extensive sac roe fisheries occurring on these stocks coupled with the "Dutch Harbor" food and bait fishery which may harvest some of these stocks, may create biological concern due to possible exploitation above the board's guideline harvest policy. In 1986, a modification of the harvest ceiling was implemented by ADF&G in response to the BOF concern for the possible lack of recruitment in the contributing stocks (primarily Togiak, to which the bulk of the Aleutian catch is estimated to be comprised). The 1986 harvest allocation in the Aleutians was reduced by 30% (2,453 ton harvest allocation). This reduction corresponded with the percent reduction of the observed Togiak spawning biomass between the springs of 1985 and 1986. The 1987 harvest allocation was 2,332 tons, which was proportional to the 1985 to 1987 reduction of observed Togiak spawning biomass.

In 1988, the BOF implemented the Bering Sea Herring Fisheries Management Plan, which established criteria for calculating the "Dutch Harbor" food and bait quota. To ensure conservation of herring stocks, the BOF adopted a requirement that the overall exploitation of a herring stock should not exceed 20% of the spawning biomass. In the case of the Togiak spawning stock, an allocation between the sac roe, spawn on kelp, and the "Dutch Harbor" food and bait fisheries was established so that the catch did not exceed 20% of the observed spawning biomass. The number of fishers involved and the value of the fishery were factors considered by the BOF when allocations were determined. The Bering Sea Herring Fishery Management Plan defines the biological criteria and the quota for the "Dutch Harbor" food and bait fishery (Appendix B).

In 1991, the BOF changed the "Dutch Harbor" food and bait herring fishery opening date from August 15 to July 16. This change was implemented to lessen the chance of catching herring stocks other than Togiak and North Alaska Peninsula in the "Dutch Harbor" fishery. In 1992, ADF&G action changed the fishery from night to a day time fishery; prior to 1992 the fishery located and set on herring schools at night using sonar. In 1992, as an aid in monitoring the fishery, ADF&G initially made day time fishing periods of two hours or less. Although sonar

was still used to locate schools, spotter pilots and fishers visually detected feeding birds and sea mammals which directed them to herring schools.

The objectives of this report are: (1) to present the numbers of herring in the commercial catch for each statistical day in the Alaska Peninsula and Aleutian Islands Management Areas during 1993; (2) to estimate the age and sex composition of harvests; (3) to estimate the mean length and weight of herring harvested in commercial fisheries; and (4) to estimate the biomass of herring within each area. This information will provide a data base for developing brood tables, forecasting runs, and evaluating management goals. This report is intended as a reference document; interpretation and discussion of the data are therefore limited.

METHODS

Commercial catch data were compiled by the Commercial Fisheries Management and Development Division of ADF&G. Data were based on computer tabulations originating from individual sale receipts (fish tickets) given to fishermen at the time of delivery. Fish tickets and the computer generated summaries were edited by ADF&G Alaska Peninsula staff for errors and omissions. Because extensive fish ticket editing is usually required to finalize the data for any given year, later reports may contain minor differences in the catch information listed in this report.

Catches were sampled throughout the season from harvests in the fishing areas. Catch sampling occurred in Port Moller and Canoe Bay for Alaska Peninsula harvests, and in Kodiak for herring harvested in the Aleutian Islands. In the Alaska Peninsula, herring were randomly sampled, usually collected from the holds of tender vessels to minimize scale loss. The harvest area of each tender sampled was determined through vessel operator interviews and fish ticket information. In the Aleutian Islands, 50 pound boxes of frozen herring were randomly sampled from one Dutch Harbor shorebased processor. This processor purchased about 16% of the total Aleutian Islands harvest from several fishing vessels and tenders.

Generally, tender operators purchase herring from fishers who sell their catch to a specific company. Since all Alaska Peninsula catch sampling occurred before sorting within the cannery, there was no preselection of herring other than from delivery areas; although not tested, each sample was assumed to be representative of the harvest within a sample area. In the Aleutian Islands, catch sampling occurred after the herring were frozen. The sample was assumed to be representative of the harvest, no herring were sorted. While this insured that samples were randomly selected from the fishery, the samples may not be characteristic of the population structure because the distribution of the population is unknown in the fishery.

Age compositions were computed for the catch for each area sampled. Age was determined by examining scales (Warner and Shafford 1979). Scales were taken from the preferred area, located on the left side of the herring three rows below the lateral line and three scales posterior to the center of the operculum plate (Anonymous 1986). One scale was taken from each herring. Ages were recorded in actual fish age in years. The accuracy of age determination was not tested.

Standard length measurements were taken from the anterior most portion of the fish, including the lower jaw with the mouth closed, to the end of the vertebra (hypural plate) using a meter stick with 1 mm gradations and reading the measuring device to within 1 mm. Accuracy of a length measurement was within $\pm$ 5 mm. Mean lengths were calculated from an unweighted composite of the data collected from each area sampled.

Weight measurements of fish were taken using a digital scale with 2.0 g gradations and reading the scale device to within 2.0 g. Accuracy of a weight measurement was within $\pm$ 2.0 g. Mean weights were calculated from an unweighted composite of the data collected from each area sampled.

Biomass estimates of herring schools occurred during aerial surveys. The methodology of these surveys is described by Anonymous (1986). Observers fly at a recommended altitude of 1,500 feet and count the number of schools of herring and measure the length and width of each school. Each school is classified into one of three size classes based on its surface area: small schools with an area $\leq$50 m^2; medium-sized schools with a surface area $>$50 m^2 and $\leq$450 m^2; and large schools with a surface area $>$450 m^2. The number of schools in each size-class are converted to Relative Abundance Indices (RAI) by assuming that one small school equals one RAI, one medium-sized school equals five RAI, and the RAI's of a large school equals the schools total surface area in square feet divided by 538 square feet. Aerial observers also classify the conditions on each survey with a rating system: one equals excellent, two equals good, three equals fair, four equals poor, five equals unsatisfactory. A conversion factor of 1.52 short tons/RAI is used for schools observed in water depths of 16 feet or less and 2.58 short tons/RAI is used for schools observed in water depths of 16 to 26 feet. In deep water, no attempt was made to convert RAI units into tonnages due to the lack of data. Conversion factors were calculated from surveys of schools of known biomass and surface area in known water depths that were conducted with commercial fishing vessels in Bristol Bay in 1983. If more than one survey of an area was conducted in a single day, then the largest number of RAI's recorded in each area was chosen as the most accurate index of biomass, because observers were more likely to underestimate the biomass than they were to overestimate the biomass (Anonymous 1986). Some schools of fish, especially in South Peninsula waters, may have been capelin or other finfish.

Harvest guidelines were established preseason and were based on past fishery performance, age class data, and biomass estimates from ADF&G and industry aerial surveys (Table 4). Areas where little or no data on stock biomass was known were open for exploratory fishing.

SAC ROE FISHERY

Results

In 1993, 61 landings were made in the Alaska Peninsula Management Area by 17 purse seine permit holders (Table 7). The 1993 catch of 632.9 tons of herring was nearly seven times less than the 1992 catch of 4,151.4 tons and about half the 1982-92 average of 1,219.3 tons. The decrease was due to below average Port Moller and Canoe Bay District catches.

In 1993, 20 purse seine permit holders, 21 tenders, and 6 companies indicated an interest in fishing or purchasing fish in the Alaska Peninsula during the sac roe herring season. However, only 17 purse seine permit holders made at least one landing and five companies purchased herring. This was a decrease of 12 purse seine permit holders making deliveries and a decrease of eight companies buying herring from the 1992 level.

The total 1993 commercial sac roe, food, and bait herring catch during the sac roe season for the Alaska Peninsula and Aleutian Islands Management Areas was 632.9 tons (all sac roe product), with an exvessel value of about $193,350.

Fishing Effort

In 1993, the number of permit holders making at least one delivery was nearly half that of 1992, with most of the decreased in effort occurring in the Port Moller and Port Heiden Districts. The decreased effort was in part due to the early arrival of herring on the spawning grounds at both Togiak and the North Peninsula, and extended fishing periods in the Togiak fishery which kept fishers interested in Togiak stocks.

In 1993, the Port Moller District opened on May 8; herring were observed in the district on May 3 when ADF&G staff arrived. Fishing vessels were not on the grounds until May 5; the first tender arrived on the grounds on May 5, and the first commercial harvest occurred on May 8. Only two companies, one shorebased and one floating, processed herring in North Peninsula waters. Most herring were tendered out of North Peninsula waters to Bristol Bay, Dutch Harbor, and King Cove.

In 1993, areas open for exploration (Aleutian Islands Management Area, the Port Heiden and Amak Districts, the Western Section of the Port Moller District, the Seal Cape-Wosnesenski Section of the Pavlof District and General Sections of the King Cove and Sand Point Districts), liberal fishing time was allowed to give fishers the opportunity to locate and exploit unknown herring stocks. The Port Heiden District may have had herring present in late April or early May (a salmon subsistence fisher caught about 50 herring) but did not produce a commercial harvest. All exploration areas were unproductive (Tables 2, 3).

North Peninsula

There are three commercial herring fishing districts in North Peninsula waters: Port Heiden, Port Moller, and Amak Districts. No catches were reported nor were herring observed in the Amak and Port Heiden Districts. In all districts herring may be taken with purse seines and gill nets, both gear types share common time and area openings.

The 1993 projected guideline herring harvest for North Peninsula commercial herring fisheries was 3,500 tons (Table 4), which included herring harvested in Port Heiden District but did not include harvests in sections open for exploration (McCullough and Campbell 1993a). All fishing periods in the Port Moller and Port Heiden Districts were by emergency order when herring biomass and tender capacity warranted an opening. The Amak District was open for exploration continuously from April 15 through June 30. All North Peninsula waters closed to herring fishing on June 30. A minimum of six hours advanced notice for commercial fishing periods in the Port Moller and Port Heiden Districts was initiated prior to the 1993 fishing season.

ADF&G herring staff observed herring in Port Moller Bay on May 3, the first day of their arrival. The first commercial fishing vessels arrived on May 4, the first tenders on May 5, and the first spotter pilot on May 6. The Port Moller District opened to commercial herring fishing on May 7, because of the lack of quality herring (only an 8% roe recovery due to spawned out fish) and poor weather conditions, no herring were harvested until the second opening on May 8. By May 9, ADF&G had documented an estimated biomass of 725 tons of herring in Port Moller; effort consisted of 15 purse seine vessels, nine tenders, and three processors with a daily processing capacity of 200 tons. During the opening on May 9, several schools of herring were sampled and released due to low roe percentages. Most herring were unmarketable, either immature or partially spent. Herring continued to enter the Port Moller District and additional openings occurred on May 10-11. On May 11, an estimated 17,250 tons of herring were observed by ADF&G several miles off the coast near Cape Seniavin; fishers were placed on a one hour advanced notice for the next period. The large biomass observed near Cape Seniavin failed to enter the Port Moller District and no herring appeared in commercial quantities in the Port Heiden District. Additional openings in the Port Moller District from May 12 through June 15 produced harvests of herring until June 9, when the last processor quit purchasing herring. During late May and June effort decreased. Fishing time was adjusted to keep the exploitation rate near 16% and to concentrate effort on arriving schools and away from spawned out herring (McCullough and Campbell 1993a). Herring continued to enter Port Moller Bay through at least June 8, the date of the last ADF&G aerial survey.

Table 8 lists ADF&G aerial surveys of North Peninsula waters. In past years, biomass estimates have been difficult due to survey conditions and the rapid arrival and departure of fish. In 1993, herring were visible in substantial numbers on 17 different surveys. The 1993 aerial survey estimates resulted in a much lower biomass estimate as compared to the 1992 estimate. In 1993, the documented biomass for the North Peninsula was 3,686 tons: 775 tons for Herendeen Bay, 2,878 tons for Moller Bay, and 33 tons along the Bering Sea coast (Table 8). The herring observed on May 11 along the Bering Sea coast did not enter the Port Moller District to spawn. Intensive aerial surveys by ADF&G to document spawning biomass and locations were not possible after June 9 due to budget constraints.

In the Port Moller District, most herring spawned in the Inner and Outer Port Moller Bay Sections, although limited spawning was observed in all sections except for the Western Section. ADF&G did not document any herring or spawning in the Port Heiden District although a few herring were caught in early May in a subsistence salmon net.

A total of 535.9 tons of herring were harvested in North Peninsula waters from the Port Moller District (Table 2). About 70% of the harvest (353.8 tons) occurred prior to May 15. The entire North Peninsula harvest was sold as a sac roe product. The exploitation rate in individual districts ranged from no harvest in the Amak and Port Heiden Districts to 15.0% in the Port Moller District. The five companies that bought herring from North Peninsula waters paid about $300 per ton for 10% roe recovery $\pm$ $50 for each percentage point above or below 10%. The average roe recovery was 9.9%. The total exvessel value of the North Peninsula herring sac roe catch is estimated to be $160,650.

In 1993, herring were landed earlier in the year than during any prior year. Commercial catches of herring from the Port Moller District from 1982 to 1993 were landed from May 8 to July 4 (Figure 6, Table 1). Historically, most catches were taken during a time period of 20 days or less from mid-May to mid-June, although during 1993 most of the catch occurred from early to mid-May. In 1993, the commercial catch occurred mostly in the Inner and Outer Port Moller Bay Sections, Outer Port Moller Bay Section (181.0 tons), Inner Port Moller Bay Section (190.0 tons), and Mud Bay-Deer Island Sections (106.6 tons; Table 9).

A total of 156 herring were sampled from the commercial catch in Inner Port Moller Bay. In the Inner Port Moller Bay catch the most abundant age classes were estimated as 10% age 5, 48% age 6, 17% age 9, and 10% age 11+ (Tables 10, 11; Figure 10). The male to female ratio was 1:0.95. The average herring length in the catch was 326 mm, and the average weight was 282 g (Table 12).

The biomass of age 6 herring in the 1993 catch should produce substantial North Peninsula catches of age 7 in 1994. The biomass of age 6+ herring should produce approximately 10% of the North Peninsula catch of age 7+ herring in 1994. Since the abundance of the newly recruited year classes (ages 3 and 4) cannot be reliably determined until the herring are nearly fully recruited into the fishery at age 5, no attempt has been made to estimate the potential contribution of younger age herring to the 1994 fishery.

From mid-May through early-June, commercial spotter pilots and ADF&G observers reported several thousand tons of capelin in the Entrance Point to Cape Seniavin reach.

South Peninsula

The 1993 projected guideline harvest for South Peninsula herring fisheries was 415 tons (Table 4), which did not include herring harvested in sections open for exploration (McCullough and Campbell 1993a). The General Sections of the Sand Point and King Cove Districts and the Seal Cape-Wosnesenski Section of the Pavlof District were open for exploration. South Peninsula

herring fisheries were open seven days a week beginning April 15 through the closure of the sac roe season (July 15), except for the Canoe Bay Section, which closed on June 23.

South Peninsula commercial herring catches from 1980 to 1992 were landed from May 9 to June 23 and in 1993 were landed from May 27 to June 9 (Table 1). Most catches have been taken during a time period of 20 days or less. In 1993, most commercial catches occurred in Canoe Bay (one small catch occurred in Stepovak Bay). From May 27 to June 9, 97.0 tons were harvested by three purse seine permit holders making 17 deliveries (Tables 7 and 13). The average roe recovery was 10.8%. Prices paid by the two companies that purchased herring from South Peninsula waters was about $300 per ton for 10% roe recovery $\pm$ $50 for each percentage point above or below 10%. The South Peninsula herring sac roe fishery exvessel estimated value was $32,738.

The first fishing vessel arrived in Canoe Bay on June 4 and harvests occurred from June 4 through June 9. The market for South Peninsula herring closed on June 10, no additional South Peninsula sac roe harvests occurred after June 9.

Table 14 lists ADF&G aerial surveys of South Peninsula waters. Poor survey conditions and the late timing of the fish limited ADF&G aerial survey effort and commercial fishing effort (early June is the beginning of sockeye salmon fisheries and ADF&G personnel are occupied with salmon concerns). The first ADF&G herring survey occurred on May 17 in Canoe Bay, no herring were observed. ADF&G also surveyed South Peninsula waters on May 21, May 23, May 29, June 7, and June 8 to document the presence of herring. Aerial surveys documented a substantial herring biomass only during the June 7 survey in Canoe Bay (498 tons; Table 14). Commercial spotter pilots and several fishing vessels reported herring through mid-July in other locations, but ADF&G was not able to document their presence. The harvest of 92.4 tons in Canoe Bay represents a 18.5% exploitation rate of the observed biomass.

A total of 213 herring were sampled from the commercial catch in Canoe Bay. In Canoe Bay, the most abundant age classes in the commercial harvest were estimated as 21.1% age 3, 15.5% age 5, 35.2% age 8, and 10.8% age 9 (Table 15; Figure 11). The male to female ratio was 1:1.1. The average herring length in the catch was 276 mm, and the average weight was 299 g (Table 12).

No spawning was observed by ADF&G personnel in South Peninsula waters but several schools of spawning herring were reported by commercial pilots. Other finfish (capelin) were abundant in Stepovak and Canoe Bays.

ALEUTIAN ISLANDS FOOD AND BAIT FISHERY

The Aleutian Islands (Unimak, Akutan, and Unalaska Districts and that portion of the Umnak District located east of Samalga Pass) "Dutch Harbor" commercial food and bait herring fishery may open to commercial herring fishing on July 16. In 1993, only the Akutan and Unalaska Districts were opened on July 16 from 8:00 a.m. through 9:00 a.m. and from 3:00 p.m. through

3:20 p.m. (Figures 2-5). A 2,193 ton quota was allocated for the fishery. An estimated 650 tons remained on the quota following the 8:00 a.m. July 16 period. Because of the fleet size and the small remaining allowable harvest (650 tons), ADF&G reopen the fishery for only 20 minutes in the afternoon of July 16.

In 1993, the entire allocation was harvested in Unalaska Bay. The commercial catch totaled 2,789.8 tons, which exceeded the allocation by 596.8 tons (Table 16).

Fourteen permit holders participated in the July 16 period with all but one permit holder making at least one delivery. After the commercial fishery ADF&G conducted a test fishery to obtain age, length, and weight data of the herring present in Unalaska Bay. ADF&G contracted a commercial permit holder who harvested an additional 34.0 tons of herring.

Thirteen purse seine permit holders made 32 landings for a commercial harvest of 2,789.8 tons of herring (Tables 5, 6, 16). About 886.6 tons were processed as food and the remainder (1,903.2 tons) was processed as bait. Prices paid by the five companies that purchased herring during this fishery was about $300 per ton. The exvessel value of the fishery was about $836,940.

A total of 629 herring were sampled from the commercial catch. The most abundant age classes in the harvest were estimated as 9.5% age 5, 51.8% age 6, and 13.2% age 9 (Table 17; Figures 12, 13). The male to female ratio was 1:1.2. The average herring length in the sample was 272 mm, and the average weight was 305 g.

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Table 1. Alaska Peninsula Management Area commercial sac roe herring catch by time period and area, 1979-93.

	South Peninsula		North Peninsula		
Year	Harvest (Tons)	Time Period	Harvest (Tons)	Time Period	Total
1979	10.1	July 4-July 4	0.0		10.1
1980	453.8	May 18-July 14	0.0		453.8
1981	797.4	May 9-June 23	0.0		797.4
1982	138.3	May 31-June 14	505.5	May 31-June 12	643.8
1983	0.0		627.0	May 9-May 29	627.0
1984	210.4	May 13-June 1	431.2	May 24-June 8	641.6
1985	287.8	June 1-June 11	710.2	May 24-June 4	998.0
1986	281.9	June 7-June 14	894.4	May 18-May 30	1,176.3
1987	319.0	June 8-June 19	513.8	May 9-June 5	832.8
1988	376.7	May 31-June 20	294.3	May 17-June 15	671.0
1989	310.3	May 13-June 19	729.0	May 28-June 23	1,039.3
1990	312.2	May 14-June 14	272.8	June 4-June 19	585.0
1991	157.4	May 16-June 11	1,313.0	May 17-July 4	1,470.5
1992	180.4	June 4-June 7	3,969.0	May 23-June 17	4,149.4
1993	97.0	May 27-June 9	535.9	May 8-June 9	632.9
1988-92 Average	267.4		1,315.6		1,583.0

Table 2. North Peninsula commercial sac roe herring catch by geographic area, 1982-93.

Year	Port Moller District			Bear River Bering Sea Coast	Port Heiden District	Total
	Deer Island	Herendeen Bay	Moller Bay		Port Heiden Bay	
1982	0.0	279.5	180.0	46.0	0.0	505.5
1983	0.0	509.3	36.5	81.3	0.0	627.0
1984	0.0	180.8	250.4	0.0	0.0	431.2
1985	0.0	173.3	255.5	281.4	0.0	710.2
1986	0.0	156.1	254.8	483.5	0.0	894.4
1987	0.0	156.6[a]	349.8	7.3	0.0	513.8
1988	0.0	8.2	286.1	0.0	0.0	294.3
1989	0.0	67.0	246.5	415.6	0.0	729.0
1990	0.0	155.8	117.1	0.0	0.0	272.8
1991	156.3	167.0	689.6	300.2	0.0	1,313.0
1992	18.3	0.0	2,350.7	0.0	1,600.0	3,969.0
1993	0.0	106.6	371.0	57.9	0.0	535.9
1993 District Total		535.9			0.0	535.9
1988-92 Average	34.9	79.6	738.0	143.2	320.0	1315.6

[a] At least 11 tons were caught in the Deer Island-Mud Bay Section.

Table 3. South Peninsula commercial sac roe herring catch by geographic area, 1980-93.

