

KODIAK MANAGEMENT AREA
ANNUAL HERRING MANAGEMENT REPORT, 1997

By

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SAC ROE HERRING FISHERY

Area Description

The Kodiak Management Area (KMA) comprises the entire Kodiak archipelago and that portion of the Alaska Peninsula, which drains into Shelikof Strait between Cape Douglas and Kilokak Rocks at Imuya Bay. The archipelago is approximately 150 miles long, extending from Shuyak Island south to the Trinity Islands. The Alaska Peninsula portion is about 160 miles long and is separated from the archipelago by the Shelikof Strait, which averages 30 miles in width (Figure 1).

Historical Perspective

The Pacific herring, (*Clupea pallasii*), sac roe fishery began in Kodiak in 1964. From 1964-1997 sac roe herring harvests have averaged 1,948 short tons (tons) (Table 1; Figure 2). Prior to 1974, the fishery was unregulated with regard to harvest quotas, gear types, seasons, and fishing periods. From 1964-1977 purse seine gear was used exclusively, with an average annual harvest of 898 tons and up to ten vessels participating in the fishery. Annual harvests, along with effort levels, fish abundance, prices and processor interest, fluctuated greatly. Starting in 1974 purse seine gear was restricted to 150 fathoms in length and 1,000 meshes in depth. Between 1974 and 1978 the season ran from March 1 through June 30 with a harvest quota of 3,400 tons. Improved market conditions in 1978 prompted increased effort in this fishery with 28 purse seiners and 7 gillnetters participating. It was during this time period that spotters and tenders became involved in the fishery.

Between 1977 and 1982 the regulatory and management strategy went through a rapid developmental phase. Regulatory changes focused on gear efficiency, gear conflicts between seiners and gillnetters, gear level restrictions (exclusive registration and limited entry) and closed waters. In 1979 the sac roe season was reduced to May 1 through June 30, and the overall Guideline Harvest Level (GHL) was reduced to 2,400 tons distributed throughout the management area. A limit of 300 fathoms was also placed on the maximum length of gillnets and fishing periods were first limited to 48 hour openings followed by 24 hour closures.

The maximum lengths for gillnets and purse seines were reduced again in 1981 to 150 fathoms and 100 fathoms, respectively. In addition, trawl and beach seine gears were eliminated as legal gear during the sac roe season. Fishing periods were established by emergency order in 1981, in which 24 hour fishing periods were followed by 24 hour closures. Beginning in 1982 the starting date for the season was changed from May 1 to April 15. In 1985 the fixed overall GHL of 2,400 tons was replaced by the current harvest strategy where GHL's are set annually on a stock by stock basis.

The overall regulatory effect during the developmental phase (1977-1982) was the emergence of a relatively stable commercial sac roe herring fishery through 1991. A very strong year class from the 1988 brood year resulted in dramatically increased stocks and record to near record harvests occurring in 1992 through 1995, averaging 4,927 tons.

Beginning in 1979, combined gear levels increased substantially, reaching a high of 201 units (92 seiner and 109 gillnet) and 193 units (79 seiner and 114 gillnet) in 1980 and 1981 respectively (Table 1 and Figure 3). With the implementation of limited entry following the 1981 sac roe season, new entry into the fishery was restricted to past participants until permanent transferable permits could be awarded. The total number of permits that could potential participate in this fishery for the years 1990-1997 have ranged from 173 to 192 (Table 2).

The trend in harvest during the years 1979 through 1991 was relatively stable, averaging 2,101 tons per year. With the increase in the herring stocks starting in 1992 catches also increased and averaged 4,619 tons for the years 1992 through 1996 (Table 3). Prior to 1978, the entire sac roe herring harvest was taken by seine gear. In 1978 seven units of gillnet gear accounted for 3% of the total harvest. From 1979 to 1996 the percentage of the total harvest by seine gear ranged from a high of 85% to a low of 60% and averaged 75% (Figure 6). Gillnet percentage of total harvest peaked in 1988 at 40%, and averaged 25% from 1979-1996.