Year	Stepovak Bay[a]	Balboa Bay	Pavlof Bay	Canoe Bay	Volcano-Dolgoi	Belkofski Bay	Lenard Harbor	Dolgoi Harbor	Shumagin Islands	Total
1980	195.0	132.0	114.0	12.0	0.0	0.0	0.0	0.0	0.0	453.0
1981	122.0	36.0	225.0	206.0	65.0	23.0	110.0	0.0	0.0	787.0
1982	0.0	5.0	0.0	171.2	0.0	0.0	0.0	0.0	0.0	176.2
1983[b]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1984	30.0	25.0	0.0	155.4	0.0	0.0	0.0	0.0	0.0	210.4
1985	11.0	0.0	95.0	239.0	0.0	0.0	0.0	0.0	0.0	345.0
1986[c]	0.0	0.0	61.0	140.5	13.0	8.0	59.0	0.0	0.0	281.5
1987[c]	0.0	0.0	92.0	118.0	0.0	38.0	59.0	12.0	0.0	319.0
1988[d]	0.3	11.0	69.0	236.5	17.0	12.0	31.0	0.0	0.0	376.8
1989	39.0	17.0	53.0	148.0	0.0	0.0	9.0	5.0	39.0	310.0
1990	71.7	20.8	0.0	120.4	0.0	3.2	5.9	0.0	90.4	312.2
1991	19.3	19.3	0.0	77.5	0.0	0.0	0.0	0.0	41.4	157.4
1992	0.0	0.0	0.0	180.4	0.0	0.0	0.0	0.0	0.0	180.4
1993	4.6	0.0	0.0	92.2	0.0	0.0	0.0	0.0	0.0	96.8
1988-92 Average	26.1	13.6	24.4	152.6	3.4	3.0	9.2	1.0	34.2	267.4

[a] The 1984-88 catches came from Ramsey Bay, the 1989 and 1993 catch came from Granville

[b] In 1983 the South Peninsula sac roe fishery was closed, all herring catches were allocated to a food and bait fishery that did not develop.

[c] Stepovak Bay (Kupreanof Point to Swedania Point) was closed during 1986-87 due to the herring biomass being below the threshold required for a commercial fishery.

[d] In Stepovak Bay seven tons of green herring were dumped on May 7, and an additional two tons were dumped on May 11.

Table 4. Alaska Peninsula and Aleutian Islands Management Areas sac roe herring harvest guideline levels, by management area, 1993.[a]

Management Area	Sac Roe Guideline Harvest In Short Tons
South Peninsula	
Sand Point District	
Stepovak Bay Section	150
Swedania Point-Balboa Bay Section	15
Point Aliaksin-Beaver Bay Section	40
General Section	[b]
Pavlof District	
Canoe Bay Section	100
Pavlof Bay Section	25
Seal Cape-Wosnesenski Section	[b]
General Section (Volcano Bay)	20
King Cove District	
Belkofski Section	25
Deer Passage Section	15
Cold Bay Section	25
General Section	[b]
South Peninsula Total	*415*
North Peninsula	
Amak District	[b]
Port Moller District[c]	
Western Section	[b]
Deer Island Section[d]	
Herendeen Bay Section	150
Inner Moller Bay Section	900
Outer Moller Bay	900
Bear River Section[e]	50
Port Heiden District[f]	1,500
North Peninsula Total	*3,500*
Aleutian Islands	
Unimak District	[b]
Akutan District	[b]
Unalaska District	[b]
Umnak District	[b]
Adak District	[b]
Guideline Harvest Total[g]	*3,915*

-Continued-

Table 4. (page 2 of 2)

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[a] The Aleutian Islands Management Area is open for exploration; no deliveries have ever been made from the Aleutian Islands. Portions of a section, district, or area may be closed if it is suspected that additional harvests in a given location will exceed 20% of the spawning biomass.

[b] All areas without guideline harvest levels are open for exploration. Harvests in these areas will be kept small until ADF&G is able to document the spawning biomass. For the General Section of the Sand Point District (Shumagin Islands), Seal Cape- Wosnesenski Section, the General Section of the King Cove District, Amak District, Western Section of the Port Moller District, and the Aleutian Islands, no more than 50 tons of herring will be allowed to be harvested from the waters near any single island or bay in exploratory areas unless ADF&G documents a herring biomass that would allow a larger harvest.

[c] Herring abundance in the Port Moller District is difficult to document. The 1993 herring abundance may justify a larger catch than 2,000 tons, however to increase the guideline harvest level a larger than expected spawning biomass must be documented by ADF&G.

[d] Herring harvested in the Deer Island Section of Herendeen Bay will be counted against the Herendeen Bay guideline harvest level.

[e] Herring harvested along the Bering Sea coast will be counted against the Port Moller and Herendeen Bays guideline harvest level if it is suspected that these herring were traveling into Port Moller or Herendeen Bays.

[f] In 1992, commercial quantities of herring were harvested for the first time in the Port Heiden District. The 1993 herring abundance may justify a larger catch than 1,500 tons, however to increase the guideline harvest level a larger than expected spawning biomass must be documented by ADF&G. The commercial herring fishery will be managed conservatively until adequate data is obtained to warrant a liberal management approach. Herring harvested along the Bering Sea coast will be counted against the Port Heiden guideline harvest level if it is suspected that these herring were traveling in to Port Heiden Bay.

[g] Total does not include harvests that may occur in areas open for exploration.

Table 5. Aleutian Islands "Dutch Harbor" area food and bait herring fisheries historical industry summary, 1929-93.

Year	Harvest In Short Tons	Number Processors	Number Permits	Number Landings	Tons Per Boat	Tons Per Landing	Price Per Ton	Exvessel Value (Thousands)	Exvessel Value Per Vessel (Thousands)
1929	1,259	*	*	*	*	*	*	*	*
1930	1,916	*	*	*	*	*	*	*	*
1931	1,056	12	26	*	*	*	*	*	*
1932	2,510	12	30	*	*	*	*	*	*
1933	1,585	12	38	*	*	*	*	*	*
1934	1,533	9	*	*	*	*	*	*	*
1935	2,412	10	*	*	*	*	*	*	*
1936	1,379	8	*	*	*	*	*	*	*
1937	579	*	*	*	*	*	*	*	*
1938	513	*	*	*	*	*	*	*	*
1939-44					No Fishery				
1945	75	*	*	*	*	*	*	*	*
1946-80					No Fishery				
1981	704	a	a	16	352	44	300	211	a
1982	3,565	6	7	95	509	38	300	1,020	146
1983	3,567	5	8	96	446	37	232	828	104
1984	3,578	5	9	61	398	59	210	751	83
1985	3,480	3	6	78	560	45	162	564	94
1986	2,394	4	7	53	342	45	254	600	86
1987	2,503	4	8[b]	45	373	56	300	751	94
1988	2,004	6	8[b]	59	251	34	252	505	63
1989	3,081	5	9[b]	69	342	45	283	873	97
1990	820	5	7	8	117	103	350	287	41
1991	1,325	5	8	18	166	74	300	398	50
1992	1,949	5	11	26	177	75	300	573	52
1993	2,790	4	13	32	215	87	300	837	64
1929-38 Average	1,474	11	31	*	*	*	*	*	*
1982-93 Average	2,588	5	8	53	325	58	270	666	81

* Data not available.

a The number of processors, fishing vessels, and catch by gear type can not be released due to state confidentiality requirements.

b The catch by gear type can not be released due to state confidentiality requirements.

Table 6. Aleutian Islands "Dutch Harbor" commercial food and bait herring catch, 1981-93.

Year	Landing Date First	Landing Date Last	Days Fished	Preseason Togiak Spawning Biomass Short Tons	Harvest Quota Short Tons	Food & Bait Harvest Short Tons	% Togiak Spawning Biomass Harvested	Number Permit Holders Fishing
1981	8/03	8/23	21	159,000	None	704	0.4	[a]
1982	8/05	9/12	39	98,000	None	3,565	3.6	6
1983	7/23	9/06	46	142,000	3,525[b]	3,567	2.5	5
1984	7/17	7/27	11	115,000	3,525[b]	3,578	3.1	5
1985	7/17	8/11	26	132,000	3,525[b]	3,480	2.6	3
1986	7/16	7/28	13	96,000	2,453[c]	2,394	2.5	4
1987	7/16	7/23	4[d]	88,000	2,332[c]	2,503	2.8	9
1988	7/16	9/18	21	132,000	3,100[e]	2,004	1.6	8
1989	7/16	8/05	19[f]	100,108	3,100[e]	3,081	3.2	9
1990	8/15	8/15	<1	72,000	903[e]	820	1.1	7
1991	7/17[g]	7/17	<1	83,229	931[e]	1,325	1.6	8
1992	7/16	7/28[h]	5	60,214[i]	1,940[i]	1,949	1.3	11
1993	7/16	7/16	<1	164,135	2,193	2,790	1.7	13
Average			16	110,899	2,502	2,443	2.2	7

[a] Number may not be released due to State of Alaska confidentiality requirements.
[b] Harvest ceiling of 3,525 established by Alaska Board of Fisheries.
[c] Harvest quota set by ADF&G. Reduced proportionate with the drop from the 1985 Togiak spawning biomass level.
[d] Closed 7/19, reopened for 14 hours on 7/23.
[e] Harvest quota set under provisions of the Bering Sea Herring Fisheries Management Plan.
[f] Closed 7/26, reopened 7/27 through 8/5.
[g] Fishery opened for six hours on 7/16; weather prevented any fishing effort.
[h] Fishery co-op after 7/16.
[i] The preseason forecasted biomass was adjusted by ADF&G, the final biomass estimate for Togiak was 146,037 tons and the harvest quota was adjusted to 1,940 tons.

Table 7. Alaska Peninsula sac roe herring catch and number of landings and permits by year, 1979-93.

	North Peninsula				South Peninsula				Total			
Year	Pounds	Tons	Landings	Permits	Pounds	Tons	Landings	Permits	Pounds	Tons	Landings	Permits
1979					20,213	10.1	1	1	20,213	10.1	1	1
1980					907,649	453.8	15	6	907,649	453.8	15	6
1981					1,594,884	797.4	93	56	1,594,884	797.4	93	56
1982	1,011,000	505.5	6	3	276,655	138.3	13	4	1,287,655	643.8	19	7
1983	1,253,922	627.0	47	23	0	0	0	0	1,253,922	627.0	47	23
1984	862,345	431.2	20	11	420,755	210.4	20	5	1,283,100	641.6	40	15
1985	1,420,394	710.2	31	17	575,561	287.8	8	5	1,995,955	998.0	39	20
1986	1,788,775	894.4	116	50	563,816	281.9	14	6	2,352,591	1,176.3	130	51
1987	1,027,617	513.8	46	27	637,960	319.0	8	2	1,665,577	832.8	54	27
1988	588,599	294.3	21	9	753,322	376.7	22	10	1,341,921	671.0	43	19
1989	1,457,925	729.0	24	10	620,549	310.3	31	13	2,078,474	1,039.2	55	19
1990	545,685	272.8	23	5	624,420	312.2	31	6	1,170,105	585.1	54	9
1991	2,626,080	1,313.0	59	11	314,828	157.4	26	10	2,940,908	1,470.5	85	18
1992	7,938,010	3,969.0	100	24	360,600	180.3	11	7	8,302,710	4,151.4	112	29
1993	1,071,740	535.9	44	16	193,600	96.8	17	3	1,265,780	632.9	61	17
1983-92 Average	1,950,932	975.5	49	19	487,181	243.6	17	6	2,428,526	1,219.3	66	23

Table 8. North Peninsula aerial herring biomass surveys, 1993.

	Port Moller District									Port Heiden District		
	Herendeen Bay			Moller Bay			Bear River to Strogonof Point			Port Heiden Bay		
Date	RAI[a]	Tons[b]	Rating[c]	RAI[a]	Tons[b]	Rating[c]	RAI[a]	Tons[b]	Rating[c]	RAI[a]	Tons[b]	Rating[c]
May 4	0	0	2	56	85[d]	2						
May 6	0	0	3	6	9[d]	2	0	0	2	0	0	2
May 7				101	154[d]	2						
May 8				159	411[d]	2						
May 9				51	77[d]	1						
May 11	3	5[d]	3	748	1,137[e]	2		17,250[f]	2			
May 12	28	43[d]	2	62	94[g]	2	13	33[d]	1	0	0	3
May 13	0	0	2	62	94[h]	2	0	0	2			
May 16	11	17[d]	3	39	60[d]	2						
May 17	0	0	2	84	128[i]	2						
May 19	0	0	2	6	9[d]	2						
May 20							0	0	2			
May 21	0	0	2	34	51[d]	2						
May 23	0	0	2	0	0	2						
May 29	3	5[d]	2	0	0	2						
May 31	62	94[d]	2	0	0	2						
June 2	51	77	2	17	26[d]	2						
June 4	239	439[d]	2	0	0	2						
June 6	49	103[d]	2	52	117[d]	2						
June 7	0	0	2	274	594[d]	2						
June 8	61	92[d]	2	0	0	2						
June 9	0	0	2	18	27[d]	2						
Total Biomass Observed	457	775		1,631	2,878		13	33		0	0	

Herendeen Bay includes both the Herendeen Bay and Deer Island-Mud Bay Sections. Moller Bay includes both the Inner and Outer Port Moller Bay Sections.

RAI units express the surface area of herring schools in terms of small schools (surface area equal to 538 square feet). For example, 10 RAI units are equivalent to 10 small herring schools, each with a surface area of 538 square feet.

[a] Relative Abundance Index (RAI): small school (less than 538 square feet) = 1 RAI unit medium school (538 square feet to 4,841 square feet) = 5 RAI units large school (total surface area in square feet/538 square feet) = RAI units

-Continued-

Table 8. (page 2 of 2)

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[b] Tons: RAI units are multiplied by 1.52 (schools in water less than 16 feet of depth) RAI units are multiplied by 2.58 (schools in water 16 to 26 feet of depth)

[c] Rating of survey: (1) Excellent, (2) Good, (3) Fair, (4) Poor, (5) Unsatisfactory

[d] Used in calculating biomass estimate

[e] 1,030 tons were considered new herring.

[f] All but 33 tons of these herring were observed about 3 miles off the coast moving in a SW direction; they did not enter the Port Moller District.

[g] 68 tons were considered new herring.

[h] 67 tons were considered new herring.

[i] 94 tons were considered new herring.

Table 9. North Peninsula commercial sac roe herring catch by area, day, and percent roe, 1993.

Area	Date	Catch in Short Tons: Food/Bait	Sac Roe	Percent Roe	Total
Deer Island	May 30	0.0	10.3	10.3	
	June 4	0.0	96.3	10.0	
Total		0.0	106.6	10.0	106.6
Inner Moller Bay	May 8	0.0	56.6	8.9	
	May 9	0.0	61.6	9.4	
	May 10	0.0	62.9	9.9	
	May 12	0.0	5.6	8.9	
	May 13	0.0	3.3	11.0	
Total		0.0	190.0	9.4	190.0
Outer Moller Bay	May 9	0.0	9.0	10.0	
	May 12	0.0	89.7	9.7	
	May 13	0.0	7.2	10.0	
	June 7	0.0	47.7	10.0	
	June 9	0.0	27.4	10.0	
Total		0.0	181.0	9.9	181.0
Bering Sea Coast	May 12	0.0	57.9	10.4	
Total		0.0	57.9	10.4	57.9
Total		0.0	535.5	9.8	535.5

Table 10. Estimated age composition of North Peninsula commercial purse seine sac roe herring catches by area and percent, 1985-93.

	Ages									
Year	2	3	4	5	6	7	8	9	10	11+
Herendeen Bay										
1985	0	5	49	21	15	6	4	0	0	0
1986	0	0	3	25	13	20	21	17	1	0
1987	0	2	4	22	24	17	13	10	6	2
1988	0	3	23	30	22	9	4	3	3	2
1989	0	0	2	62	22	5	1	1	0	7
1990	0	14	3	1	57	15	3	1	1	5
1991	0	2	72	5	2	11	4	0	2	3
1992				No catch in this section						
1993				No catch in this section						
Deer Island-Mud Bay										
1991	0	1	65	7	3	18	5	0	1	1
1992	0	0	17	64	5	2	6	3	2	2
1993				No samples from this section						
Inner Moller Bay										
1985	0	1	12	8	15	33	27	2	0	1
1986	0	1	7	21	12	18	19	20	1	1
1987	0	2	11	13	22	12	11	17	11	0
1988	0	1	30	29	12	6	5	5	8	5
1989	0	1	1	67	19	3	1	2	2	4
1990	0	13	4	2	49	16	5	2	2	6
1991	0	1	59	13	2	16	1	5	2	1
1992	0	0	23	60	4	2	6	2	1	2
1993	0	0	0	10	48	5	2	17	8	10
Outer Moller-Bering Sea Coast										
1985	0	1	26	16	20	17	17	1	1	0
1986	0	0	2	22	13	21	23	18	1	0
1987	0	2	48	9	14	5	11	8	3	0
1988				No catch in this section						
1989	0	0	0	6	26	6	24	7	10	21
1990	90	10	0	0	0	0	0	0	0	0
1991[a]	0	3	74	6	1	11	2	1	1	0
1992[a]	0	2	41	49	2	0	2	2	0	2
1993				No samples from this section						
Bering Sea Coast										
Bear River area										
1991	0	2	86	8	0	4	1	0	0	1
1992				No catch in this section						
1993				No samples from this section						
Cape Kutuzof area										
1991	0	0	37	10	0	40	9	2	2	2
1992				No catch in this section						
1993				No catch in this section						

-Continued-

Table 10. (page 2 of 2)

	Ages									
Year	2	3	4	5	6	7	8	9	10	11+
Port Heiden										
1992	0	0	9	64	5	1	13	2	1	4
1993	No catch in this section									

[a] Outer Port Moller Bay Section samples only.

Table 11. Estimated age composition of Alaska Peninsula commercial purse seine sac roe herring catches by area and day, in percent, 1993.

Date		Sample Size	Ages 2	3	4	5	6	7	8	9	10	11+
North Peninsula												
Inner Moller Bay												
May	7	156	0.0	0.0	0.0	10.3	48.1	5.1	1.9	16.7	7.7	10.3
Total		156	0	0	0	10.3	48.1	5.1	1.9	16.7	7.7	10.3
South Peninsula												
Canoe Bay												
June	4	22	0.0	27.3	18.2	9.1	13.6	0.0	22.7	9.1	0.0	0.0
June	6	108	0.0	27.8	0.0	15.7	10.2	1.9	32.4	6.5	4.6	0.9
June	7	83	0.0	10.8	4.8	16.9	6.0	2.4	42.2	16.9	0.0	0.0
Total		213	0.0	21.1	3.8	15.5	8.9	1.9	35.2	10.8	2.3	0.5

Table 12. Alaska Peninsula Management Area commercial purse seine sac roe herring harvest summary of average weights (g) and lengths (mm) by age, 1993.

Fishery/Area	Harvest (tons)	Sample Date	Weight Length	Age 2	3	4	5	6	7	8	9	10	11+	Average	Sample Size
North Peninsula															
Inner Port Moller Bay	535.9	7 May	Weight	-	-	-	200	243	302	298	316	351	426	282	156
			Length	-	-	-	294	315	334	334	339	353	366	326	156
South Peninsula															
Canoe Bay	97.0	4 June - 7 June	Weight	-	149	187	276	317	289	377	374	377	410	299	212
			Length	-	228	234	272	287	285	298	298	302	309	276	212

Table 13. South Peninsula commercial sac roe herring catch by area, day, and percent roe, 1993.

Area	Date	Catch Tons	Roe Percent
Stepovak Bay	May 27	4.6	9.7
Canoe Bay	June 4	8.9	9.6
	June 6	39.1	10.1
	June 7	14.8	9.9
	June 8	2.6	13.7
	June 9	27.0	12.5
Total		97.0	10.8

Table 14. South Peninsula aerial herring biomass surveys, 1993.

	Stepovak Bay			Beaver Bay			Balboa Bay			Canoe Bay		
Date	RAI[a]	Tons[b]	Rating[c]	RAI[a]	Tons[b]	Rating[c]	RAI[a]	Tons[b]	Rating[c]	RAI[a]	Tons[b]	Rating[c]
May 17										0	0	2
May 21										0	0	2
May 23										0	0	2
May 29	3	5[d]	2							11	29	2
June 7										202	498[d]	2
June 8										0	0	2
Total Biomass Observed		5			0			0			498	

RAI units express the surface area of herring schools in terms of small schools (surface area equal to 532 square feet). For example, 10 RAI units are equivalent to 10 small herring schools, each with a surface area of 538 square feet.

[a] Relative Abundance Index (RAI): small school (less than 538 square feet) = 1 RAI unit
medium school (532 square feet to 4,841 square feet) = 5 RAI units
large school (total surface area in square feet/538 square feet) = RAI units

[b] Tons: RAI units are multiplied by 1.52 (schools in water less than 16 feet of depth)
RAI units are multiplied by 2.58 (schools in water 16 to 26 feet of depth)

[c] Rating of survey: (1) Excellent, (2) Good, (3) Fair, (4) Poor, (5) Unsatisfactory

[d] Used in calculating biomass estimate

Table 15. Estimated age composition of South Peninsula commercial purse seine sac roe herring catches by area and percent, 1985-93.

	Ages									
Year	2	3	4	5	6	7	8	9	10	11
Stepovak Bay										
1985	No samples									
1986	No catch									
1987	No catch									
1988	0	5	78	17	0	0	1	0	0	0
1989	0	3	31	50	13	0	0	0	2	0
1990	1	6	8	28	50	7	1	0	1	1
1991[a]	0	4	13	6	23	42	13	0	0	0
1992	No catch									
1993[a]	No samples									
Balboa										
1988	0	32	50	9	0	1	3	1	2	3
1989	No samples									
1990	0	4	7	22	59	4	0	4	0	0
1991	0	16	11	16	26	32	0	0	0	0
1992	No catch									
1993	No catch									
Shumagin Islands										
1989	0	1	15	79	1	0	0	3	0	2
1990	0	4	0	26	67	2	0	0	0	1
1991	0	0	17	2	30	48	2	0	0	0
1992	No catch									
1993	No catch									
Canoe Bay										
1985	0	1	3	81	7	6	1	1	0	1
1986	0	6	0	3	82	6	2	0	1	0
1987	0	25	28	1	5	34	3	3	0	0
1988	0	24	31	20	0	1	16	4	2	1
1989	0	6	56	22	9	0	0	5	1	1
1990	0	23	5	49	17	5	0	0	1	0
1991	0	27	16	1	41	12	2	0	1	0
1992	0	0	6	9	1	55	23	4	0	2
1993	0	21	4	16	9	2	35	11	2	1
Pavlof Bay										
1985	No samples									
1986	No samples									
1987	0	6	18	5	11	48	9	2	1	0
1988	0	34	50	5	0	2	7	0	2	0
1989	No samples									
1990	No catch									
1991	No catch									
1992	No catch									
1993	No catch									

-Continued-

Table 15. (page 2 of 2)

Year	Ages									
	2	3	4	5	6	7	8	9	10	11
Lenard Harbor										
1986	0	3	0	3	83	7	4	0	0	0
1987	0	67	5	0	3	25	0	0	0	0
1988	No samples									
1989	No samples									
1990	0	3	2	35	46	6	0	3	6	0
1991	No catch									
1992	No catch									
1993	No catch									

[a] The 1991 and 1993 Stepovak Bay catch was in the Northeastern portion of the bay.

Table 16. Aleutian Islands Management Area "Dutch Harbor" commercial purse seine food and bait herring catch by day, 1993.

		Catch in Short Tons		
Area	Date	Food	Bait	Total
Unalaska Island	July 16	886.6	1,903.2	2,789.8[a]
Total		886.6	1,903.2	2,789.8[a]

[a] There was an additional 34.0 tons harvested during test fisheries

Table 17. Estimated age, sex, weight, and length of herring harvested in the Aleutian Islands "Dutch Harbor" commercial food and bait herring fishery, July 16, 1993.

Age	Sample Size			Catch (%)			Weight			Length		
Years	Male	Female	Total	Male	Female	(%) of Total	N	Mean (g)	STD (g)	N	Mean (mm)	STD (mm)
4	1	1	2	50.0	50.0	0.3	2	232	41.0	2	255	2.1
5	25	35	60	42.0	58.0	9.5	60	242	30.3	60	256	6.2
6	145	181	326	44.5	55.5	51.8	326	274	30.4	326	266	7.0
7	18	14	32	56.2	43.8	5.1	32	277	53.8	32	267	12.9
8	17	20	37	45.9	54.1	5.9	37	309	55.4	37	280	10.0
9	39	44	83	47.0	53.0	13.2	83	351	51.7	83	286	10.3
10	16	23	39	41.0	59.0	6.2	39	378	69.9	39	292	12.0
11	8	8	16	50.0	50.0	2.5	16	431	60.1	16	305	10.8
12	4	5	10 [a]	44.0	56.0	1.6	10	416	41.9	10	302	9.9
13	6	5	11	55.0	45.0	1.7	11	470	66.9	11	312	13.0
14	3	5	8	38.0	62.0	1.3	8	479	88.7	8	316	15.5
15	0	5	5	00.0	100.0	0.8	5	528	69.2	5	320	8.3
Total	282	346	629	44.9	55.1	100.0	629	304	72.4	629	273	17.0

[a] Unable to determine the sex of one of the herring sampled.

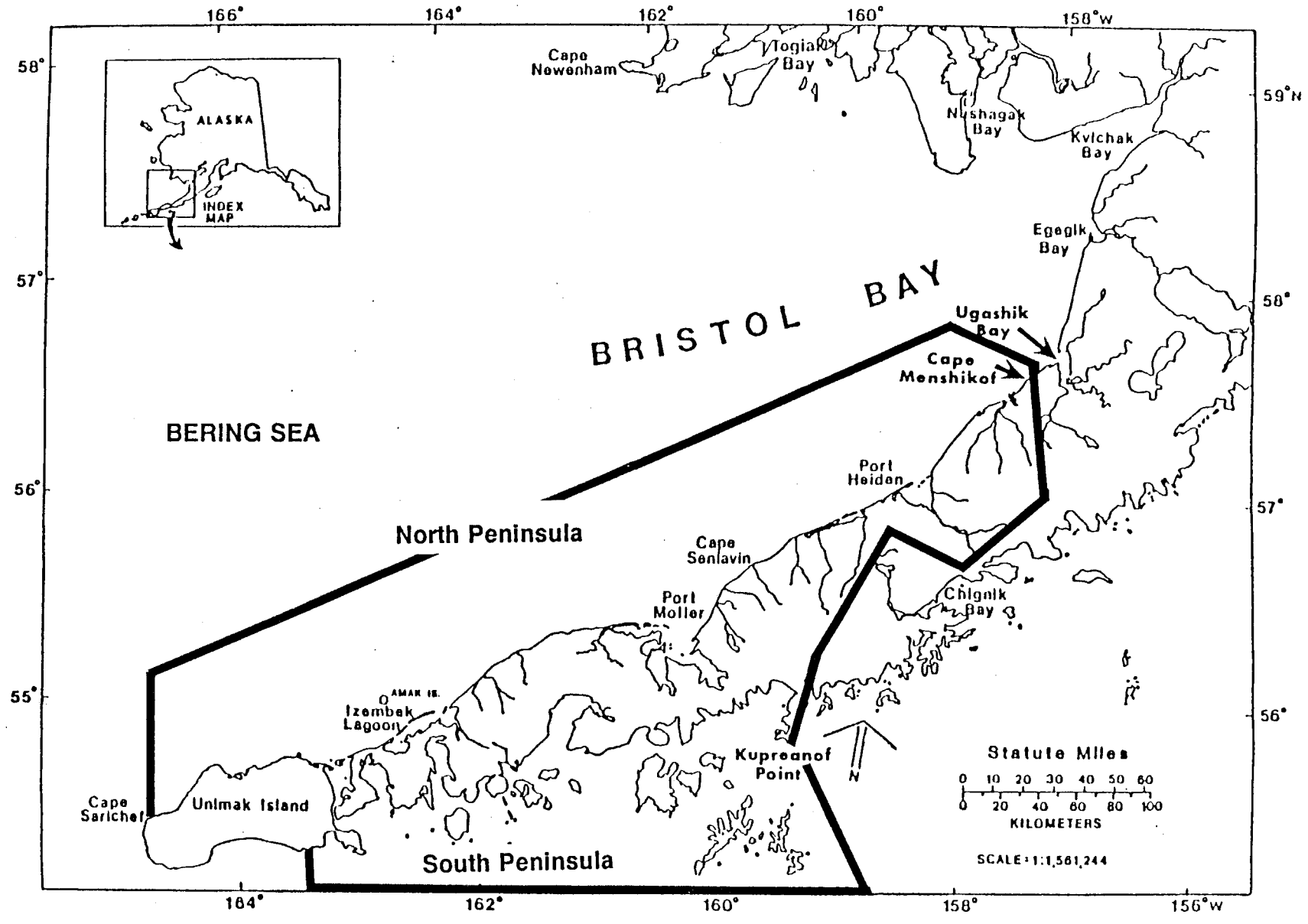

Figure 1. Map of the Alaska Peninsula Management Area, the study area on the Pacific Ocean portion of map is from Kupreanof Point to Unimak Island and on the Bering Sea from Cape Sarichef to Cape Menshikof.

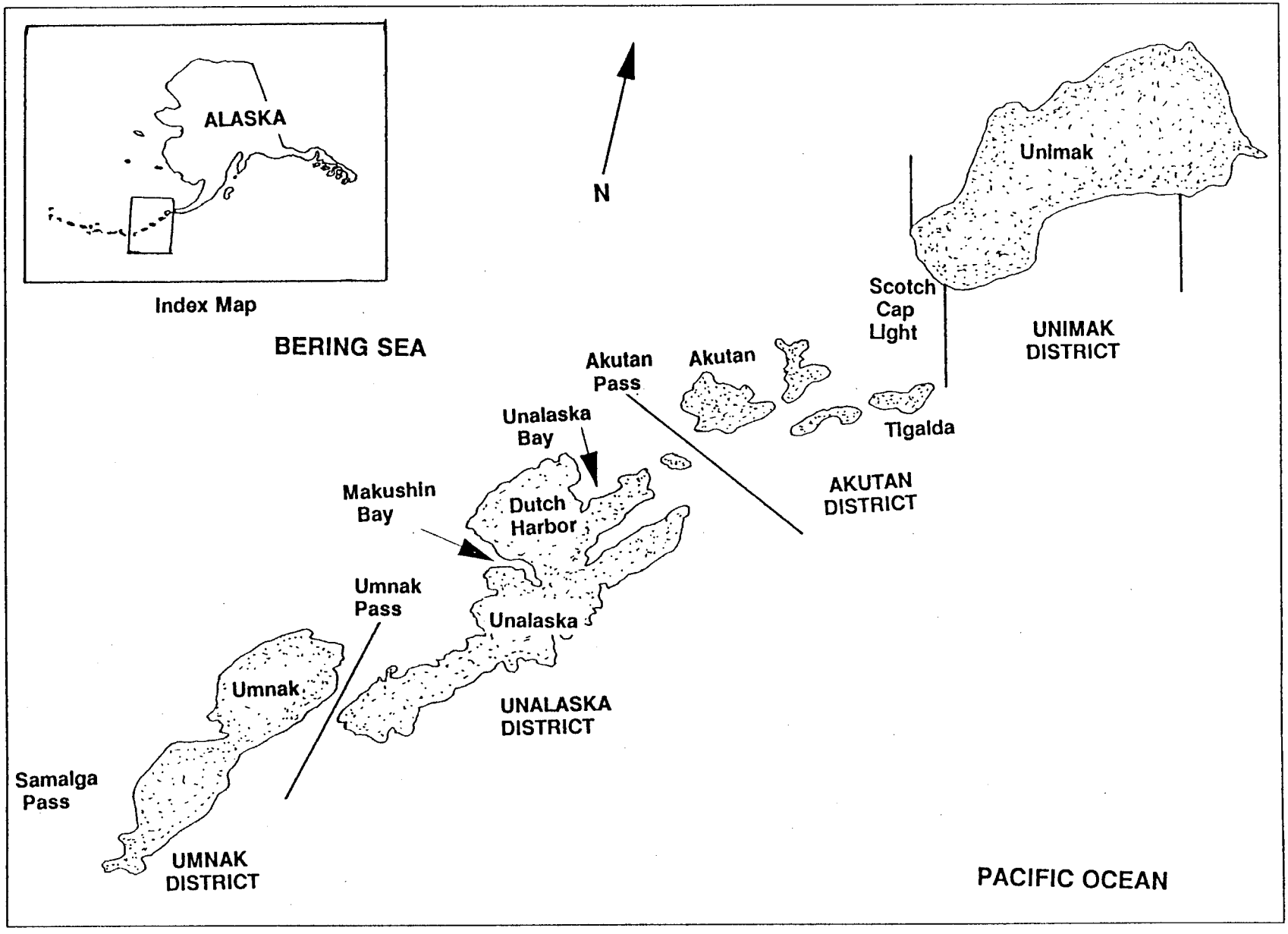

Figure 2. Map of the Aleutian Islands "Dutch Harbor" Management Area, the study area is from the Unimak District to Samalga Pass.

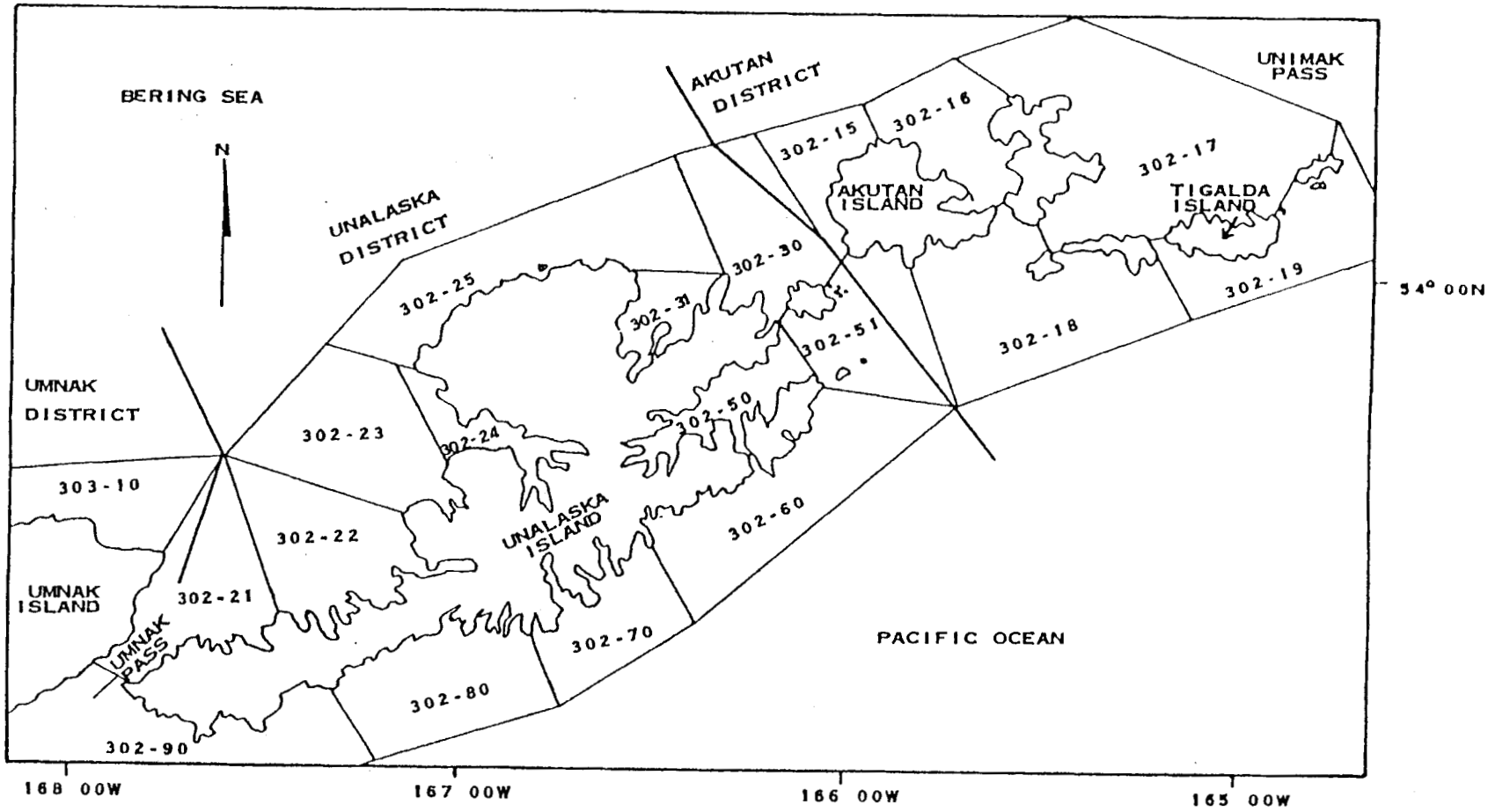

Figure 3. Map of the Aleutian Islands Area from Unmak Pass to Unimak Pass with the statistical herring fishing areas shown.

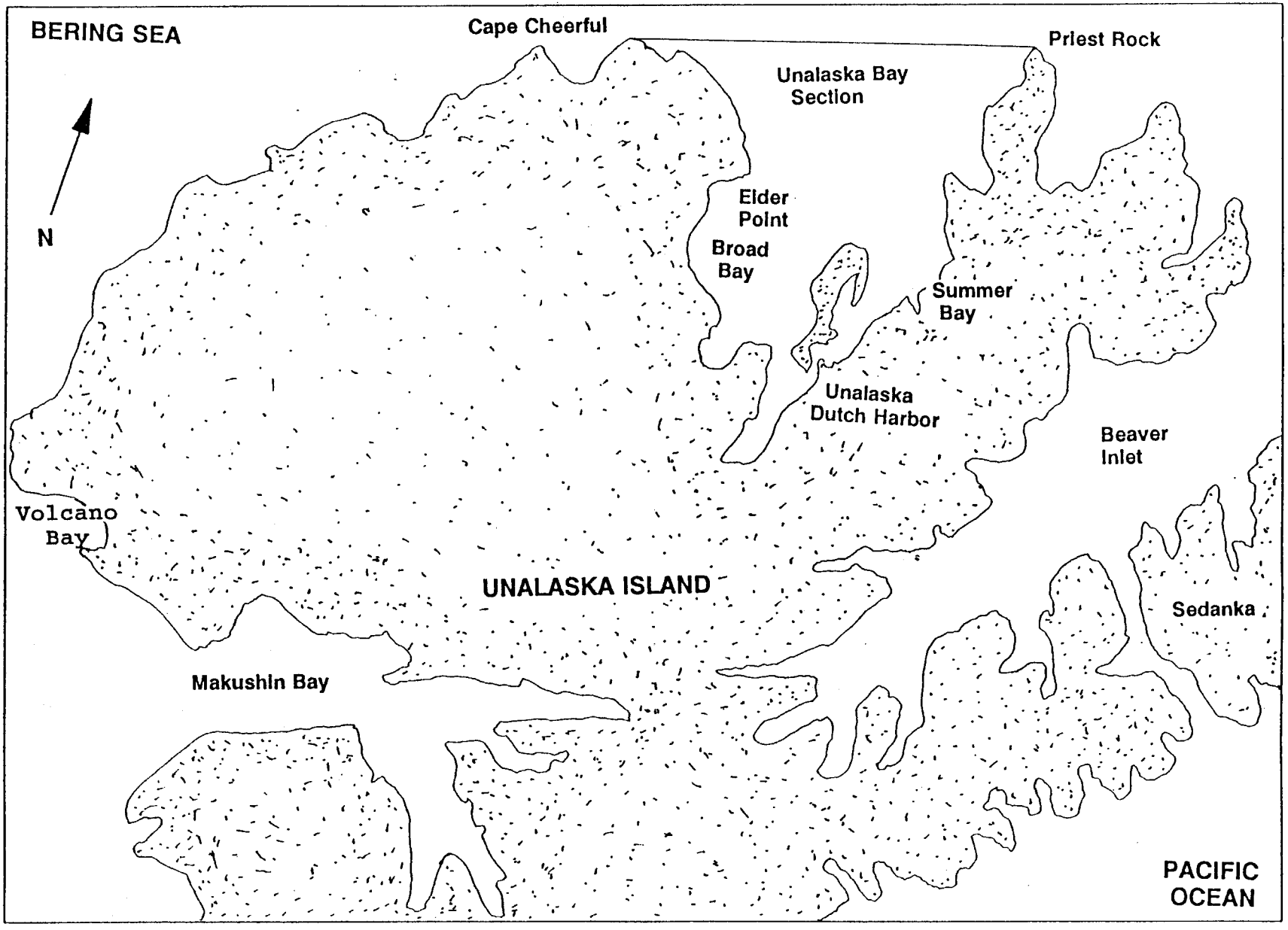

Figure 4. Map of Unalaska Island from Beaver Inlet to Volcano Bay.

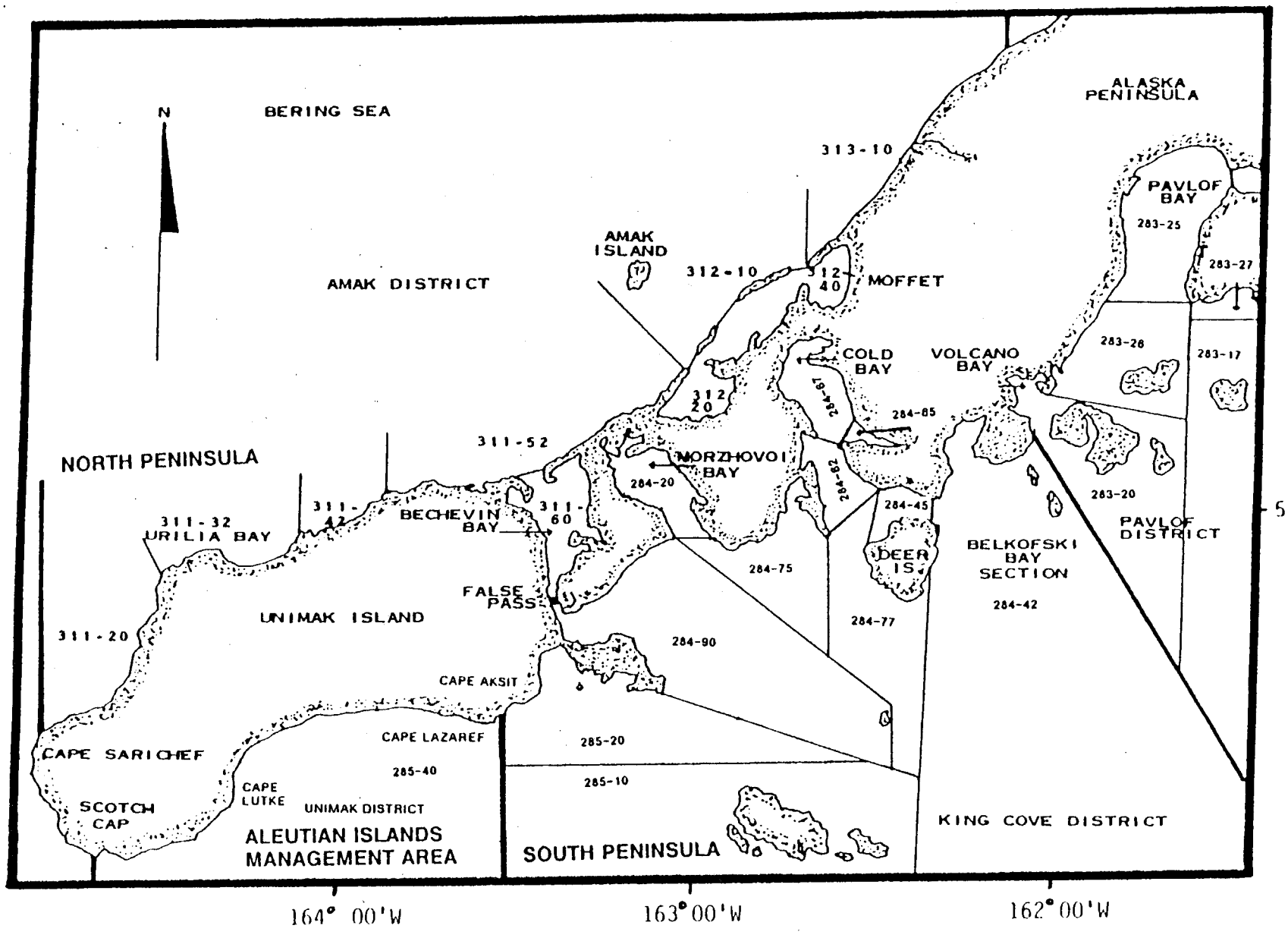

Figure 5. Map of the Alaska Peninsula Area from Cape Sarichef to Pavlof Bay with the statistical herring fishing areas shown.