Recent Regulation Changes

With the increase in the herring stocks and effort levels, competition in this fishery dramatically increased and changes in the fishing periods were made inseason in 1995. This change in the fishing schedule was prompted by: 1) ADF&G's inability to monitor the purse seine fleet during the night; 2) near record numbers of purse seine gear participating in the fishery; and 3) low roe recovery standards which were set by some processors, (Gretsch 1995). With the changes in the fishing schedule and a diminishing percentage of the catch going to the gillnet fleet, tension between the two gears types escalated. During the fall of 1995, the Kodiak Fish and Game Advisory Committee established a work group comprised of gillnet and seine fishers along with ADF&G staff to work on a resolution to better manage the sac roe herring fishery to present to the Alaska Board of Fisheries (BOF).

The BOF met in Kodiak in December 1995 and after lengthy discussions adopted new regulations concerning gear specifications for seine and gillnets, fishing periods, and a harvest strategy which guides management of the sac roe herring fishery. The new gillnet specifications regulation (5 AAC 27.520 (c)) limits gillnets to a maximum of 230 meshes in depth, while the previous regulation had no depth requirements. Additionally the time limit allowed for gillnetters to remove their gear from the water after an emergency closure was increased from two hours to four hours (5 AAC 27.520 (d); ADF&G 1996-97).

The seine specifications regulation (5 AAC 27.525 (a)) limits the depth of seines, no purse seine shall exceed 20 fathoms stretch measure in depth or 100 fathoms of length. The depth shall be determined by using a stretch measure of the web from the corkline to the bottom of the net including any lines that hang below the lead line. The previous regulation only specified a seine depth limit of 1,025 meshes with no limits on the size of mesh. This regulation allowed fishers to use larger mesh in part of their seines to increase the depth and efficiency of the gear.

The fishing periods regulation (5 AAC 27.510) establishes fishing periods from April 15 through May 4 for purse seines to run from 12:00 noon until 10:00 p.m. on odd-numbered days, and from 9:00 a.m. until 12:00 noon on even-numbered days if a harvestable surplus is available; from May 5

through June 30, the fishing period for purse seines is 12:00 noon on odd-numbered days until 12:00 noon on even numbered days; the commissioner may open or close, by emergency order, the season before or after May 5 depending on the assessment of effort, harvest rate, and ADF&G's ability to monitor the fishery. This new regulation eliminates the majority of the night fishing for purse seiners during the time period when gear levels are the highest. For gillnetters from April 15 through June 30 fishing periods will run from 12:00 noon on odd-numbered days until 12:00 noon on even-numbered days. Gillnet fishing periods remain the same as first established in 1981.

Lastly the BOF put into regulation a harvest strategy (5 AAC 27.535 (e)) which in essence has been used by ADF&G staff to manage the sac roe fishery since the early 1980's. The harvest strategy outlines how ADF&G shall manage the sac roe fishery as follows; the commissioner shall issue emergency orders as necessary: 1) depending on ADF&G's assessment of effort levels, harvest rates, and its ability to monitor the fishery, the length of the fishing periods for either or both gear groups may be increased or reduced; 2) ADF&G shall establish guideline harvest levels (GHL's) by section based on information such as historical data, current and past fishery performance, sampling of commercial catch, and aerial surveys; 3) an individual section shall be closed to fishing once its GHL has been achieved; the GHL for an individual section may be adjusted up or down inseason depending on observed stock abundance; ADF&G may make adjustments in the management of a section based on inseason changes in fish behavior or harvest patterns; these changes may result in an adjacent section closure; 4) a section that does not have an extensive history of sac roe production may be designated as exploratory with no specified GHL; 5) a section that has been closed because its GHL has been achieved may be reopened, if ADF&G determines that additional herring arriving on the grounds have increased the available biomass to the point that the initial exploitation rate has dropped below 10 percent for that stock; any reopening will require information indicating that juvenile herring, post spawners, or other forage fish are not present and that ADF&G has the ability to monitor and regulate the reopening on the grounds; ADF&G shall give at least 24 hours advance notice before a section is reopened; 6) the KMA sac roe herring fishery is intended to occur in an orderly fashion, with minimal waste of the resource and within conservation limits as determined by ADF&G without regard to roe recovery standards.