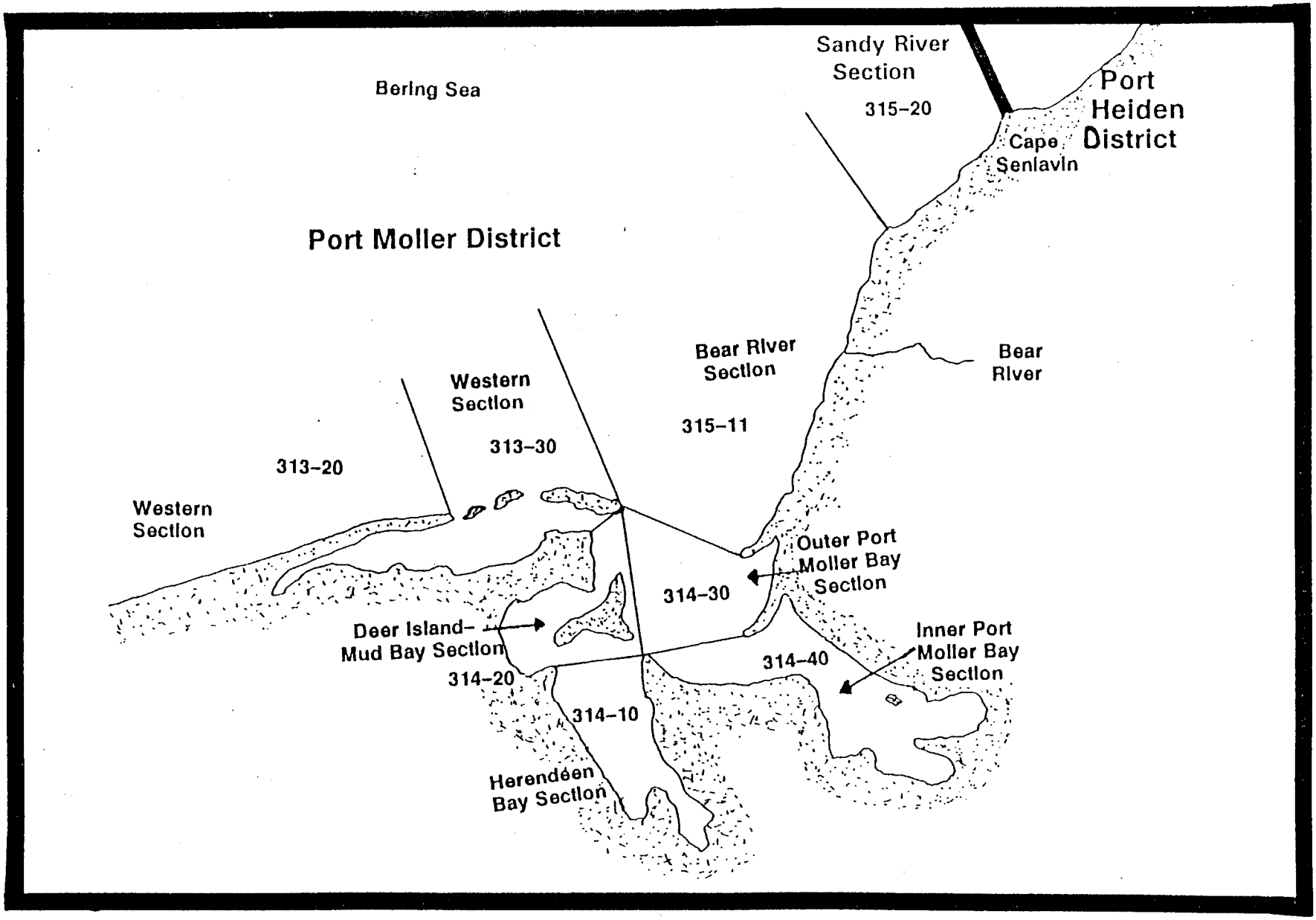

Figure 6. Map of the Port Moller District with the statistical herring fishing areas shown.

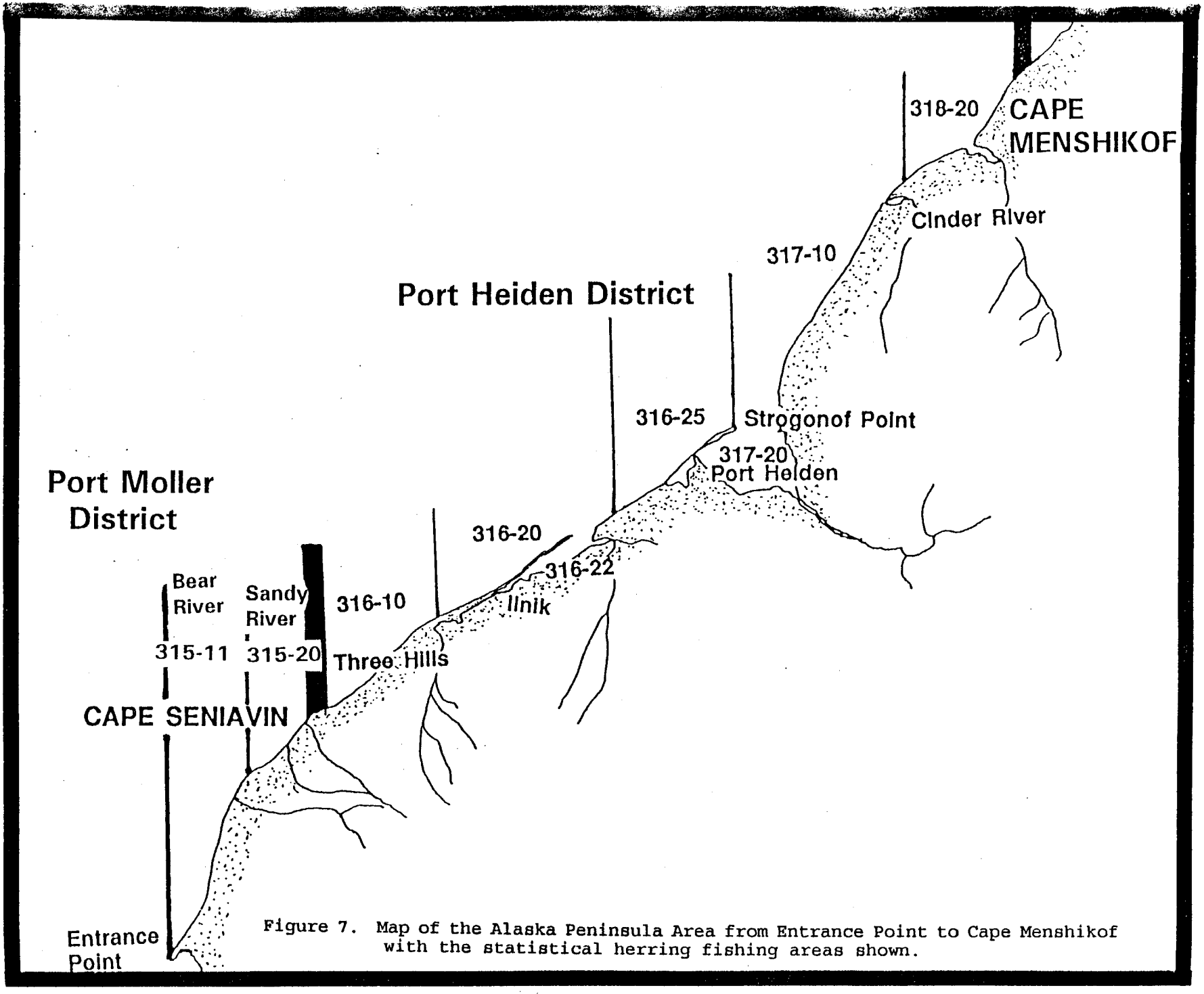

Figure 7. Map of the Alaska Peninsula Area from Entrance Point to Cape Menshikof with the statistical herring fishing areas shown.

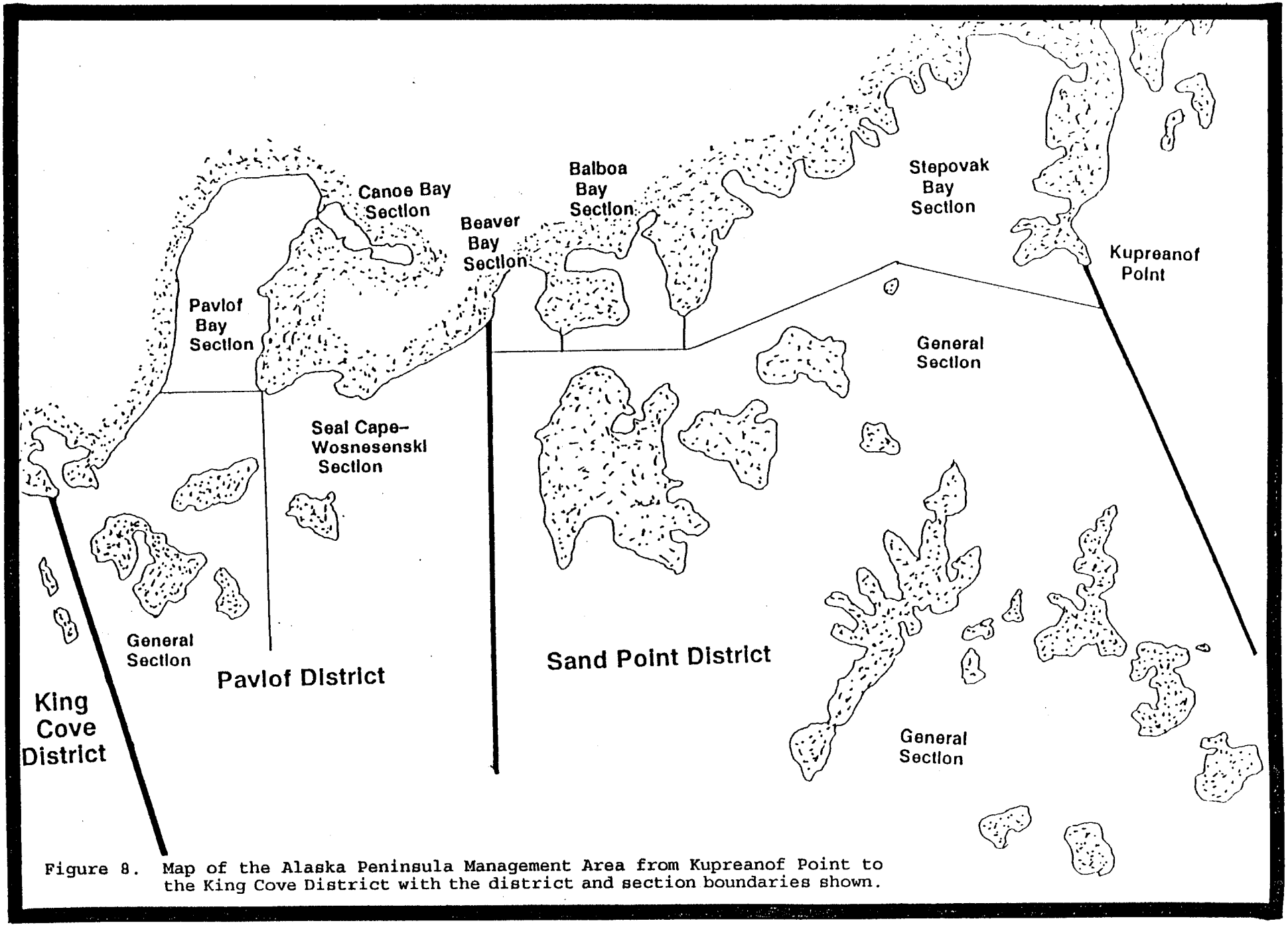

Figure 8. Map of the Alaska Peninsula Management Area from Kupreanof Point to the King Cove District with the district and section boundaries shown.

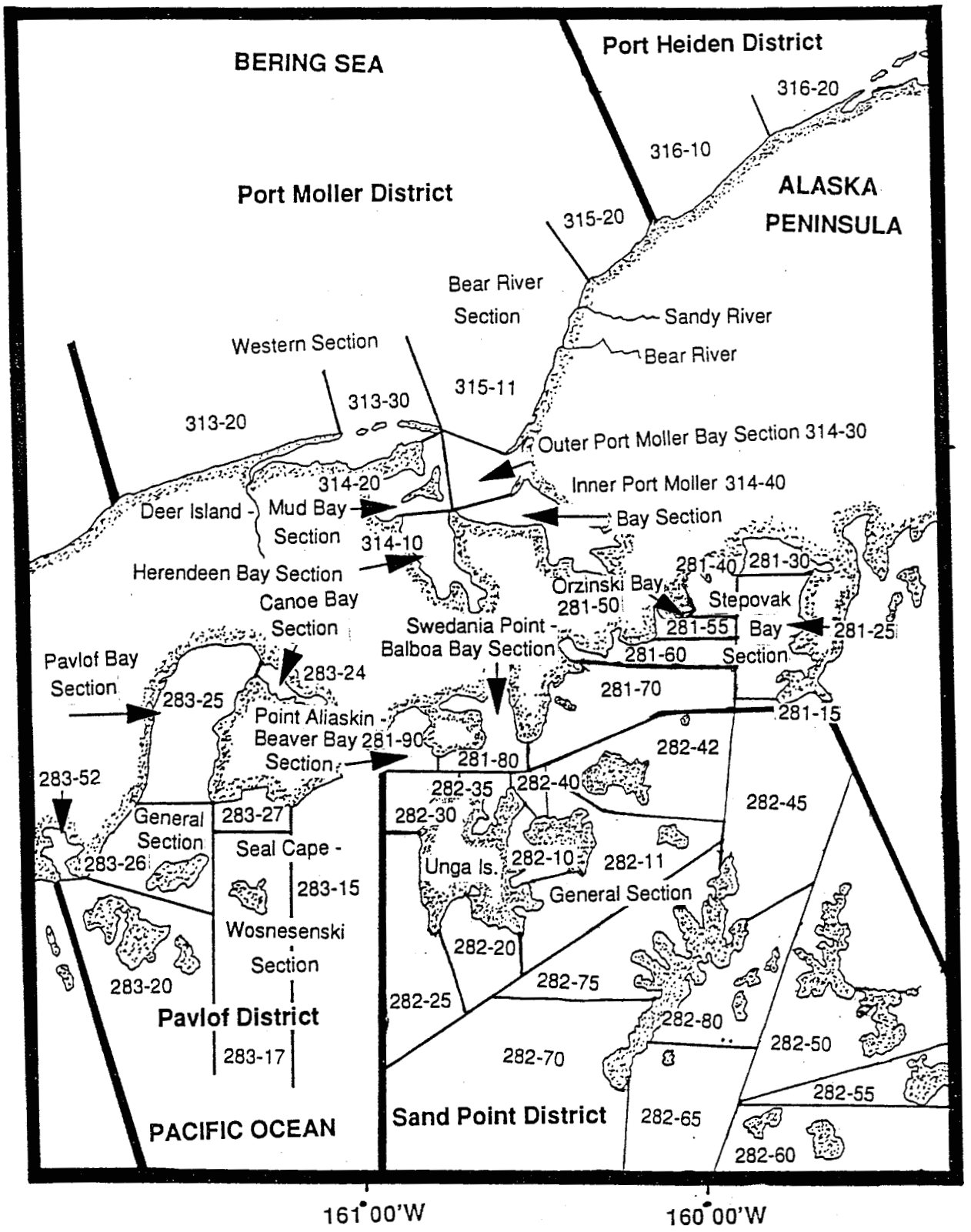

Figure 9. Map of the Alaska Peninsula Area from Bear Bay to Kupreanof Point with the statistical herring fishing areas shown.

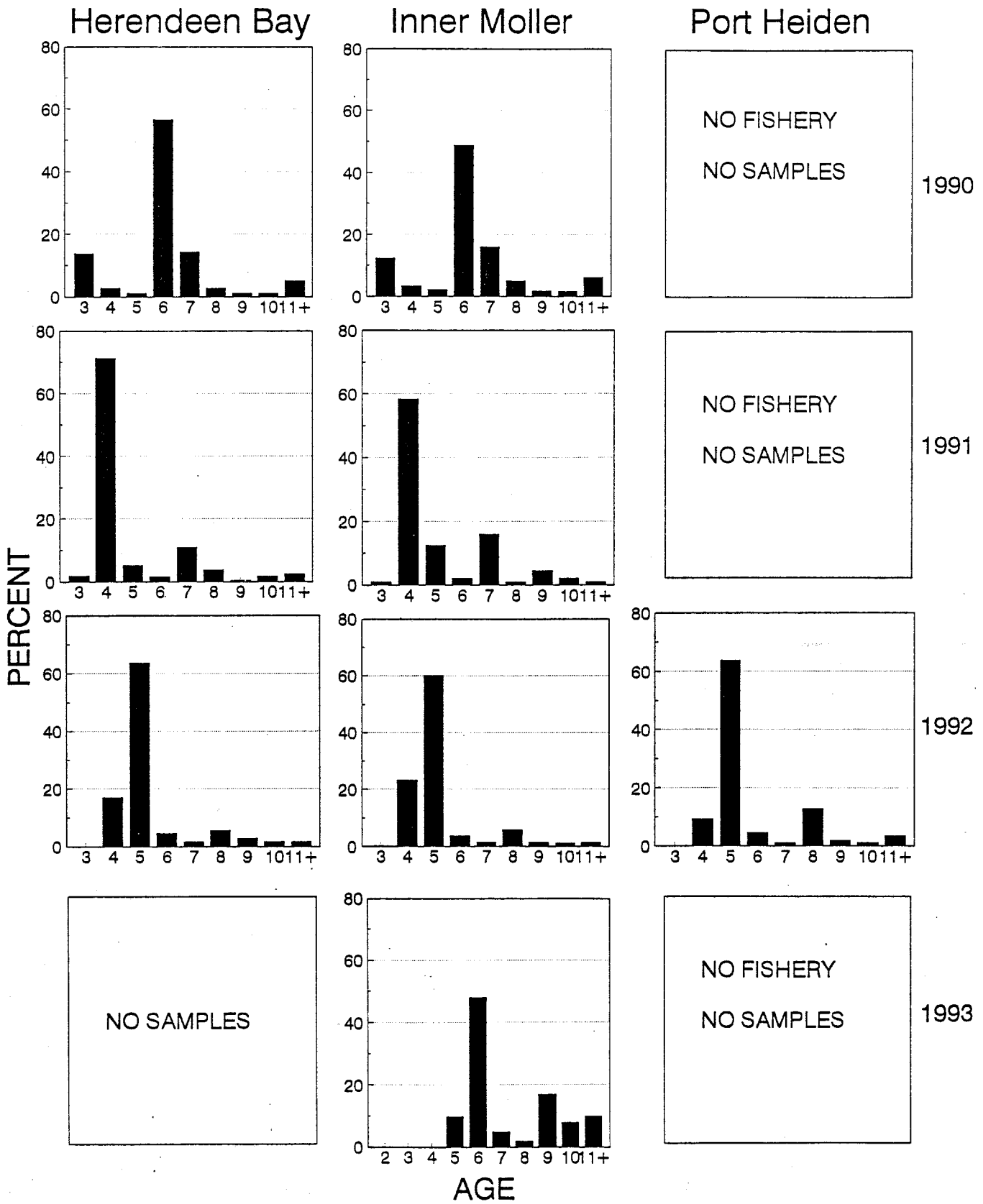

Figure 10. Age distribution of annual sac roe herring catches from Herendeen, Inner Moller, and Port Heiden Bays, 1990-93.

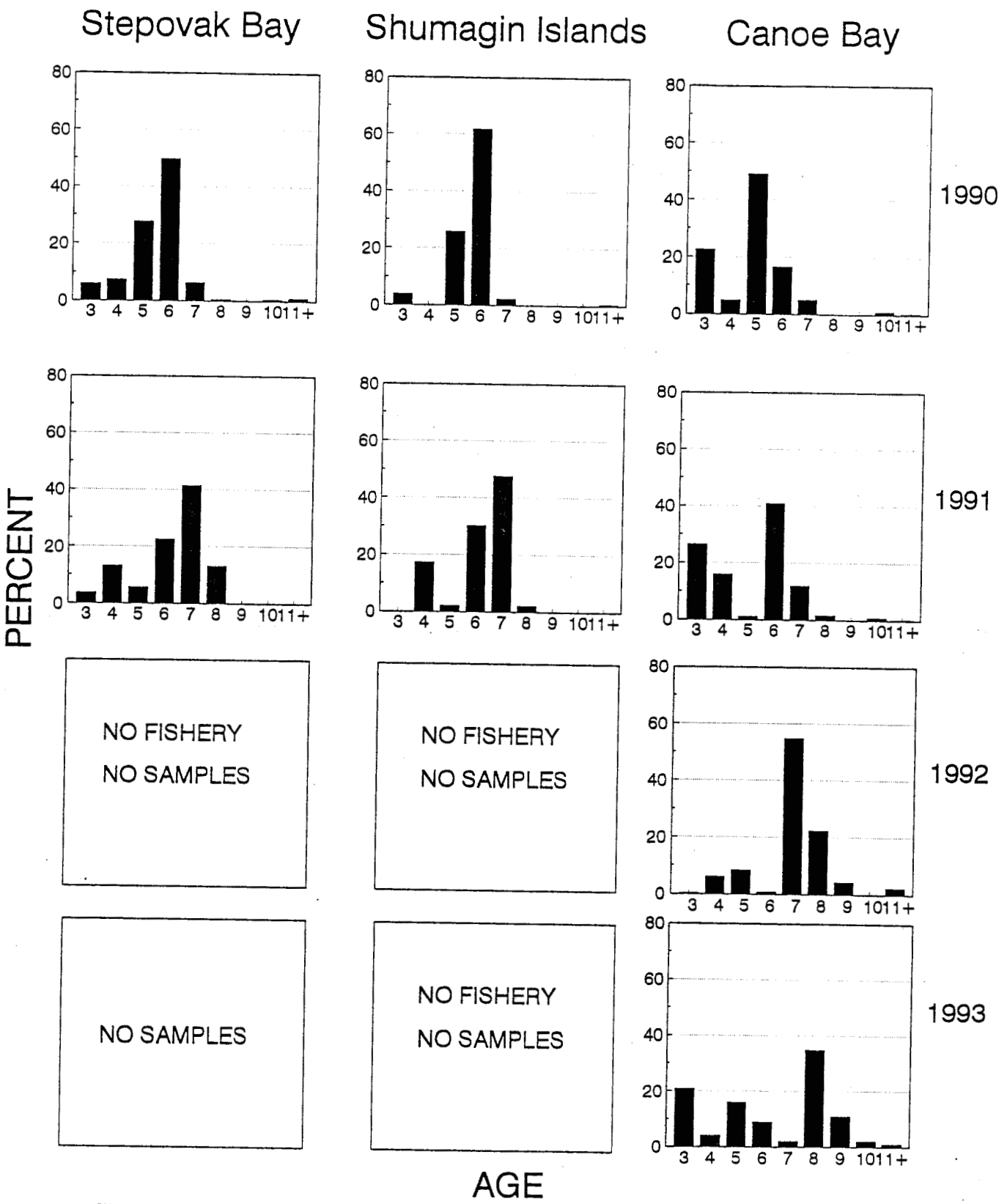

Figure 11. Age distribution of annual sac roe herring catches from Stepovak Bay, Shumagin Islands, and Canoe Bay, 1990-93.

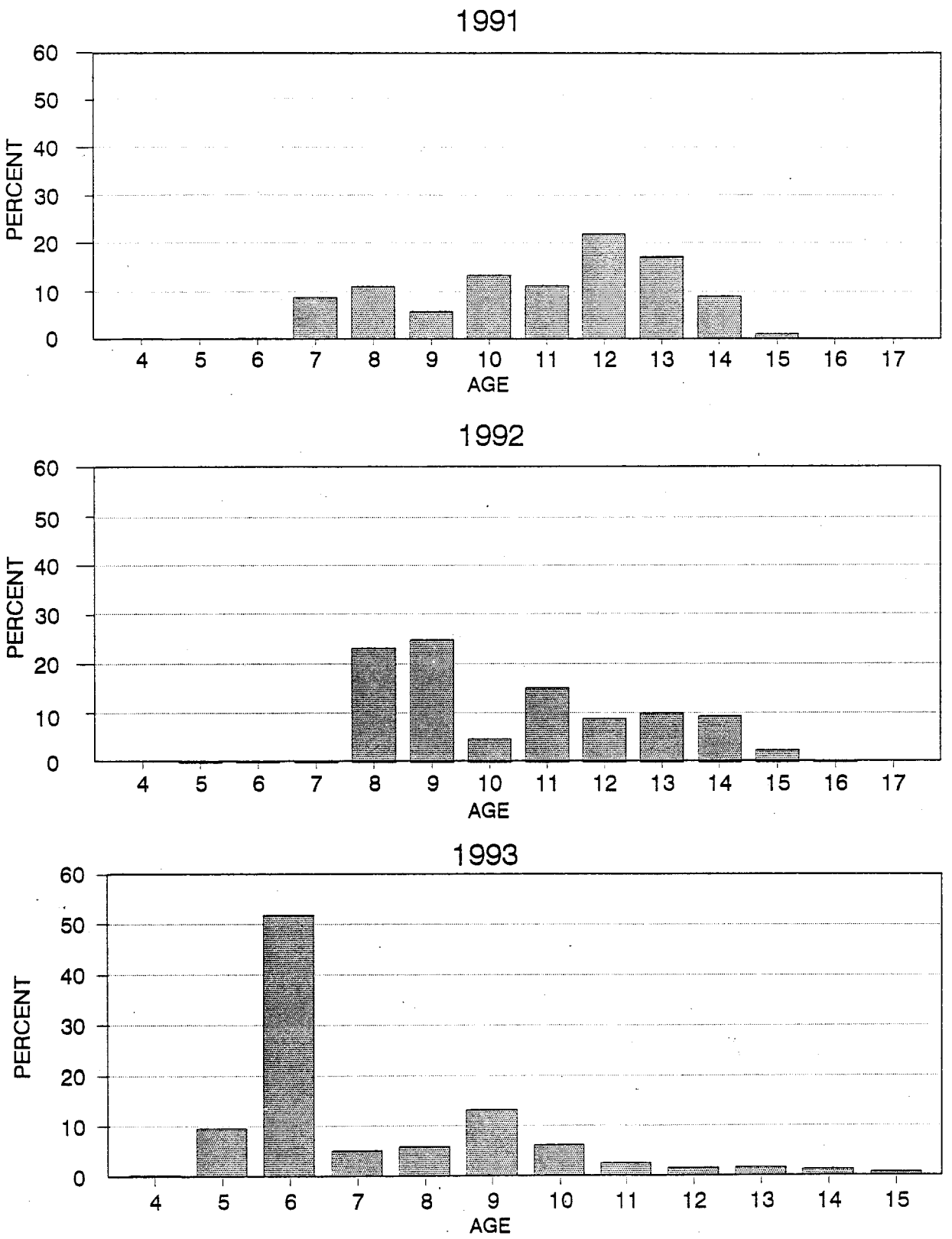

Figure 12. Age distribution of annual food and bait herring catches from the Aleutian Islands "Dutch Harbor" Management Area, 1991-93.

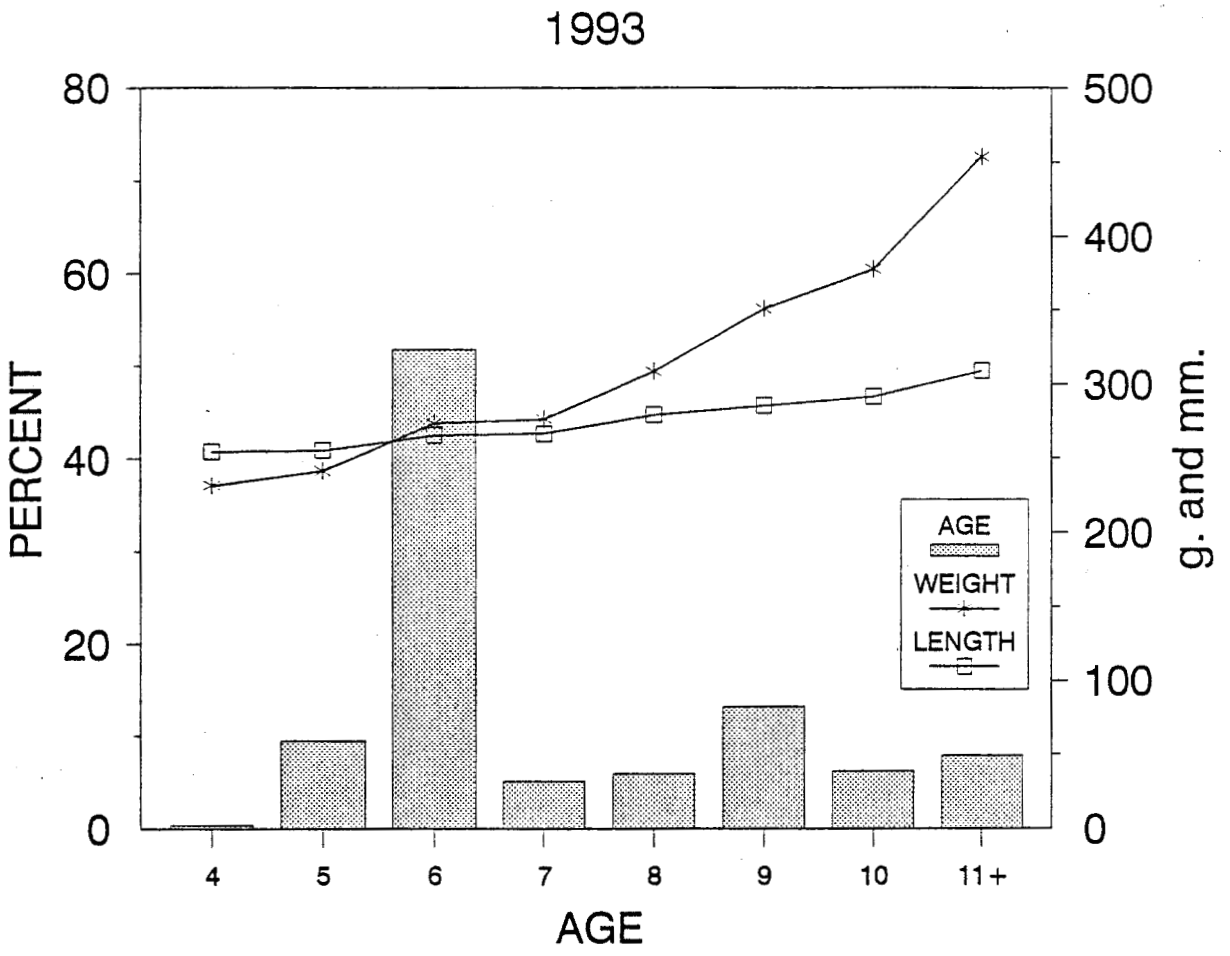

Figure 13. Length (mm), weight (g), and distribution of annual food and bait herring catches from the Aleutian Islands "Dutch Harbor" Management Area, 1993.

APPENDIX

APPENDIX A: EMERGENCY ORDER SUMMARY

ALASKA PENINSULA MANAGEMENT AREA

EMERGENCY ORDER NO. 4-F-M-SP-01-93

EFFECTIVE DATE: April 15, 1993

EXPLANATION: This emergency order establishes weekly commercial herring sac roe season fishing periods as follows for the Alaska Peninsula and Aleutian Islands Management Areas:

(1) South Peninsula: Sand Point, Pavlof, and King Cove Districts.

April 15 through July 15 herring may be taken during Sunday through Saturday.

(2) Aleutian Islands: Unimak, Akutan, Unalaska, Umnak, and Adak Districts.

April 15 through June 15 herring may be taken during Sunday through Saturday.

June 16 through July 15, no open fishing periods.

(3) North Peninsula: Amak, Port Moller, and Port Heiden Districts.

(a) Amak District.

April 15 through June 30 herring may be taken during Sunday through Saturday. July 1 through July 15, no open fishing period

(b) Port Moller and Port Heiden Districts.

April 15 through June 30 herring may be taken only during periods established by subsequent emergency order(s). July 1 through July 15, no open fishing period.

JUSTIFICATION: Fishing time is needed to allow herring sac roe harvests in the Alaska Peninsula and Aleutian Islands Management Areas during the sac roe season. Effort is anticipated to be light in Aleutian and South Peninsula waters and the Amak District of the North Peninsula. Effort is anticipated to be heavy in the Port Moller and Port Heiden Districts. Therefore, until harvests indicate more conservative measures are needed, seven fishing days per week can be allowed without causing stock conservation concerns in the Aleutian and South Peninsula waters and the Amak District while restricted fishing periods are needed in the Port Moller and Port Heiden Districts. The reason that portions of the area will remain closed during part of the sac roe season is as follows:

-Continued-

Unimak, Akutan, Unalaska, Umnak, and Adak Districts during June 16 through July 15:

These districts are managed on a herring food and bait fishery allocation during the food and bait season beginning July 16. The food and bait fishery is managed on the basis of 5 AAC 27.060 Bering Sea Herring Fishery Management Plan. During some years food and bait stocks (non local spawning stocks) are present in these areas by June 16. The closure from June 16 through July 15 will prevent food and bait herring being harvested prior to the food and bait season. If sac roe stocks are discovered during the June 16 through July 15 time period, appropriate locations can be opened to herring sac roe fishing by subsequent emergency order(s).

Port Moller and Port Heiden Districts during April 15 through June 30.

These districts are managed on local herring sac roe stocks. During recent years fishing effort has increased to the point where most of the allowable harvest occurs during one to three 20 minute fishing periods. These districts should remain closed until a large biomass of herring is observed, fishing vessels are on the grounds, and tender capacity sufficient to transport the harvest are on the grounds.

Port Heiden, Port Moller, and Amak District during July 1 through July 15:

These districts are managed on local herring sac roe stocks. During some years non-local, spawned-out herring are present in coastal waters by July 1. The closure from July 1 through July 15 will prevent the harvested of any non-local, spawned-out herring. If sac roe stocks are discovered during the July 1 through July 15 time period, appropriate locations can be opened to herring sac roe fishing by subsequent emergency order(s).

==========

EMERGENCY ORDER NO. 4-F-M-SP-02-93

EFFECTIVE DATE: 8:00 p.m., May 7, 1993

EXPLANATION: This emergency order opens all waters of the Port Moller District to commercial herring fishing effective 8:00 p.m. Friday May 7 through 9:00 p.m. Friday May 7, 1993.

JUSTIFICATION: Historically, herring have been observed in the Port Moller District within 2 to 4 days of the arrival of herring at Togiak. ADF&G arrived at Port Moller on May 3 and the first survey was on May 4, more than a week after a large biomass of herring were observed in Togiak.

-Continued-

In the Port Moller District a single test set this morning from a 50 ton school in the Outer Port Moller Bay Section indicated an 8% roe recovery due to partially spent herring.

Currently one company has registered as being able to buy fish. That company has a 95 ton confirmed capacity. Approximately 15 purse seine vessels are on-the-grounds, 5 of which are reported to have a confirmed market.

The observed cumulative biomass in the Port Moller District is 350 tons. The harvest guideline level for the Port Moller District is 2,000 tons. A one hour fishing period from 8:00 p.m. to 9:00 p.m. should give fishermen the opportunity to catch herring without exceeding the processing capacity of the registered company.

==========

EMERGENCY ORDER NO. 4-F-M-SP-03-93

EFFECTIVE DATE: 7:00 p.m., May 8, 1993

EXPLANATION: This emergency order opens all waters of the Port Moller District to commercial herring fishing effective 7:00 p.m. Saturday May 8 through 9:00 p.m. Saturday May 8, 1993.

JUSTIFICATION: Historically, herring have been observed in the Port Moller District within 2 to 4 days of the arrival of herring at Togiak. ADF&G arrived at Port Moller on May 3 and the first survey was on May 4, more than a week after a large biomass of herring were observed in Togiak.

In the Port Moller District during a two hour fishing period on May 7 no herring were harvested due to poor weather conditions.

Currently three companies has registered as being able to buy fish. The companies have a 200 ton confirmed processing capacity. Approximately 15 purse seine vessels and nine tenders are on-the-grounds.

The observed cumulative biomass in the Port Moller District is 450 tons. The harvest guideline level for the Port Moller District is 2,000 tons. A two hour fishing period from 7:00 p.m. to 9:00 p.m. should give fishermen the opportunity to catch herring without exceeding the processing capacity of the registered companies.

-Continued-

EMERGENCY ORDER NO. 4-F-M-SP-04-93

EFFECTIVE DATE: 10:00 a.m., May 9, 1993

EXPLANATION: This emergency order opens all waters of the Port Moller District to commercial herring fishing effective 10:00 a.m. Sunday May 9 through 12:00 a.m., Noon, Sunday May 9, 1993.

JUSTIFICATION: Historically, herring have been observed in the Port Moller District within 2 to 4 days of the arrival of herring at Togiak. ADF&G arrived at Port Moller on May 3 and the first survey was on May 4, more than a week after a large biomass of herring were observed in Togiak.

In the Port Moller District during a two hour fishing period on May 8 approximately 50 tons of herring were harvested.

Currently three companies has registered as being able to buy fish. The companies have a 200 ton confirmed processing capacity. Approximately 15 purse seine vessels and nine tenders are on-the-grounds.

The observed cumulative biomass in the Port Moller District is 650 tons. The harvest guideline level for the Port Moller District is 2,000 tons. A two hour fishing period from 10:00 a.m. to 12:00 a.m., noon, should give fishermen the opportunity to catch herring without exceeding the processing capacity of the registered companies.

==========

EMERGENCY ORDER NO. 4-F-M-SP-05-93

EFFECTIVE DATE: 12:00 a.m., Sunday, May 9, 1993

EXPLANATION: This emergency order extends the Port Moller District commercial herring fishing period an additional four hours from 12:00 a.m., noon, Sunday May 9, through 4:00 p.m., Sunday May 9, 1993.

JUSTIFICATION: Historically, herring have been observed in the Port Moller District within 2 to 4 days of the arrival of herring at Togiak. ADF&G arrived at Port Moller on May 3 and the first survey was on May 4, more than a week after a large biomass of herring were observed in Togiak.

-Continued-

In the Port Moller District during a two hour fishing period on May 9 several schools of herring were sampled by fishermen and released due to low roe percentages, most herring were unmarketable, either immature or partially spent.

Currently three companies has registered as being able to buy fish. The companies have a 200 ton confirmed processing capacity. Approximately 15 purse seine vessels and nine tenders are on-the-grounds.

The observed cumulative biomass in the Port Moller District is 725 tons. The harvest guideline level for the Port Moller District is 2,000 tons. The estimated harvest to date is 54 tons. An additional four hours of fishing time, until 4:00 p.m., should give fishermen the opportunity to catch herring without exceeding the processing capacity of the registered companies.

==========

EMERGENCY ORDER NO. 4-F-M-SP-06-93

EFFECTIVE DATE: 6:00 p.m., May 10, 1993

EXPLANATION: This emergency order opens all waters of the Port Moller District to commercial herring fishing effective 6:00 p.m., Monday May 10, through 10:00 p.m., Monday May 10, 1993.

JUSTIFICATION: Historically, herring have been observed in the Port Moller District within 2 to 4 days of the arrival of herring at Togiak. ADF&G arrived at Port Moller on May 3 and the first survey was on May 4, more than a week after a large biomass of herring were observed in Togiak.

In the Port Moller District the cumulative herring harvest is 117 tons. Several schools of herring have been sampled by fishermen and released due to low roe percentages, most herring have been unmarketable, either immature or partially spent.

Currently three companies have registered as being able to buy fish. The companies have a 200 ton confirmed processing capacity. Approximately 15 purse seine vessels and nine tenders are on-the-grounds.

The observed cumulative biomass in the Port Moller District is 725 tons. The harvest guideline level for the Port Moller District is 2,000 tons. Poor weather conditions have continued to limit the effectiveness of the fishing fleet. A four hour fishing period from 6:00 p.m., Monday May 10 until 10:00 p.m., Monday May 10 should give fishermen the opportunity to catch herring without exceeding the processing capacity of the registered companies.

-Continued-

EMERGENCY ORDER NO. 4-F-M-SP-07-93

EFFECTIVE DATE: 3:00 p.m., May 11, 1993

EXPLANATION: This emergency order opens all waters of the Port Moller District to commercial herring fishing effective 3:00 p.m., Tuesday May 11, through 7:00 p.m., Tuesday May 11, 1993.

JUSTIFICATION: In the Port Moller District the cumulative herring harvest through May 10 is 173.0 tons. Several schools of herring have been sampled by fishermen and released due to low roe percentages, most herring have been unmarketable, either immature, green, or partially spent.

Currently three companies have registered as being able to buy fish. The companies have a 700 ton confirmed processing/tendering capacity. Approximately 13 purse seine vessels and 12 tenders are on-the-grounds.

The observed cumulative biomass in the Port Moller District is 725 tons. Aerial surveys have been unsuccessful since the morning of May 9 due to poor weather. The harvest guideline level for the Port Moller District is 2,000 tons. Poor weather conditions have continued to limit the effectiveness of the fishing fleet. A four hour fishing period from 3:00 p.m., Tuesday May 11 until 7:00 p.m., Tuesday May 11 should give fishermen the opportunity to catch herring without exceeding the processing capacity of the registered companies.

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EMERGENCY ORDER NO. 4-F-M-SP-08-93

EFFECTIVE DATE: 7:00 p.m., May 11, 1993

EXPLANATION: This emergency order extends the Port Moller District commercial herring fishing period an additional three hours from 7:00 p.m., Tuesday May 11, through 10:00 p.m., Tuesday May 11, 1993.

JUSTIFICATION: In the Port Moller District during a four hour fishing period from 3:00 p.m. until 7:00 p.m. May 11 several schools of herring were sampled by fishermen and released due to low roe percentages, most herring were unmarketable, either immature or spawned-out.

During an aerial survey in the morning of May 11 an additional 1,035 tons of herring were observed, these herring were spawning in the Inner Port Moller Bay Section.

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Currently three companies has registered as being able to buy fish. The companies have a 900 ton confirmed processing capacity. Approximately 13 purse seine vessels and nine tenders are on-the-grounds.