Fishery Characteristics

The current KMA sac roe herring fishery occurs from April 15 through June 30 in 30-40 bays and coastal locations. The fishery opens at 12:00 noon on April 15, with the entire management area opened at one time, excluding those areas where local stocks require protection. A unique characteristic of this fishery is that it typically commences prior to any major build-up of herring. This allows for a greater distribution of effort, which should reduce harvest rates within individual bays. Both gear types fish the same areas during the same time periods, except for April 15 to approximately May 4 time period when purse seine fishing is closed from 10:00 p.m. to 9:00 a.m. during an opening.

To reduce operational costs and to cover more areas most purse seiners form combines of two to ten vessels. These combines include one or several tenders and spotter aircraft. By 1979 the use of small, single engine, float equipped airplanes became more prevalent. Airplanes are the most productive way to find and direct seiners to harvestable herring. In 1986, several seiners started

using side-scanning sonar to locate schools of herring. This technology enabled fishermen to work during any time of the day or night and in adverse weather conditions, which were unworkable for airplanes. Sonar technology continues to improve and most seiners are now equipped with scanning sonar equipment.

Gillnet vessels generally work independently and usually rely on processors to provide tenders to deliver their fish to the processing location. A few gillnetters are equipped with scanning sonar but the majority of these fishermen rely on color down-sounding sonar to locate herring schools, or fish areas where seiners are making sets. In recent years the use of mechanical shakers has increased. The shaker is a common tool and greatly reduces the time and effort needed to remove herring from the net and greatly increases gear efficiency.

From 1978-1983 herring were harvested at or near their spawning area. As fishermen's knowledge increased in identifying these areas, gillnet gear has been fished in deeper waters, (15-25 fathoms) further from the spawning destination. Fishing deeper waters and nets has increased the amount of herring harvested with low roe recovery. In most cases this fish is dumped. If ADF&G field crews document this, the poundage is subtracted from the management section GHL. In some cases the low quality herring is sold as bait, which is also subtracted from the management section GHL.

The ADF&G relies on the fishing industry to establish roe recovery standards. Generally, tenders will have a processor representative onboard to ensure that marketable sac roe quality herring are harvested. Competition among shore-based and floating processors results in this fishery having one of the highest exvessel values per ton in the state. The quality of Kodiak sac roe herring is generally high, due to inseason handling of a relatively small amount of herring over a long time period.

Fishery Monitoring

The ADF&G Commercial Fisheries Division (CFD) manages this fishery from its Kodiak Area Office. From 1974-1997 the ADF&G primarily used one department vessel to monitor this fishery. A second state vessel R/V Resolution has also been used in the early portion of the fishery in recent years. The Fish and Wildlife Protection (FWP) vessel M/V Trooper assisted in monitoring the fishery from 1995-1997, with an ADF&G employee aboard. From 1979-1997, in conjunction with the state vessels, several two person ADF&G field crews were also utilized to monitor this fishery.

Field and vessel crews are stationed in management sections, which have historically produced the major harvests for a district. These crews are positioned in remote bays by chartered floatplanes or vessels and are equipped with an inflatable boat or skiff. Daily contact with fishermen, spotters and tender operators is maintained to acquire fishery data. Inseason harvest, effort levels, and fleet movements are reported via single side band (SSB) radio at least three times per day. The use of field crews has been a key element in preventing excessive harvests from occurring and greatly exceeding the GHL. Field crews also identify herring spawning areas and collect age, weight, and length (AWL) samples from the commercial harvest. ADF&G aerial surveillance of the entire area supplements and often directs the placement of fishery monitoring field crews. The ADF&G office staff tally, field crew, processor, and tender reports to assess herring harvests and decide which

management sections need to be closed to fishing. Industry spotter reports are also used to provide information concerning all aspects of the fishery. A "Kodiak Sac Roe Herring Harvest Strategy" is distributed annually, which describes in detail the GHL's, regulatory changes, and expected fishing periods (Gretsch et al. 1997).

Fishing Seasons and Periods

The KMA sac roe herring fishery opens by regulation on April 15 and closes by regulation on June 30 (ADF&G 1996-97). Fishing periods are established by emergency order.