The observed cumulative biomass in the Port Moller District is 1,760 tons. The harvest guideline level for the Port Moller District is 2,000 tons. The estimated harvest to date is 173 tons. An additional three hours of fishing time, until 10:00 p.m., should give fishermen the opportunity to catch herring without exceeding the processing capacity of the registered companies.

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EMERGENCY ORDER NO. 4-F-M-SP-09-93

EFFECTIVE DATE: 10:30 p.m., May 11

EXPLANATION: This emergency order changes the required 6 hour notice to a 1 hour notice prior to the next commercial herring fishing period in the Port Moller District.

JUSTIFICATION: All North Peninsula commercial herring fishing effort is in the Port Moller District.

During a survey of the outer coast this afternoon an estimated 17,250 tons of herring were observed. If these herring enter Port Moller or Herendeen Bays, a reduction in the required notice time before the opening of a commercial herring fishing period in the Port Moller District may make it possible to have a fishing period before these herring become mixed with other spent fish in the area.

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EMERGENCY ORDER NO. 4-F-M-SP-10-93

EFFECTIVE DATE: 11:00 a.m., May 12, 1993

EXPLANATION: This emergency order opens all waters of the Port Moller District to commercial herring fishing effective 11:00 a.m., Wednesday May 12, through 2:00 p.m., Wednesday May 12, 1993.

JUSTIFICATION: In the Port Moller District the cumulative herring harvest through May 11 is 173.0 tons. Several schools of herring have been sampled by fishermen and released due to low roe percentages, most herring have been unmarketable, either immature, green, or partially spent.

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Currently three companies have registered as being able to buy fish. The companies have a daily 500 ton confirmed processing-tendering capacity. Approximately 13 purse seine vessels and 9 tenders are on-the-grounds.

The observed cumulative biomass in the Port Moller District is 1,760 tons. The harvest guideline level for the Port Moller District is 2,000 tons. An aerial survey this morning of the Outer Port Moller Bay Section and the coast from Entrance Point to Bear River did not indicate the presence of herring. During a survey of the coast from Port Moller to Port Heiden on May 11 approximately 17,250 tons of fish were observed about 3 miles off shore from Cape Kutuzof, it is not known at this time if these fish are herring nor is their destination known. No herring have been observed in the Port Heiden District.

A three hour fishing period from 11:00 a.m., Wednesday May 12 until 2:00 p.m., Wednesday May 12 should give fishermen the opportunity to catch herring without exceeding the processing capacity of the registered companies.

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EMERGENCY ORDER NO. 4-F-M-SP-11-93

EFFECTIVE DATE: 2:00 p.m., May 12, 1993

EXPLANATION: This emergency order extends the Port Moller District commercial herring fishing period an additional four hours from 2:00 p.m., Wednesday May 12, through 6:00 p.m., Wednesday May 12, 1993.

JUSTIFICATION: In the Port Moller District during a three hour fishing period from 11:00 a.m. until 2:00 p.m. May 12 several small schools of herring were harvested (about 35 tons) in the Port Moller District. The herring schools are reported to be all mature and samples indicate a 14% roe content.

The observed cumulative biomass in the Port Moller District is 1,850 tons. The harvest guideline level for the Port Moller District is 2,000 tons. The estimated harvest to date is 208 tons. An additional four hours of fishing time, until 6:00 p.m., should give fishermen the opportunity to catch herring without exceeding the processing capacity of the registered companies.

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EMERGENCY ORDER NO. 4-F-M-SP-12-93

EFFECTIVE DATE: 11:00 a.m., May 13, 1993

EXPLANATION: This emergency order opens all waters of the Port Moller District to commercial herring fishing effective 11:00 a.m., Thursday May 13, through 3:00 p.m., Thursday May 13, 1993.

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JUSTIFICATION: In the Port Moller District the commercial herring catch on May 12 was about 132 tons, the cumulative herring harvest through May 12 is about 305 tons. Herring harvested today had roe percentages exceeding 10%.

Currently three companies are registered as being able to buy fish. The companies have a daily 500 ton confirmed processing-tendering capacity. Approximately 13 purse seine vessels and 9 tenders are on-the-grounds.

During an aerial survey this morning of the Port Moller District 140 tons of herring were observed entering the district. No herring have been observed in the Port Heiden District. The observed cumulative biomass in the Port Moller District is 1,900 tons. The harvest guideline level for the Port Moller District is 2,000 tons.

A four hour fishing period from 11:00 a.m., Thursday May 13 until 3:00 p.m., Thursday May 13 should give fishermen the opportunity to catch herring without exceeding the processing capacity of the registered companies.

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EMERGENCY ORDER NO. 4-F-M-SP-13-93

EFFECTIVE DATE: 3:00 p.m., May 13, 1993

EXPLANATION: This emergency order extends the Port Moller District commercial herring fishing period an additional four hours from 3:00 p.m., Thursday May 13, through 7:00 p.m., Thursday May 13, 1993.

JUSTIFICATION: In the Port Moller District during a four hour fishing period from 11:00 a.m. until 3:00 p.m. May 13 no herring were harvested in the Port Moller District.

The observed cumulative biomass in the Port Moller District is 1,930 tons. The harvest guideline level for the Port Moller District is 2,000 tons. The estimated harvest to date is 305 tons, a 16% exploitation rate. An additional four hours of fishing time, until 7:00 p.m., should give fishermen the opportunity to catch herring without exceeding the processing capacity of the registered companies or a 20% exploitation rate.

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EMERGENCY ORDER NO. 4-F-M-SP-14-93

EFFECTIVE DATE: 2:00 p.m., May 27, 1993

EXPLANATION: This emergency order opens all waters of the Port Moller District to commercial herring fishing effective 2:00 p.m., Thursday May 27, through 12:00 p.m., midnight, Tuesday June 15, 1993.

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JUSTIFICATION: In the Port Moller District the commercial herring catch through May 27 is an estimated 316 tons and the cumulative observed herring biomass is 2,150 tons. The exploitation rate as based on the estimated harvest and the observed biomass is about 14.8%. ADF&G believes that the observed biomass estimate of 2,150 tons is a conservative estimate because eggs on seaweed have been reported from locations within the Port Moller District where spawning herring were not documented as part of the cumulative observed biomass. No herring have been observed in the Port Heiden District although some were caught in a subsistence net.

Currently only one company is registered on-the-grounds as being able to buy and process fish. The company has a daily 50 ton processing capacity and a 100 ton total capacity. Currently, there is one fishing combine consisting of 4 purse seine vessels and 2 tenders on-the-grounds.

An additional harvest of 75 tons of herring would increase the exploitation rate to about 17.5% of the observed biomass.

Poor weather and muddy water conditions have limited aerial surveys for biomass estimates and caused generally poor fishing conditions. Fishing time is needed to allow a herring sac roe harvest in the Port Moller District.

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EMERGENCY ORDER NO. 4-F-M-SP-19-93

EFFECTIVE DATE: 3:00 p.m. June 23, 1993

EXPLANATION: This emergency order closes the Canoe Bay Section of the Pavlof District to commercial herring fishing effective 3:00 p.m., Wednesday, June 23, 1993 through 12:00 p.m., midnight, July 15, 1993.

JUSTIFICATION: The guideline harvest level established for the Canoe Bay Section sac roe fishery was 100 tons, the catch to date is 92.4 tons. Aerial surveys by the Alaska Department of Fish and Game do not warrant additional harvest of the Canoe Bay herring stock.

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ALEUTIAN ISLANDS MANAGEMENT AREA

EMERGENCY ORDER NO. 4-F-M-SP-32-93

EFFECTIVE DATE: 8:00 a.m. July 16, 1993

EXPLANATION: This emergency order allows a 1 hour commercial herring food and bait fishing period in the Akutan and Unalaska Districts of the Aleutian Islands Management Area, from 8:00 a.m., Friday, July 16, 1993 until 9:00 a.m. Friday, July 16, 1993.

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JUSTIFICATION: Fishing time is needed to allow herring food and bait harvests in the "Dutch Harbor" fishery. The allocation for this fishery is 2,193 tons of herring. Effort consists of 14 permit holders- purse seine vessels, 11 tenders representing 4 processing companies, and 2 aircraft. The initial holding capacity for both tenders and purse seiners is an estimated 2,600 tons. Herring are present in the Unalaska Bay Section; a one hour opening should allow for a harvest while not exceeding the allocation.

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EMERGENCY ORDER NO. 4-F-M-SP-33-93

EFFECTIVE DATE: 3:00 p.m. July 16, 1993

EXPLANATION: This emergency order allows a 20 minute commercial herring food and bait fishing period in the Akutan and Unalaska Districts of the Aleutian Islands Management Area from 3:00 p.m., Friday, July 16, 1993 until 3:20 p.m. Friday, July 16, 1993.

JUSTIFICATION: Fishing time is needed to allow a herring food and bait harvest in the "Dutch Harbor" fishery. The remaining allocation for this fishery is an estimated 650 tons of herring. Considering the relatively small amount remaining on the allocation the second opening will be limited to only 20 minutes. Effort is expected to be less than the original fleet of 14 purse seine vessels.

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EMERGENCY ORDER NO. 4-F-M-SP-34-93

EFFECTIVE DATE: 3:20 p.m. July 16 1993

EXPLANATION: This emergency order supersedes Emergency Order Number 4-F-M-SP-32-93 in regards to the Aleutian Islands Management Area. This emergency order closes the Aleutian Islands Management Area commercial herring food and bait fishery effective 3:20 p.m. Friday, July 16, 1993 until 12:00 p.m. midnight, February 28, 1994 (the end of the herring food and bait season).

JUSTIFICATION: On July 16, 1993, a news release was issued stating that 650 tons of herring remained to be harvested during the "Dutch Harbor" commercial food and bait fishery. The fishery was reopened an additional 20 minutes from 3:00 p.m. until 3:20 p.m. Friday, July 16, 1993.

Catch estimates on July 16 indicated that the remainder of the allocation was harvested during the second fishing period. Therefore, the "Dutch Harbor" commercial herring food and bait season will close effective 3:20 p.m., Friday, July 16, 1993.

APPENDIX B. PARTIAL LISTING OF HERRING REGULATIONS, 1993.

ARTICLE 2. - GENERAL SPECIFICATIONS.

5 AAC 27.060. BERING SEA HERRING FISHERY MANAGEMENT PLAN.

(a) The department shall follow the directives of the Bering Sea Herring Management Plan, as well as the regulations that govern the individual herring fisheries, when managing the commercial herring fisheries that take place in the Bering Sea.

(b) Unless otherwise specified in this chapter, the department shall manage the fisheries so that the exploitation rate on eastern Bering Sea herring stocks does not exceed 20 percent of the biomass of those stocks.

(c) The following thresholds are minimum biomass levels for each herring fishing district. When the department estimates, in season, that the biomass in a district is below its threshold, the department may not allow a commercial harvest of herring in that district.

District	Thresholds (s.t.)
Port Moller	1,000
Togiak	35,000
Security Cove	1,200
Goodnews Bay	1,200
Cape Avinof	500
Nelson Island	3,000
Nunivak Island	1,500
Cape Romanzof	1,500
Norton Sound	7,000

(d) The department shall manage the herring food and bait fishery that takes place in the Unimak, Akutan, and Unalaska Districts and that portion of the Umnak District east of Samalga Pass (Dutch Harbor fishery) so that it is allocated seven percent of the allowable Togiak District herring sac roe harvest determined under the provisions of the Bristol Bay Herring Management Plan (5 AAC 27.865).

(g) When the Togiak District is below its threshold, the Dutch Harbor fishery will be closed for that season.

(h) When any of the southwest Alaska herring stocks, from Security Cove to Port Clarence, is below its threshold, identified in (c) of this section, the department shall

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close the Dutch Harbor food and bait herring fishery for that season. For the purpose of determining the need for this closure, the threshold level for the Nelson Island herring stock is 2,000 short tons. If the department determines it necessary to close the Dutch Harbor food and bait herring fishery under this subsection, the department shall not reallocate the herring harvest set for the Dutch Harbor food and bait herring fishery, under 5 AAC 27.865 (b)(7), to the Togiak sac roe herring fishery.

ARTICLE 12. - STATISTICAL AREA T; BRISTOL BAY AREA

5 AAC 27.865. BRISTOL BAY HERRING MANAGEMENT PLAN.

(a) When managing the Bristol Bay commercial herring fishery, the primary objectives of the department will be to prosecute an orderly and manageable fishery, while striving for the highest level of product quality with a minimum of waste.

(b) To ensure that no gear group is totally disadvantaged, the Board of Fisheries directs the department to take the following actions given the specified circumstances.

(1) When circumstances preclude the department from adequately assessing the biomass, the fishery shall be managed for an exploitation based on the pre-season projected return.

(3) Whenever possible, openings for both gear types must begin during the hours of daylight, and special consideration will be given to afford the maximum amount of daylight.

(4) The department may allow only one gear type to operate in an area during any open period.

(7) The maximum exploitation rate for the Bristol Bay herring stock is 20 percent. Before opening the sac roe fishery, the department shall set aside approximately 1,500 short tons for the Togiak district herring spawn-on-kelp fishery, and seven percent of the remaining available harvest for the Dutch Harbor food and bait fishery.

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(8) After the spawn-on-kelp harvest and the Dutch Harbor food and bait fishery have been subtracted, the remaining harvestable surplus is allocated to the sac roe fishery. The department shall manage for a removal of 25 percent of that surplus by the gill net fleet and 75 percent by the purse seine fleet.

(9) If a manageable separation of the year classes occurs, an exploitation rate of up to 20 percent may be allowed on the younger age herring (4 years or less), and no fishery will be considered if this recruit population is less than 20,000 short tons.

(10) Late season (post-peak) sac roe openings must be based on one or more of the following criteria:

(A) A definable increase in the biomass of herring present on the fishing grounds;

(B) A major shift in the age composition of the herring in a definable biomass that is large enough to allow a harvest; and

(C) a major improvement in the roe maturity of fish sampled over a broad area, indicating the arrival of a quantity of new herring.

ARTICLE 10. - STATISTICAL AREA M; ALASKA PENINSULA-ALEUTIAN ISLANDS AREA.

5 AAC 27.600. DESCRIPTION OF AREA. Statistical area M includes all waters bound on the east by a line extending southeast (135°) from the southernmost tip of Kupreanof Point, on the west by the International Date Line, and on the north by a line extending west from the westernmost tip of Cape Menshikof.

5 AAC 27.605. DESCRIPTION OF DISTRICTS AND SECTIONS.

(a) Sand Point District: all waters on the south (Pacific) side of the Alaska Peninsula west of a line extending from 135° from Kupreanof Point (55°34'N. lat, 159°36' W. long.), and east of 160°59' W. long. (longitude of McGinty Point). Sections are as follows:

(1) Stepovak Bay Section: all waters of the Sand Point District located west of a line extending 135° from Kupreanof Point 55°34' N. lat., 159°36' W. long., north of a line from approximately two nautical miles south of 135° from Kupreanof Point,

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west to 55°32'12" N. lat., 160°02'36" W. long., (approximately one nautical mile north of Karpa Island), and west to 55°26' N. lat, 160°31'30" W. long., (approximately two nautical miles south of the longitude of Swedania Point 160°31'30" W. long.).

(2) Swedania Point-Balboa Bay Section: all waters of the Sand Point District located between 160°31'30" W. long. and 160°49' W. long., and north of 55°26' N. lat.

(3) Point Aliaksin-Beaver Bay Section: all waters of the Sand Point District located between 160°49' W. long. and 161°59' W. long., and north of 55°26' N. lat.

(4) General section: all other waters of the Sand Point District.

(b) Pavlof District: all waters on the south (Pacific) side of the Alaska Peninsula between 160°59' W. long. and a line extending 150° from 55°05'54" N. lat., 161°59' W. long. through Inner and Outer Iliasik Islands, including Bear and Volcano Bays.

(1) Canoe Bay Section: all waters of Canoe Bay east of 161°21'45" W. long.

(2) Pavlof Bay Section: all waters of Pavlof Bay north of 55°21'42" N. lat. (latitude of Cape Tolstoi), excluding the Canoe Bay and Seal Cape-Wosnesenski Sections.

(3) Seal Cape-Wosnesenski Section: all waters of the Pavlof District located between 160°59' W. long. and 161°30" W. long. (longitude of Cape Tolstoi).

(4) General section: all other waters of the Pavlof District.

(c) King Cove District: all waters of the south (Pacific) side of the Alaska Peninsula between a line extending 150° from 55°05'54" N. lat., 161°59' W. long. through Inner and Outer Iliasik Islands and 163°30' W. long., including waters of Isanotski Strait south of a line from Nichols Point to the False Pass dock.

(1) Belkofski Section: all waters of the King Cove District east of 162°15'W. long. (longitude of Bold Cape).

(2) Deer Passage Section: all waters of the King Cove District between 162°15' W. long. (longitude of Bold Cape) and 162°25' W. long (longitude of Vodapoini Point), and north of 54°55' N. lat., excluding all waters of Lenard Harbor.

(3) Cold Bay Section: all waters of the King Cove District bounded by a line from Thin Point to Vodapoini Point.

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(4) General section: all other waters of the King Cove District.

(d) Unimak District: all waters on the southside of Unimak Island between 163°30' W. long. and the longitude of Scotch Cap Light.

(e) Akutan District: all waters extending west of Unimak Island to and including Akutan Pass.

(f) Unalaska District: all waters west of Akutan Pass to and including Umnak Pass.

(1) Unalaska Bay Section: all waters of the Unalaska Bay District enclosed by a line from Priest Rock at 54°00'24" N. lat., 166°22'42" W. long. to Cape Cheerful at 54°00'33" N. lat., 166°37'45" W. long.

(2) General Section: all waters of the Unalaska District not included in the Unalaska Bay Section.

(g) Umnak District: all waters west of Umnak Pass to and including Atka Pass.

(h) Adak District: all waters west of Atka Pass to the terminus of the Aleutian Islands.

(i) Amak District: all Bering Sea waters south and west of Cape Lieskof (55°47'N. lat., 162°04' W. long.) to the longitude of Cape Sarichef Light, including all waters of Bechevin Bay and Isanotski Strait north of a line from the False Pass Cannery dock to the tip of Nichols Point.

(j) Port Moller District: all Bering Sea waters between the latitude of Cape Lieskof and the latitude of Cape Seniavin (56°24' N. lat.).

(1) Western Section: all waters of the Port Moller District west of the longitude of Wolf Point on Walrus Island, excluding the waters of Herendeen Bay and Deer Island - Mud Bay Sections.

(2) Deer Island - Mud Bay Section: all waters of the Port Moller District bounded by a line from the northernmost tip of Point Edward to the southernmost tip of Wolf Point on Walrus Island to Point Divide (55°53'10" N. lat., 160°47' W. long.) to the northernmost tip of Black Point.

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(3) Herendeen Bay Section: all waters of Herendeen Bay south of a line from the northernmost tip of Black Point to Point Divide (55°53'10" N. lat., 160°47' W. long.).

(4) Inner Port Moller Section: all waters of Port Moller Bay enclosed by a line from Point Divide (55°53'10" N. lat., 160°47' W. long), to Harbor Point (55°55' N. lat.,160°34'30" W. long.).

(5) Outer Port Moller Bay Section: all waters of the Port Moller District south and east of a line from Point Divide (55°53'10" N. lat., 160°47'W. long.) to the southernmost tip of Wolf Point on Walrus Island to the southernmost tip of Entrance Point (55°59'30" N. lat., 160°34' W. long.).

(6) Bear River Section: all Bering Sea waters between the longitude of Wolf Point on Walrus Island and Cape Seniavin Light, excluding the waters of the Herendeen Bay, Deer Island - Mud Bay, Outer Port Moller Bay, and Inner Port Moller Bay Sections.

(k) Port Heiden District: all waters between the latitude of Cape Seniavin (56°24' N. lat.) and the latitude of Cape Menshikof (57°31'20" N. lat.).

5 AAC 27.610. FISHING SEASONS AND PERIODS.

(a) In the Sand Point, Pavlof, King Cove, Amak, Port Moller, and Port Heiden Districts, herring may be taken from April 15 through July 15 (sac roe season).

(d) Herring may be taken only during periods established by emergency order.

(e) In the Unimak, Akutan, Unalaska, Umnak, and Adak Districts, herring may be taken from April 15 through July 15 (sac roe season) and from July 16 through February 28 (food and bait season).

5 AAC 27.630. GEAR. Herring may be taken only by purse seines and gill nets.

5 AAC 27.631. GILL NET SPECIFICATIONS AND OPERATIONS.

(a) During the herring sac roe season, the aggregate length of herring gill nets in use by a herring CFEC permit holder may not exceed 150 fathoms.

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(b) The interim-use or entry permit holder must be physically present while the gill net is being fished.

(c) Each drift gill net in operation must have a buoy at one end and the opposite end must be attached to the fishing vessel. Each set gill net in operation must be anchored and buoyed at both ends. Each buoy must be plainly and legibly marked with the permanent vessel license plate number (ADF&G number) of the vessel operating the gear. The buoy may bear only a single number and this number must be that of the vessel used in operating the gear. The numbers must be painted on the top one-third of the buoy in numerals at least four inches in height, one-half inch in width and in a color contrasting to that of the buoy. The buoy markings must be visible on the buoy above the water surface.

5 AAC 27.632. SEINE SPECIFICATIONS AND OPERATIONS. During the herring sac roe season, no purse seine may be more than 1,000 meshes in depth and more than 100 fathoms in length. During the herring food and bait season, no purse seine may be more than 250 fathoms in length.

5 AAC 27.650. WATERS CLOSED TO HERRING FISHING.

(a) Herring may not be taken from June 25 through September 30 in any waters closed to salmon fishing.