Districts and Management Sections

The KMA is divided into 13 districts, which define geographical areas used in managing the sac roe and food\bait herring fisheries (Figure 4). For the sac roe fishery, each district is then divided into management sections, which are intended to define the spawning area used by a stock of herring or may be used to define a geographical area. The descriptions of districts and management sections are based upon the 1983 datum baseline on current NOAA marine charts and all coordinates are listed in decimal degrees and minutes. There are a total of 82 management sections.

Guideline Harvest Levels

Preseason guideline harvest levels (GHL's) are established for all management sections, which have produced consistent herring harvests in previous seasons. These GHL's reflect the status of a particular stock of herring by management section or district. Criteria for establishing the 1997 GHL include: 1) 1996 expected biomass vs. actual biomass estimates, 2) trends in age composition, 3) level of recruitment (age-3), 4) proportion of the spawning population age-5 and younger, 5) proportion of age-2 fish in the spawning biomass (indicator of future recruit strength), 6) historic harvest trends, and 7) spawn observations. This information is supplemented by fishery performance information, i.e. the expected vs. actual harvest timing, duration, and level. Some management sections are designated "exploratory" and are assigned no GHL because these areas have had sporadic or no harvest of herring in past years. Inseason closures in these exploratory areas are used to ensure that excessive harvests are minimized. If at any time during the season it appears that preseason expectations are incorrect, GHL's can be adjusted above or below preseason levels.

From 1979-1982 the KMA GHL was fixed at 2,400 tons. From 1983-1997 the GHL has varied each year (based on the criteria listed above) from a low of 1,640 in 1987 and a high of 4,550 in 1994. The preseason GHL has accurately reflected the actual harvests (Figure 5). These preseason harvest projections aid fishermen and processors in planning prior to the start of each season.

Inseason Fishery Management

Inseason management of the sac roe fishery relies primarily on ADF&G field crews stationed in management sections where harvests are anticipated. Mobility of field crews to cover management sections has improved in recent years with the use of three, 21' skiffs and the use of state vessels. Presently two skiffs are used by field crews and a third skiff works from the ADF&G vessel R/V K-Hi-C. These skiffs allow field crews to monitor more management sections and under rougher sea conditions than the 12 foot inflatable boats. Two crews still utilize inflatable boats, which permit the crews to be rapidly moved by aircraft. The R/V K-Hi-C acts as mobile field station along with providing logistical support to field crews.

Generally, once the preseason GHJ has been achieved for a management section, it is closed for the season. Due to the rapid pace at which some fisheries occur, in-period closures are frequent. In management sections which have an ADF&G field crew present, in-period closures may occur with as little as 5 minutes advance notice. In management sections which do not have field crews present in-period closures may occur by: 1) announcement on single side band frequency 4.125 MHz following the marine weather forecast at 8:00 A.M. or 6:00 P.M. daily and at 10:30 P.M. by ADF&G announcement, or 2) field announcement with the arrival of an ADF&G representative.

Processors and independent tender operators are required to provide daily tallies of herring deliveries by management section and accurate estimates of herring onboard tenders that have not yet delivered to the cannery. Timely and accurate harvest reports from ADF&G field crews, fishermen, spotters, and processors are critical for assessing herring harvests and guide the management of the fishery. To date industry cooperation has been excellent in support of this fishery.

Fish Ticket Data

Commercial catch data is compiled by ADF&G, CFD personnel. Actual dock weights of delivered herring are used inseason to verify initial harvest estimates. All final data are compiled postseason from sales receipts (fish tickets) received from processors of purchased tonnages of herring. Fish ticket data is then compiled, and a summary of the herring harvest is generated. The ADF&G staff edits this summary for errors and lost fish tickets.

Biomass Estimates

The ADF&G have attempted in previous years to conduct aerial surveys to assess the total KMA herring biomass. The results of aerial assessments provided only a limited evaluation of the biomass and did not give a true representation of the total biomass. Problems associated with aerial surveys in the KMA include: 1) herring tend to spawn in the evening, night, and early morning hours, limiting the time fish are visible in shallow water; 2) most management sections have many distinct schools of herring which will spawn from April through June; 3) large numbers of juvenile herring, spawning herring, spawned out herring, and other fishes such as capelin can be found in sac roe herring fishery areas (fish may stay within an area for the duration of the sac roe season or may move, so that aerial biomass estimates may be duplicated or be incomplete); 4) the large

geographical area of the KMA; and 5) adverse weather conditions. Industry spotters have helped greatly in past seasons by providing biomass estimates, spawn observations, fleet movements, and harvest estimates. These spotters are very experienced; many having been involved for several seasons in the KMA and other statewide herring fisheries. Biomass estimates are compiled for each district from surveys flown by industry and ADF&G spotters. It has been estimated by both ADF&G and industry spotters that only 25% to 50% of the actual biomass are observed for the KMA herring stocks. There appears to be a significant amount of subtidal spawning occurring in waters 10-20 fathoms in depth. These fish and spawning activity may not be detected from aerial surveys. Previous attempts to assess this subtidal spawning with divers were not successful.

Commercial Catch Sampling

Commercial catch samples are taken from purse seine harvests, except when a management section has only a gillnet harvest. Seine caught herring are preferred for samples, since this gear type is less size selective than gillnet gear. Field crews collect samples from multiple seine sets within a management section to obtain a representative sample of all age classes in the catch. Samples are also obtained from tenders and/or fishing boats delivering to the processor if it is known that the catch being delivered came from a single management section. Catch samples are frozen upon arrival in Kodiak and are analyzed by the end of the sac roe season. Commercial catch samples are thawed and analyzed for age, weight, length, sex, and sexual maturity.

A single scale is removed from the preferred area, located on the left side of the fish, approximately three rows below the middle of the fish and three scales posterior to the center of the opercular plate (Brodie, personal communication 1997). The scale is visually analyzed with the aid of a microscope to estimate the age of the fish in years.

Standard length measurements are taken on all herring sampled. This length is the straight-line distance from the anterior most part of the fish, including the lower jaw with the mouth closed, to the end of the vertebra (hypural plate). Lengths are taken on all samples using a herring measuring board to the nearest millimeter (mm).

Weight measurements are taken on a Mettler balance to the nearest gram (g) of all fish within a sample.

The sex and sexual maturity of all sampled herring are recorded. Each fish is slit open and visually inspected for gonad relative maturity. The relative maturity is broken down into a scale of key characteristics ranging from virgin herring through spawned out herring, with eight levels of maturity identifying gonad key characteristics.

1997 Season Summary

The 1997 KMA sac roe herring season was 49 days in duration and a total of 3,235 tons of herring were harvested, which was six percent lower than the preseason GHF of 3,435 tons (Table 3). This was the sixth largest harvest for the fishery, exceeded by the 1992-1996 seasons, which annually averaged 4,619 tons. Seine caught herring totaled 2,629 tons, which was 81% of the total harvest,

while gillnet gear accounted for 606 tons, which was 19% of the total harvest. Harvest by gear type from 1979-1996 averaged 75% and 25% for seine and gillnet gear, respectively (Figure 6). During the period 1979-1996, seine and gillnets accounted for an average harvest of 2,150 and 650 tons, respectively (Table 3). Weather conditions for the 1997 season were excellent for herring spotters, with light winds and clear skies frequently occurring throughout the season. These weather conditions improved the effectiveness of spotters and likely contributed to the increase in the percentage of the harvest taken by the seine fleet. Further, going into the 1997 season there was uncertainties concerning the herring price and many gillnetters opted not to participate in the herring fishery or participated in the new state waters cod jig fishery.

The 1997 roe recovery averaged 10.7% for seine caught fish and 9.9% for gillnet caught fish. The average price per ton paid for 10% roe recovery herring was approximately \$300 per ton. This was the lowest price per ton paid in the history of the fishery. The average exvessel earnings for purse seine fishers was a record low of \$12,300 and for gillnetters a record low of \$3,100. The total exvessel value of the fishery was estimated at a record low value of \$970,500. (Table 3).