5 AAC 27.662. BUYER AND TENDER REPORTING REQUIREMENTS. In addition to the requirements of 5 AAC 39.130(f) each tender operator and each buyer or his agents shall report in person to and register with a local representative of the department upon arrival in the statistical area before commencing operations and before changing location of the operation. Each buyer shall:

(1) identify all vessels to be employed in transporting or processing herring and shall register such vessels with a local representative of the department located in the statistical area before transporting or processing of herring;

(2) make daily reports of all herring purchased from fishermen, and other processing records as specified by a local representative of the department; and

(3) submit fish tickets before departure from the area and no later than 10 days after termination of buying operations in the area, or as otherwise specified by a local representative of the department.

Appendix C.1. Port Moller tides, 1993.

Date		---HIGH TIDE--- Time	Feet	---HIGH TIDE--- Time	Feet	---LOW TIDE--- Time	Feet	----LOW TIDE--- Time	Feet
May	1	6:45 AM	11.3	7:17 PM	9.6	0:02 AM	1.7	12:55 PM	1.6
	2	7:33 AM	11.1	8:22 PM	10.3	1:02 AM	2.3	1:44 PM	0.1
	3	8:23 AM	10.8	9:26 PM	11.1	2:04 AM	3.1	2:35 PM	-1.2
	4	9:15 AM	10.5	10:29 PM	11.7	3:07 AM	3.7	3:27 PM	-2.4
	5	10:09 AM	10.1	11:29 PM	12.3	4:11 AM	4.2	4:20 PM	-3.2
	6	11:05 AM	9.7	:		5:13 AM	4.4	5:14 PM	-3.5
	7	0:28 AM	12.7	12:03 PM	9.4	6:14 AM	4.5	6:08 PM	-3.5
	8	1:25 AM	12.9	1:01 PM	9.1	7:13 AM	4.4	7:02 PM	-3.0
	9	2:20 AM	12.8	2:00 PM	8.8	8:10 AM	4.2	7:56 PM	-2.2
	10	3:13 AM	12.6	2:59 PM	8.6	9:05 AM	4.0	8:49 PM	-1.1
	11	4:03 AM	12.3	3:58 PM	8.4	9:58 AM	3.7	9:42 PM	0.0
	12	4:51 AM	11.8	4:57 PM	8.4	10:48 AM	3.4	10:35 PM	1.4
	13	5:37 AM	11.3	5:55 PM	8.4	11:37 AM	3.0	11:28 PM	2.7
	14	6:20 AM	10.8	6:53 PM	8.5	:		12:23 PM	2.7
	15	7:01 AM	10.2	7:49 PM	8.7	0:20 AM	3.9	1:07 PM	2.2
	16	7:41 AM	9.6	8:43 PM	9.0	1:13 AM	5.0	1:49 PM	1.8
	17	8:20 AM	9.1	9:35 PM	9.4	2:07 AM	6.0	2:30 PM	1.4
	18	8:58 AM	8.6	10:24 PM	9.8	3:01 AM	6.7	3:11 PM	1.1
	19	9:37 AM	8.2	11:10 PM	10.2	3:54 AM	7.2	3:52 PM	0.8
	20	10:16 AM	7.9	11:54 PM	10.6	4:47 AM	7.4	4:32 PM	0.6
	21	10:57 AM	7.6	:		5:37 AM	7.5	5:12 PM	0.4
	22	0:37 AM	10.9	:		:		5:54 PM	0.2
	23	1:18 AM	11.2	1:23 PM	7.4	7:13 AM	7.2	6:36 PM	0.1
	24	1:59 AM	11.4	1:12 PM	7.4	7:59 AM	6.8	7:20 PM	0.1
	25	2:40 AM	11.6	2:04 PM	7.5	8:43 AM	6.1	8:07 PM	0.2
	26	3:21 AM	11.8	3:02 PM	7.8	9:27 AM	5.1	8:57 PM	0.6
	27	4:03 AM	11.8	4:03 PM	8.2	10:12 AM	3.9	9:51 PM	1.2
	28	4:46 AM	11.8	5:06 PM	8.8	10:58 AM	2.4	10:48 PM	2.1
	29	5:30 AM	11.6	6:11 PM	9.4	11:45 AM	0.8	11:48 PM	3.0
	30	6:17 AM	11.3	7:05 PM	10.1	:		12:34 PM	-0.7
	31	7:05 AM	11.0	8:20 PM	10.9	:50 AM	3.9	1:24 PM	-2.1
June	1	7:56 AM	10.6	9 :22 PM	11.5	1 :53 AM	4.7	2 :15 PM	-3.1
	2	8 :50 AM	10.1	10 :23 PM	12.1	2 :56 AM	5.3	3 :07 PM	-3.7
	3	9 :45 AM	9.7	11 :21 PM	12.4	3 :59 AM	5.6	4 :00 PM	-3.9
	4	10 :43 AM	9.3	:		5 :00 AM	5.6	4 :54 PM	-3.7
	5	0 :17 AM	12.6	11 :41 AM	8.9	6 :00 AM	5.5	5 :47 PM	-3.1
	6	1 :11 AM	12.6	12 :39 PM	8.5	6 :57 AM	5.2	6 :39 PM	-2.2
	7	2 :01 AM	12.5	1 :38 PM	8.3	7 :52 AM	4.8	7 :31 PM	-1.1
	8	2 :50 AM	12.2	2 :37 PM	8.1	8 :44 AM	4.4	8 :22 PM	0.1
	9	3 :35 AM	11.8	3 :35 PM	8.0	9 :33 AM	3.9	9 :12 PM	1.5
	10	4 :17 AM	11.4	4 :32 PM	8.0	10 :20 AM	3.4	10 :03 PM	2.8
	11	4 :57 AM	10.9	5 :29 PM	8.2	11 :04 AM	2.8	10 :54 PM	4.1
	12	5 :36 AM	10.4	6 :24 PM	8.4	11 :46 AM	2.2	11 :45 PM	5.3
	13	6 :13 AM	9.9	7 :18 PM	8.8	:		12 :27 PM	1.6
	14	6 :50 AM	9.4	8 :10 PM	9.2	0 :38 AM	6.3	1 :08 PM	1.1
	15	7 :27 AM	9.0	9 :00 PM	9.6	1 :32 AM	7.0	1 :49 PM	0.6
	16	8 :05 AM	8.6	9 :48 PM	10.1	2 :25 AM	7.6	2 :30 PM	0.1
	17	8 :45 AM	8.3	10 :35 PM	10.5	3 :18 AM	7.9	3 :11 PM	-0.1
	18	9 :27 AM	8.0	11 :20 PM	10.9	4 :11 AM	8.1	3 :53 PM	-0.4
	19	10 :11 AM	7.8	:		5 :02 AM	8.0	4 :36 PM	-0.6
	20	0 :03 AM	11.2	10 :59 AM	7.7	5 :51 AM	7.7	5 :20 PM	-0.8
	21	0 :45 AM	11.5	11 :51 AM	7.8	6 :39 AM	7.1	6 :06 PM	-0.7
	22	1 :27 AM	11.7	12 :48 PM	7.9	7 :25 AM	6.3	6 :55 PM	-0.4
	23	2 :09 AM	11.9	1 :48 PM	8.1	8 :12 AM	5.1	7 :46 PM	0.0
	24	2 :51 AM	11.9	2 :52 PM	8.5	8 :58 AM	3.6	8 :40 PM	0.8
	25	3 :35 AM	11.9	3 :56 PM	9.0	9 :45 AM	2.0	9 :37 PM	1.8
	26	4 :19 AM	11.7	5 :02 PM	9.6	10 :33 AM	0.3	10 :36 PM	2.9

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Appendix C.1. (page 2 of 3)

Date		---HIGH TIDE--- Time	Feet	---HIGH TIDE--- Time	Feet	---LOW TIDE--- Time	Feet	----LOW TIDE--- Time	Feet
June	27	5 :06 AM	11.5	6 :07 PM	10.2	11 :22 AM	-1.1	11 :38 PM	4.0
	28	5 :54 AM	11.1	7 :11 PM	10.8	:		12 :13 PM	-2.4
	29	6 :45 AM	10.7	8 :13 PM	11.4	0 :40 AM	4.9	1 :05 PM	-3.4
	30	7 :38 AM	10.3	9 :14 PM	11.8	1 :42 AM	5.5	1 :58 PM	-3.8
July	1	8 :33 AM	9.8	10 :12 PM	12.1	2 :44 AM	5.9	2 :51 PM	-3.9
	2	9 :29 AM	9.4	11 :09 PM	12.2	3 :45 AM	6.1	3 :44 PM	-3.5
	3	10 :27 AM	9.0	:		4 :45 AM	6.1	4 :36 PM	-2.9
	4	0 :02 AM	12.2	11 :24 AM	8.6	5 :42 AM	5.8	5 :28 PM	-1.9
	5	0 :52 AM	12.0	12 :22 PM	8.3	6 :37 AM	5.5	6 :19 PM	-0.8
	6	1 :39 AM	11.8	1 :19 PM	8.0	7 :28 AM	5.1	7 :08 PM	0.3
	7	2 :23 AM	11.4	2 :15 PM	7.9	8 :17 AM	4.6	7 :57 PM	1.6
	8	3 :03 AM	11.0	3 :11 PM	7.9	9 :02 AM	4.1	8 :45 PM	2.9
	9	3 :41 AM	10.6	4 :05 PM	8.1	9 :44 AM	3.5	9 :34 PM	4.1
	10	4 :17 AM	10.2	4 :58 PM	8.3	10 :25 AM	2.8	10 :23 PM	5.1
	11	4 :52 AM	9.8	5 :50 PM	8.6	11 :05 AM	2.1	11 :13 PM	6.1
	12	5 :27 AM	9.4	6 :40 PM	9.0	11 :45 AM	1.5	:	
	13	6 :03 AM	9.1	7 :30 PM	9.4	0 :04 AM	6.8	12 :26 PM	0.9
	14	6 :40 AM	8.8	8 :19 PM	9.8	0 :56 AM	7.4	1 :07 PM	0.3
	15	7 :20 AM	8.6	9 :07 PM	10.2	1 :48 AM	7.8	1 :50 PM	-0.1
	16	8 :02 AM	8.5	9 :53 PM	10.6	2 :39 AM	8.0	2 :33 PM	-0.6
	17	8 :48 AM	8.4	10 :39 PM	10.9	3 :30 AM	8.0	3 :17 PM	-0.9
	18	9 :38 AM	8.3	11 :24 PM	11.2	4 :21 AM	7.7	4 :04 PM	-1.1
	19	10 :33 AM	8.4	:		5 :10 AM	7.1	4 :52 PM	-1.1
	20	0 :08 AM	11.5	11 :32 AM	8.5	5 :59 AM	6.1	5 :43 PM	-0.8
	21	0 :52 AM	11.7	12 :34 PM	8.8	6 :48 AM	4.8	6 :36 PM	-0.3
	22	1 :36 AM	11.7	1 :38 PM	9.1	7 :36 AM	3.3	7 :31 PM	0.4
	23	2 :21 AM	11.7	2 :43 PM	9.6	8 :25 AM	1.6	8 :28 PM	1.4
	24	3 :07 AM	11.6	3 :48 PM	10.1	9 :16 AM	0.0	9 :27 PM	2.4
	25	3 :55 AM	11.4	4 :53 PM	10.6	10 :07 AM	-1.4	10 :28 PM	3.4
	26	4 :45 AM	11.1	5 :56 PM	11.1	10 :59 AM	-2.5	11 :28 PM	4.3
	27	5 :36 AM	10.8	6 :59 PM	11.4	11 :52 AM	-3.3	:	
	28	6 :30 AM	10.4	8 :00 PM	11.7	0 :29 AM	5.0	12 :46 PM	-3.6
	29	7 :26 AM	10.0	8 :59 PM	11.8	1 :30 AM	5.4	1 :41 PM	-3.4
	30	8 :22 AM	9.6	9 :55 PM	11.7	2 :30 AM	5.7	2 :35 PM	-3.0
	31	9 :20 AM	9.2	10 :50 PM	11.6	3 :28 AM	5.8	3 :28 PM	-2.2
Aug.	1	10 :17 AM	8.8	11 :40 PM	11.4	4 :25 AM	5.7	4 :20 PM	-1.2
	2	11 :14 AM	8.5	:		5 :19 AM	5.5	5 :11 PM	-0.1
	3	0 :28 AM	11.1	12 :10 PM	8.3	6 :10 AM	5.2	6 :00 PM	0.9
	4	1 :11 AM	10.8	1 :04 PM	8.2	6 :58 AM	4.9	6 :48 PM	2.1
	5	1 :51 AM	10.4	1 :56 PM	8.2	7 :42 AM	4.4	7 :36 PM	3.2
	6	2 :27 AM	10.0	2 :47 PM	8.3	8 :23 AM	4.0	8 :23 PM	4.2
	7	3 :02 AM	9.6	3 :37 PM	8.5	9 :03 AM	3.4	9 :10 PM	5.1
	8	3 :36 AM	9.3	4 :25 PM	8.8	9 :42 AM	2.8	9 :58 PM	5.8
	9	4 :10 AM	9.1	5 :12 PM	9.1	10 :22 AM	2.2	10 :46 PM	6.4
	10	4 :45 AM	8.9	5 :59 PM	9.4	11 :02 AM	1.6	11 :34 PM	6.9
	11	5 :21 AM	8.7	6 :47 PM	9.7	11 :43 AM	1.0	:	
	12	6 :01 AM	8.6	7 :34 PM	10.0	0 :23 AM	7.3	12 :26 PM	0.4
	13	6 :43 AM	8.6	8 :21 PM	10.3	1 :12 AM	7.4	1 :10 PM	-0.1
	14	7 :30 AM	8.6	9 :08 PM	10.6	2 :01 AM	7.4	1 :56 PM	-0.4
	15	8 :21 AM	8.7	9 :54 PM	10.9	2 :50 AM	7.1	2 :44 PM	-0.6
	16	9 :17 AM	8.9	10 :40 PM	11.1	3 :40 AM	6.4	3 :35 PM	-0.7
	17	10 :17 AM	9.2	11 :26 PM	11.2	4 :29 AM	5.4	4 :28 PM	-0.4
	18	11 :20 AM	9.5	:		5 :19 AM	4.1	5 :24 PM	-0.1
	19	0 :13 AM	11.3	12 :25 PM	10.0	6 :10 AM	2.6	6 :21 PM	0.6
	20	1 :00 AM	11.2	1 :29 PM	10.5	7 :01 AM	1.0	7 :19 PM	1.4
	21	1 :49 AM	11.2	2 :34 PM	11.0	7 :53 AM	-0.5	8 :19 PM	2.2

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Date		---HIGH TIDE--- Time	Feet	---HIGH TIDE--- Time	Feet	---LOW TIDE--- Time	Feet	----LOW TIDE--- Time	Feet
Aug.	22	2 :40 AM	11.0	3 :37 PM	11.4	8 :46 AM	-1.7	9 :18 PM	2.9
	23	3 :32 AM	10.8	4 :39 PM	11.7	9 :40 AM	-2.6	10 :18 PM	3.5
	24	4 :26 AM	10.6	5 :40 PM	11.9	10 :35 AM	-3.1	11 :17 PM	4.0
	25	5 :22 AM	10.3	6 :40 PM	11.9	11 :31 AM	-3.1		
	26	6 :19 AM	10.0	7 :38 PM	11.8	0 :16 AM	4.4	12 :26 PM	-2.8
	27	7 :17 AM	9.7	8 :35 PM	11.6	1 :14 AM	4.7	1 :22 PM	-2.1
	28	8 :15 AM	9.4	9 :30 PM	11.3	2 :11 AM	4.8	3 :10 PM	-0.2
	29	9 :13 AM	9.1	10 :21 PM	10.9	3 :07 AM	4.8	3 :10 PM	-0.2
	30	10 :11 AM	8.9	11 :09 PM	10.5	4 :00 AM	4.7	4 :02 PM	0.8
	31	11 :06 AM	8.7	11 :53 PM	10.1	4 :50 AM	4.6	4 :53 PM	1.9
Sept.	1	:		12 :00 PM	8.7	5 :37 AM	4.4	5 :43 PM	3.0
	2	0 :34 AM	9.7	12 :51 PM	8.7	6 :20 AM	4.1	6 :31 PM	3.9
	3	1 :11 AM	9.2	1 :39 PM	8.8	7 :01 AM	3.8	7 :18 PM	4.7
	4	1 :46 AM	8.9	2 :24 PM	9.0	7 :40 AM	3.5	8 :05 PM	5.3
	5	2 :20 AM	8.6	3 :09 PM	9.2	8 :19 AM	3.1	8 :51 PM	5.1
	6	2 :54 AM	8.4	3 :52 PM	9.5	8 :58 AM	2.6	9 :37 PM	6.3
	7	3 :29 AM	8.2	4 :36 PM	9.7	9 :37 AM	2.2	10 :22 PM	6.5
	8	4 :06 AM	8.2	5 :20 PM	10.0	10 :18 AM	1.7	11 :07 PM	6.7
	9	4 :45 AM	8.2	6 :04 PM	10.2	11 :01 AM	1.2	11 :53 PM	6.7
	10	5 :28 AM	8.3	6 :50 PM	10.4	11 :45 AM	0.8	:	
	11	6 :15 AM	8.5	7 :35 PM	10.6	0 :40 AM	6.5	12 :32 PM	0.5
	12	7 :08 AM	8.8	8 :21 PM	10.7	1 :26 AM	6.1	1 :22 PM	0.3
	13	8 :05 AM	9.1	9 :08 PM	10.8	2 :14 AM	5.3	2 :15 PM	0.3
	14	9 :06 AM	9.5	9 :56 PM	10.8	3 :03 AM	4.2	3 :11 PM	0.6
	15	10 :09 AM	10.0	10 :44 PM	10.8	3 :52 AM	2.8	4 :09 PM	1.0
	16	11 :13 AM	10.6	11 :34 PM	10.7	4 :43 AM	1.3	5 :08 PM	1.5
	17	:		12 :17 PM	11.2	5 :35 AM	-0.1	6 :08 PM	2.0
	18	0 :26 AM	10.6	1 :20 PM	11.8	6 :28 AM	-1.4	7 :08 PM	2.5
	19	1 :19 AM	10.4	2 :21 PM	12.2	7 :23 AM	-2.4	8 :08 PM	2.9
	20	2 :14 AM	10.3	3 :22 PM	12.4	8 :18 AM	-3.0	9 :07 PM	3.2
	21	3 :11 AM	10.1	4 :21 PM	12.5	9 :14 AM	-3.1	10 :06 AM	3.4
	22	4 :09 AM	9.9	5 :19 PM	12.4	10 :10 AM	-2.9	11 :03 PM	3.5
	23	5 :08 AM	9.8	6 :16 PM	12.1	11 :07 AM	-2.2	:	
	24	6 :07 AM	9.6	7 :11 PM	11.7	0 :01 AM	3.6	12 :03 PM	-1.3
	25	7 :07 AM	9.4	8 :04 PM	11.3	0 :55 AM	3.6	12 :59 PM	-0.2
	26	8 :07 AM	9.2	8 :55 PM	10.8	1 :49 AM	3.5	1 :54 PM	0.8
	27	9 :06 AM	9.1	9 :42 PM	10.2	2 :40 AM	3.5	2 :49 PM	2.0
	28	10 :03 AM	9.1	10 :27 PM	9.7	3 :29 AM	3.4	3 :42 PM	3.1
	29	10 :57 AM	9.1	11 :09 PM	9.2	4 :15 AM	3.2	4 :34 PM	4.1
	30	11 :47 AM	9.3	11 :48 PM	8.7	4 :58 AM	3.1	5 :25 PM	4.9

Tidal Station Location: Port Moller (Entrance Point)
55 59'N., 160 34'W.

Port Heiden 56 56'N., 158 44'W.

Note: To correct the time and height for high and low tides for Port Heiden add time and feet from the Port Moller tide table.

Port Heiden:	Time		Feet	
	High	Low	High	Low
	1:30	2:04	0.6	0.8

Appendix C.2. Kodiak tides, 1993.