A total of 78 seiners and 59 gillnetters participated in the 1997 fishery; approximately 20 seiners did not make a delivery during the season. There were four floating processors and six shorebased plants, representing nine companies registered to process herring within the KMA. A total of 82 tenders registered to transport herring within the KMA in 1997.

The increase in seine and floating processor effort in recent years can mainly be attributed to the variable fishery performance of the Prince William Sound and Lower Cook Inlet Management Areas sac roe herring fisheries. The relatively high preseason GHIL for the KMA attracted seiners and processors to Kodiak. The floating processors operated in the vicinity of Port Bailey in Kupreanof Strait near the major harvest locations of the West Afognak and Uganik Districts. The floating processors departed the KMA at the end of April to participate in the Togiak herring fishery.

This was the second season that the purse seine fishers were restricted to 13 hour fishing periods for the early portion of the season. Purse seine periods were allowed from 12:00 noon to 10:00 p.m. on odd-numbered days and from 9:00 am until 12:00 noon on even-numbered days through May 2. During the early portion of the season as many as 79 seiners were involved in the fishery and effort levels diminished by late April to approximately 10-15 vessels, with many vessels leaving the KMA for the Togiak herring fishery. With the reduction in seine effort beginning on May 3 fishing periods were increased to 24 hours in duration for the remainder of the season.

Gillnet fishing periods remained unchanged for the 1997 season with 24 hour openings followed by 24 hour closed periods. The staggered days of fishing provided clearly defined closed periods, which allowed ADF&G staff time to assess, summarize, and update all harvest data from previous fishing periods.

District Summaries

The majority of the 1997 harvest was taken in the West Afognak, Uganik, Alitak, and Eastside Districts (Figure 7). Of the 82 management sections in the KMA, herring were harvested from 30 sections (Table 4), 22 of these sections were closed inseason by emergency order, and 22 sections were closed prior to the start of the season due to low stock abundance.

West Afognak District. The bays along the westside of Afognak Island are among the earliest areas in which herring are harvested in the KMA. The R/V Resolution monitored the Paramanof and Foul Bay Sections (Figure 8). For the first fishing period on April 15, a large portion of the seine and gillnet fleet fished the Foul Bay and Paramanof Bay Sections. The Foul Bay Section closed at 4:40 PM. April 15 with a harvest of 183 tons (GHL 100 tons) and the initial harvest in Paramanof Bay was estimated at 170 tons. The Paramanof Bay Section was closed during the next fishing period on April 17 with a total harvest of 686 tons (GHL 700 tons). The majority of this fleet moved to the Uganik District by the evening of April 17.

The Raspberry Strait and Malina Bay Sections were closed to fishing for the 1997 season. Poor fishery performance in these sections for the last two years prompted the closures. The 1994 and 1995 biomass observations and fishery harvests indicated a strong stock status for these sections. There is no clear explanation for the dramatic change in the Raspberry Strait stock status and the decline in the Malina Bay stock.

Of the three management sections in this district which have GHL's, two were closed with the assistance of ADF&G field crews and the Bluefox Bay Section remained open through June 30. The total GHL for the district was 820 tons and a total of 869 tons were harvested. Purse seiners accounted for 83% of the harvest and gillnetters accounted for 17%.

North Afognak District. There are five management sections within this district and four were closed prior to the start of the 1997 season (Figure 8). Herring stocks in these sections have declined in recent years and a closure of these sections was initiated in 1995 in attempts to rebuild these stocks. There was no herring harvest from the one open management section, the Shuyak Island Section.

South Afognak District. There are six management sections within this district and all were closed prior to the start of the 1997 season (Figure 8). The herring stocks in this district have also declined and all sections were closed starting in 1995 to help rebuild these stocks.