Date		---HIGH TIDE--- Time	Feet	---HIGH TIDE--- Time	Feet	---LOW TIDE--- Time	Feet	----LOW TIDE--- Time	Feet
May	1	10 :20 AM	6.9	11 :09 PM	7.9	4 :16 AM	2.0	4 :35 PM	0.8
	2	11 :35 AM	7.1	11 :57 PM	8.7	5 :26 AM	0.9	5 :32 PM	0.8
	3	:		12 :40 PM	7.4	6 :26 AM	-0.1	6 :24 PM	0.9
	4	0 :43 AM	9.5	1 :37 PM	7.7	7 :18 AM	-1.2	7 :13 PM	0.9
	5	1 :28 AM	10.0	2 :29 PM	7.8	8 :07 AM	-1.9	7 :59 PM	1.1
	6	2 :11 AM	10.4	3 :18 PM	7.8	8 :54 AM	-2.3	8 :44 PM	1.2
	7	2 :54 AM	10.4	4 :06 PM	7.7	9 :40 AM	-2.4	9 :28 PM	1.5
	8	3 :38 AM	10.1	4 :54 PM	7.4	10 :26 AM	-2.1	10 :13 PM	1.9
	9	4 :21 AM	9.6	5 :43 PM	7.1	11 :11 AM	-1.5	11 :00 PM	2.3
	10	5 :06 AM	8.9	6 :34 PM	6.7	11 :57 AM	-0.8	11 :50 PM	2.7
	11	5 :54 AM	8.1	7 :28 PM	6.5	:		12 :45 PM	-0.1
	12	6 :48 AM	7.2	8 :25 PM	6.4	0 :48 AM	3.0	1 :36 PM	0.5
	13	7 :51 AM	6.5	9 :23 PM	6.5	1 :58 AM	3.1	2 :30 PM	1.1
	14	9 :06 AM	6.0	10 :15 PM	6.8	3 :16 AM	3.0	3 :25 PM	1.6
	15	10 :23 AM	5.8	11 :01 PM	7.2	4 :29 AM	2.5	4 :19 PM	1.9
	16	11 :31 AM	5.8	11 :41 PM	7.6	5 :29 AM	1.8	5 :09 PM	2.1
	17	:		12 :27 PM	6.0	6 :18 AM	1.1	5 :54 PM	2.1
	18	0 :18 AM	8.1	1 :15 PM	6.3	7 :00 AM	0.4	6 :36 PM	2.2
	19	0 :54 AM	8.5	1 :58 PM	6.5	7 :38 AM	-0.2	7 :15 PM	2.2
	20	1 :28 AM	8.9	2 :38 PM	6.7	8 :15 AM	-0.7	7 :52 PM	2.2
	21	2 :03 AM	9.1	3 :17 PM	6.8	8 :52 AM	-1.1	8 :30 PM	2.2
	22	2 :38 AM	9.3	3 :56 PM	6.9	9 :28 AM	-1.4	9 :08 PM	2.3
	23	3 :14 AM	9.3	4 :36 PM	6.9	10 :06 AM	-1.5	9 :47 PM	2.3
	24	3 :52 AM	9.2	5 :18 PM	6.9	10 :46 AM	-1.4	10 :31 PM	2.4
	25	4 :34 AM	9.0	6 :02 PM	6.9	11 :28 AM	-1.1	11 :20 PM	2.5
	26	5 :20 AM	8.5	6 :50 PM	7.0	:		12 :12 PM	-0.8
	27	6 :14 AM	7.9	7 :42 PM	7.2	0 :18 AM	2.5	1 :00 PM	-0.2
	28	7 :19 AM	7.2	8 :38 PM	7.5	1 :26 AM	2.4	1 :53 PM	0.2
	29	8 :37 AM	6.5	9 :34 PM	8.0	2 :43 AM	2.0	2 :50 PM	0.8
	30	10 :02 AM	6.2	10 :30 PM	8.5	4 :01 AM	1.3	3 :51 PM	1.3
	31	11 :22 AM	6.2	11 :23 PM	9.1	5 :12 AM	0.4	4 :52 PM	1.6
June	1	:		12 :32 PM	6.5	6 :14 AM	-0.4	5 :50 PM	1.8
	2	0 :15 AM	9.6	1 :31 PM	6.8	7 :08 AM	-1.3	6 :45 PM	1.9
	3	1 :04 AM	10.0	2 :24 PM	7.1	7 :58 AM	-1.8	7 :37 PM	1.9
	4	1 :51 AM	10.2	3 :12 PM	7.2	8 :44 AM	-2.1	8 :25 PM	1.9
	5	2 :36 AM	10.1	3 :57 PM	7.3	9 :28 AM	-2.2	9 :12 PM	2.0
	6	3 :20 AM	9.8	4 :41 PM	7.3	10 :10 AM	-1.9	9 :58 PM	2.1
	7	4 :03 AM	9.4	5 :24 PM	7.2	10 :51 AM	-1.5	10 :43 PM	2.3
	8	4 :45 AM	8.7	6 :06 PM	7.1	11 :31 AM	-0.9	11 :31 PM	2.5
	9	5 :28 AM	8.0	6 :49 PM	7.0	:		12 :10 PM	-0.3
	10	6 :14 AM	7.2	7 :33 PM	7.0	0 :22 AM	2.7	12 :49 PM	0.3
	11	7 :06 AM	6.4	8 :19 PM	7.0	1 :20 AM	2.7	1 :30 PM	1.0
	12	8 :09 AM	5.7	9 :06 PM	7.2	2 :25 AM	2.6	2 :14 PM	1.6
	13	9 :24 AM	5.2	9 :55 PM	7.4	3 :36 AM	2.3	3 :03 PM	2.1
	14	10 :44 AM	5.1	10 :43 PM	7.7	4 :43 AM	1.8	3 :57 PM	2.5
	15	11 :54 AM	5.2	11 :29 PM	8.1	5 :41 AM	1.1	4 :53 PM	2.7
	16	:		12 :51 PM	5.5	6 :30 AM	0.4	5 :46 PM	2.8
	17	0 :13 AM	8.5	1 :39 PM	5.9	7 :14 AM	-0.2	6 :36 PM	2.7
	18	0 :55 AM	8.9	2 :22 PM	6.3	7 :54 AM	-0.8	7 :22 PM	2.6
	19	1 :36 AM	9.3	3 :02 PM	6.7	8 :33 AM	-1.3	8 :07 PM	2.4
	20	2 :17 AM	9.6	3 :41 PM	7.0	9 :12 AM	-1.7	8 :51 PM	2.2
	21	2 :58 AM	9.7	4 :20 PM	7.2	9 :50 AM	-1.9	9 :36 PM	2.0
	22	3 :40 AM	9.6	4 :59 PM	7.5	10 :29 AM	-1.8	10 :23 PM	1.9
	23	4 :25 AM	9.2	5 :40 PM	7.7	11 :08 AM	-1.5	11 :15 PM	1.8
	24	5 :13 AM	8.6	6 :23 PM	7.9	11 :50 AM	-1.0	:	
	25	6 :07 AM	7.8	7 :10 PM	8.1	0 :11 AM	1.6	12 :33 PM	-0.3
	26	7 :08 AM	6.9	8 :01 PM	8.3	1 :15 AM	1.5	1 :20 PM	0.4
	27	8 :23 AM	6.1	8 :57 PM	8.5	2 :27 AM	1.3	2 :12 PM	1.2

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Appendix C.2. (page 2 of 4)

Date		---HIGH TIDE--- Time	Feet	---HIGH TIDE--- Time	Feet	---LOW TIDE--- Time	Feet	----LOW TIDE--- Time	Feet
June	28	9 :48 AM	5.6	9 :57 PM	8.8	3 :44 AM	0.8	3 :12 PM	1.9
	29	11 :14 AM	5.6	10 :57 PM	9.1	4 :58 AM	0.2	4 :19 PM	2.3
	30	12 :28 AM	5.8	11 :55 PM	9.4	6 :04 AM	-0.4	5 :26 PM	2.5
July	1	:		1 :28 PM	6.2	7 :01 AM	-1.0	6 :29 PM	2.5
	2	0 :49 AM	9.6	2 :18 PM	6.7	7 :50 AM	-1.5	7 :24 PM	2.3
	3	1 :38 AM	9.7	3 :02 PM	7.0	8 :34 AM	-1.7	8 :14 PM	2.1
	4	2 :23 AM	9.7	3 :42 PM	7.3	9 :14 AM	-1.8	8 :59 PM	2.0
	5	3 :05 AM	9.5	4 :19 PM	7.4	9 :51 AM	-1.6	9 :42 PM	1.9
	6	3 :45 AM	9.1	4 :55 PM	7.5	10 :26 AM	-1.3	10 :24 PM	1.9
	7	4 :24 AM	8.6	5 :29 PM	7.5	10 :59 AM	-0.8	11 :06 PM	1.9
	8	5 :03 AM	7.9	6 :04 PM	7.5	11 :31 AM	-0.2	11 :50 PM	2.0
	9	5 :42 AM	7.2	6 :39 PM	7.5	:		12 :03 PM	0.3
	10	6 :26 AM	6.4	7 :16 PM	7.4	0 :38 AM	2.1	12 :36 PM	1.0
	11	7 :17 AM	5.6	7 :58 PM	7.4	1 :33 AM	2.2	1 :12 PM	1.7
	12	8 :25 AM	5.0	8 :48 PM	7.4	2 :37 AM	2.1	1 :54 PM	2.3
	13	9 :51 AM	4.7	9 :44 PM	7.6	3 :49 AM	1.8	2 :48 PM	2.8
	14	11 :18 AM	4.8	10 :42 PM	7.9	4 :59 AM	1.3	3 :54 PM	3.1
	15	12 :26 PM	5.1	11 :37 PM	8.3	5 :59 AM	0.6	5 :03 PM	3.1
	16	:		1 :17 PM	5.7	6 :48 AM	-0.1	6 :05 PM	2.9
	17	0 :28 AM	8.8	1 :59 PM	6.2	7 :31 AM	-0.7	7 :00 PM	2.5
	18	1 :15 AM	9.3	2 :38 PM	6.8	8 :11 AM	-1.3	7 :49 PM	2.1
	19	2 :01 AM	9.7	3 :15 PM	7.4	8 :50 AM	-1.8	8 :37 PM	1.6
	20	2 :45 AM	9.9	3 :52 PM	7.9	9 :28 AM	-2.0	9 :24 PM	1.1
	21	3 :30 AM	9.8	4 :29 PM	8.3	10 :06 AM	-1.8	10 :12 PM	0.8
	22	4 :16 AM	9.4	5 :09 PM	8.6	10 :44 AM	-1.5	11 :03 PM	0.6
	23	5 :05 AM	8.7	5 :50 PM	8.8	11 :23 AM	-0.8	11 :57 PM	0.5
	24	5 :58 AM	7.7	6 :35 PM	8.9	:		12 :04 PM	-0.1
	25	6 :58 AM	6.7	7 :25 PM	8.8	0 :58 AM	0.5	12 :49 PM	0.8
	26	8 :10 AM	5.8	8 :24 PM	8.7	2 :06 AM	0.6	1 :40 PM	1.7
	27	9 :39 AM	5.3	9 :30 PM	8.6	3 :25 AM	0.6	2 :43 PM	2.4
	28	11 :10 AM	5.3	10 :40 PM	8.6	4 :45 AM	0.3	4 :00 PM	2.9
	29	12 :25 PM	5.7	11 :45 PM	8.8	5 :55 AM	-0.1	5 :18 PM	2.9
	30	:		1 :20 PM	6.2	6 :52 AM	-0.6	6 :24 PM	2.7
	31	0 :41 AM	9.0	2 :04 PM	6.7	7 :38 AM	-0.9	7 :18 PM	2.3
Aug.	1	1 :29 AM	9.2	2 :42 PM	7.1	8 :18 AM	-1.1	8 :05 PM	1.9
	2	2 :12 AM	9.2	3 :16 PM	7.5	8 :53 AM	-1.2	8 :46 PM	1.6
	3	2 :52 AM	9.1	3 :47 PM	7.7	9 :25 AM	-1.0	9 :24 PM	1.3
	4	3 :28 AM	8.8	4 :17 PM	7.9	9 :55 AM	-0.8	10 :01 PM	1.2
	5	4 :04 AM	8.4	4 :46 PM	7.9	10 :24 AM	-0.4	10 :38 PM	1.2
	6	4 :39 AM	7.8	5 :15 PM	7.9	10 :52 AM	0.1	11 :17 PM	1.2
	7	5 :15 AM	7.2	5 :45 PM	7.8	11 :20 AM	0.7	11 :58 PM	1.4
	8	5 :53 PM	6.4	6 :18 PM	7.7	11 :49 AM	1.3	:	
	9	6 :38 AM	5.7	6 :56 PM	7.5	0 :45 AM	1.6	12 :21 PM	1.9
	10	7 :37 AM	5.0	7 :44 PM	7.4	1 :42 AM	1.7	12 :59 PM	2.5
	11	9 :02 AM	4.6	8 :46 PM	7.4	2 :53 AM	1.7	1 :52 PM	3.0
	12	10 :42 AM	4.6	9 :58 PM	7.6	4 :12 AM	1.4	3 :09 PM	3.3
	13	11 :56 AM	5.1	11 :06 PM	8.0	5 :22 AM	0.8	4 :33 PM	3.3
	14	:		12 :47 PM	5.8	6 :16 AM	0.1	5 :45 PM	2.8
	15	0 :05 AM	8.6	1 :28 PM	6.5	7 :02 AM	-0.5	6 :43 PM	2.1
	16	0 :57 AM	9.2	2 :05 PM	7.3	7 :43 AM	-1.1	7 :34 PM	1.3
	17	1 :46 AM	9.6	2 :41 PM	8.1	8 :22 AM	-1.5	8 :22 PM	0.5
	18	2 :33 AM	9.8	3 :18 PM	8.7	9 :00 AM	-1.6	9 :10 PM	-0.1
	19	3 :19 AM	9.7	3 :55 PM	9.2	9 :38 AM	-1.4	9 58	-0.5
	20	4 :07 AM	9.2	4 :34 PM	9.5	10 :16 AM	-0.9	10 :47 PM	-0.6
	21	4 :56 AM	8.5	5 :15 PM	9.5	10 :55 AM	-0.2	11 :39 PM	-0.5
	22	5 :48 AM	7.5	6 :01 PM	9.3	11 :37 AM	0.5	:	
	23	6 :48 AM	6.6	6 :52 PM	8.9	0 :37 AM	-0.2	12 :22 PM	1.4

-Continued-

Appendix C.2. (page 3 of 4)

Date		---HIGH TIDE--- Time	Feet	---HIGH TIDE--- Time	Feet	---LOW TIDE--- Time	Feet	----LOW TIDE--- Time	Feet
Aug.	24	8 :01 AM	5.7	7 :54 PM	8.4	1 :44 AM	0.2	1 :16 PM	2.3
	25	9 :31 AM	5.3	9 :08 PM	8.0	3 :03 AM	0.5	2 :27 PM	2.9
	26	11 :03 AM	5.4	10 :27 PM	7.9	4 :26 AM	0.5	3 :56 PM	3.2
	27	12 :11 PM	5.9	11 :36 PM	8.1	5 :38 AM	0.2	5 :19 PM	3.0
	28	:		1 :00 PM	6.5	6 :33 AM	-0.1	6 :23 PM	2.5
	29	0 :32 AM	8.3	1 :38 PM	7.0	7 :16 AM	-0.2	7 :12 PM	1.9
	30	1 :19 AM	8.5	2 :11 PM	7.4	7 :52 AM	-0.4	7 :53 PM	1.4
	31	1 :59 AM	8.6	2 :41 PM	7.8	8 :24 AM	-0.4	8 :29 PM	0.9
Sept.	1	2 :36 AM	8.6	3 :09 PM	8.1	8 :53 AM	-0.3	9 :04 PM	0.6
	2	3 :11 AM	8.4	3 :36 PM	8.3	9 :21 AM	-0.1	9 :38 PM	0.4
	3	3 :45 AM	8.1	4 :02 PM	8.4	9 :48 AM	0.2	10 :10 PM	0.3
	4	4 :19 AM	7.6	4 :29 PM	8.3	10 :14 AM	0.7	10 :46 PM	0.4
	5	4 :53 AM	7.0	4 :57 PM	8.2	10 :42 AM	1.2	11 :24 PM	0.6
	6	5 :30 AM	6.4	5 :28 PM	8.0	11 :10 AM	1.7	:	
	7	6 :12 AM	5.8	6 :04 PM	7.7	0 :07 AM	0.9	11 :41 AM	2.3
	8	7 :08 AM	5.2	6 :51 PM	7.4	0 :58 AM	1.2	12 :20 PM	2.8
	9	8 :29 AM	4.8	7 :56 PM	7.2	2 :03 AM	1.4	1 :16 PM	3.3
	10	10 :06 AM	4.9	9 :18 PM	7.3	3 :22 AM	1.3	2 :42 PM	3.5
	11	11 :18 AM	5.5	10 :38 PM	7.6	4 :37 AM	0.9	4 :16 PM	3.2
	12	12 :08 PM	6.2	11 :44 PM	8.2	5 :36 AM	0.3	5 :30 PM	2.4
	13	:		12 :49 PM	7.1	6 :25 AM	-0.2	6 :28 PM	1.4
	14	0 :41 AM	8.8	1 :27 PM	8.1	7 :08 AM	-0.6	7 :19 PM	0.3
	15	1 :32 AM	9.2	2 :04 PM	8.9	7 :49 AM	-0.8	8 :08 PM	-0.6
	16	2 :21 AM	9.4	2 :42 PM	9.6	8 :29 AM	-0.8	8 :55 PM	-1.3
	17	3 :09 AM	9.2	3 :21 PM	10.1	9 :08 AM	-0.6	9 :42 PM	-1.7
	18	3 :57 AM	8.8	4 :01 PM	10.2	9 :48 AM	-0.1	10 :30 PM	-1.7
	19	4 :46 AM	8.2	4 :44 PM	10.0	10 :29 AM	0.5	11 :21 PM	-1.4
	20	5 :39 AM	7.3	5 :30 PM	9.5	11 :12 AM	1.2	:	
	21	6 :39 AM	6.5	6 :22 PM	8.8	0 :17 AM	-0.7	12 :00 PM	2.0
	22	7 :50 AM	5.9	7 :26 PM	8.0	1 :20 AM	-0.1	12 :59 PM	2.7
	23	9 :16 AM	5.6	8 :45 PM	7.4	2 :34 AM	0.4	2 :19 PM	3.2
	24	10 :39 AM	5.8	10 :09 PM	7.2	3 :54 AM	0.7	3 :54 PM	3.2
	25	11 :41 AM	6.3	11 :21 PM	7.3	5 :05 AM	0.7	5 :15 PM	2.8
	26	:		12 :26 PM	6.8	5 :59 AM	0.6	6 :13 PM	2.1
	27	0 :17 AM	7.5	1 :02 PM	7.4	6 :42 AM	0.5	6 :58 PM	1.4
	28	1 :03 AM	7.7	1 :33 PM	7.8	7 :17 AM	0.4	7 :36 PM	0.8
	29	1 :44 AM	7.8	2 :01 PM	8.2	7 :47 AM	0.5	8 :10 PM	0.3
	30	2 :20 AM	7.9	2 :28 PM	8.5	8 :16 AM	0.6	8 :43 PM	-0.1

Note: To correct tables for local areas add or subtract time for high and low tides and feet for high and low tides.

Note: X Multiply height of district tide by ratio to result, add given correction for total height correction.

-Continued-

	Time		Feet	
	High	Low	High	Low
Alaska Peninsula:				
Fox Bay, Kupreanof Peninsula	+0:22	+0:36	X0.89	X0.89
Dent Point, Stepovak Bay	+0:21	+0:36	X0.89	X0.89
Albatross Anchorage, Balboa Bay	+0:32	+0:43	X0.91	X0.91
Beaver Bay	+0:37	+0:42	X0.87	X0.87
Seal Cape, Coal Bay	+0:34	+0:45	X0.84	X0.84
Ukolnoi Island	+0:41	+0:40	X0.83	X0.83
Dolgoi Harbor, Dolgoi Island	+0:44	+0:40	X0.79	X0.79
Settlement Point, Pavlof Bay	+0:43	+0:48	X0.84	X0.84
Canoe Bay, Pavlof Bay	+1:36	+1:30	X0.76	X0.76
King Cove	+0:40	+0:42	X0.80	X0.80
Lenard Harbor, Cold Bay	+0:46	+0:57	X0.85	X0.85
Cold Bay	+0:49	+1:03	X0.84	X0.84
Morzhovoi Bay	+0:50	+0:43	X0.80	X0.80
Shumagin Islands:				
Korovin Island (east side)	+0:26	+0:52	X0.92	X0.92
Sanborn Harbor, Nagai Island	+0:37	+0:37	X0.86	X0.86
Mist Harbor, Nagai Island	+0:35	+0:38	X0.83	X0.83
Pirate Cove, Popof Island	+0:42	+0:43	X0.88	X0.88
Sand Point, Popof Island	+0:30	+0:42	X0.87	X0.87
Zachary Bay, Unga Island	+0:34	+0:49	X0.88	X0.88

APPENDIX D: ALASKA PENINSULA SAC ROE HERRING FORECAST, 1994

This forecast is for North and South Peninsula areas with guideline harvest levels, excluding those areas open for exploration such as the General Section of the Sand Point District, Seal Cape-Wosnesenski Section, the General Section of the King Cove District, Amak District, and the Western Section of the Port Moller District. This forecast does not include the Aleutian Islands Management Area, which has no history of herring sac roe harvests, nor the Port Heiden District which had a harvest only during 1992.

The 1994 North Peninsula forecasted catch is 1,200 tons. The forecast is based on the five year (1989-93) average catch of 1,367.1 tons. The forecast has been reduced by 167.1 tons to account for North Peninsula herring that are probably harvested during the Dutch Harbor food and bait herring fishery. Non-Togiak herring stocks comprise about 22% of the Dutch Harbor herring catch; due to the July 16 opening date of the food and bait fishery, North Peninsula herring stocks should comprise the majority of the non-Togiak herring component. Using a non-Togiak component mid point estimate of 11%, the North Peninsula guideline harvest level should be reduced during the sac roe fishery to insure than North Peninsula herring stocks are not harvested beyond a 20% exploitation rate. Age class data from the 1993 harvest indicates that in 1994 age 7 herring should dominate Port Moller Bay catches, no other samples were collected in North Peninsula waters. The forecast does not include the Port Heiden District where commercial fishing occurred only during 1992.

The 1994 South Peninsula forecasted sac roe herring catch is 200 tons. The forecast is based on the 1989-93 average sac roe herring catch of 211.4 tons. Age class data from the 1993 harvest indicates that in 1994 age 4 and age 9 herring should dominate Canoe Bay catches, no other samples were collected in South Peninsula waters.

APPENDIX E: ALEUTIAN ISLANDS "DUTCH HARBOR" FOOD AND BAIT HERRING FORECAST, 1994.

This forecast is for the "Dutch Harbor": Unimak, Akutan, and Unalaska Districts and that portion of the Umnak District located east of Samalga Pass, food and bait herring fishery.

A 1,890 ton quota was allocated for the "Dutch Harbor" food and bait herring fishery for 1994 using the Bering Sea Herring Management Plan allocation formula, as follows, given the maximum 20% exploitation rate of the projected biomass:

1993 Togiak Spawning Biomass	142,497 Tons
@ 20% Maximum Exploitation	
Total Allowable Catch	28,499 Tons
Togiak Spawn on Kelp Allocation	1,500 Tons
Remainder of Allowable Catch	26,999 Tons
Dutch Harbor Allocation	7%
Dutch Harbor Quota	1,890 Tons
Togiak District Sac Roe Harvest	25,109 Tons