Uganik District. Fishery monitoring in the Uganik District consisted of field crews stationed in the Terror Bay and the South Arm Uganik Sections (Figure 9). The R/V K-Hi-C was also stationed in the Village Islands Section. During the first fishing period on April 15 a large concentration of herring were present within the Village Island Section, however the herring were in deep waters and were difficult to catch until the evening hours. Fishery activity intensified near darkness with approximately 35 seiners making sets at the 10:00 P.M. closure time. After tallying the seine catch the Village Islands Section was closed at 10:30 PM and the catch totaled 336 tons, (GHL 250 tons). The fleet next dispersed to the Terror Bay, East Arm Uganik, and South Arm Uganik Sections. The Terror Bay Section was closed on April 17 with a harvest of 252 tons (GHL 250 tons). The Northeast Arm Section closed on April 18 with a catch of 101 tons (GHL 30 tons). The West

Uganik Passage Section closed April 19 and 20 minutes of fishing resulted in a harvest of 169 tons (GHL 20 tons) and the field crew moved to Viekoda Bay until its closure. Industry spotters estimated the school of herring within the West Uganik Passage ranged from 1,000 to 1,500 tons. The East Arm Uganik Section closed on April 21 with a harvest of 120 tons (GHL 125 tons) and fishing effort next shifted to the South Arm Uganik Section. The South Arm Uganik field crew was moved to Inner Ugak Bay on April 22 with the R/V K-Hi-C taking over monitoring duties of this section. The South Arm Uganik Section was closed on April 23 with a harvest of 237 tons (GHL 180 tons). The only remaining catch for the Uganik District occurred in the Viekoda Bay Section where 56 tons were harvested and the section was closed prior to reaching the GHL of 75 tons on May 14. The R/V K-Hi-C was moved to the Eastside District on April 27. Of the eight management sections in the Uganik District with GHL's, six were closed with the assistance of ADF&G field crews and the remainder were open through June 30. A district total of 1,272 tons were harvested and the district GHL was 940 tons, 90% of this harvest was from purse seine gear and 10% by gillnet.

Uyak District. The Uyak District was the largest herring producing district within the KMA through the 1980's (Figure 9). Since 1991 fishery performance and spotter observations have indicated a decline in abundance of herring in this district. ADF&G responded to this decline by reducing the GHL's for these management sections for the 1992-1994 seasons. The entire district was closed during the 1995-1997 herring seasons as a further step to promote the recovery of these stocks. The ADF&G proposed conducting a study to assess the size of the herring stocks and the age compositions within this district. The funding of this study would have come from a test fishery conducted by ADF&G, but due to the low herring prices the study was canceled. As an alternate plan the R/V Resolution conducted a hydroacoustic survey in late April and additional aerial surveys were conducted within the Uyak District. Both survey methods indicate that the herring stocks within the district are still at low levels, though a more comprehensive evaluation is needed.

Alitak District. The Alitak District is comprised of ten sections, two are exploratory areas, and eight have GHL's (Figure 12). Fishing activity started within this district in early May and the seine effort levels were low, as the majority of the seine fleet had departed to the Togiak herring fishery. An ADF&G skiff equipped field crew was stationed in Sulua Bay on May 1. The Sulua Bay Section has been the most productive fishery within the Alitak District during the last three years and the initial 1997 fishery performance was strong but quickly declined. The change in fishery performance led to the closure of the Sulua Bay Section on May 16 prior to reaching the GHL and the catch totaled 199 tons. The Portage Bay Section, (GHL 75 tons) was closed in season on June 2 with a harvest of 94 tons. All remaining sections of the Alitak District remained open through June 30, with harvests occurring in the Geese-Twoheaded (15 tons), Outer Deadman Bay (10 tons), and Inner Alitak Sections (1 ton). Fishery performance for the Inner and Outer Deadman Bay Sections remained poor for the second consecutive year. The ADF&G crew monitored the Deadman Bay Sections and then moved to Olga Bay on May 20 to monitor the herring fishery and to begin installation of salmon weir projects. The Olga Bay herring stock has declined over the last five years and the GHL has been adjusted lower to reflect this changing stock status. There was no harvest from the three sections within Olga Bay, though effort levels were very low due to market conditions and the upcoming salmon fishery openings in June. The Alitak District total GHL was 485 tons and 320 tons were harvested. Seine gear accounted for 58% of the harvest and gillnet gear 42%. Of the eight management sections in the Alitak District with GHL's, one was closed with the

assistance of the ADF&G field crew, ADF&G office staff closed one, and the remainder were open through June 30.

Eastside District: During the last three years spawning has occurred in late-March in the East and West Sitkalidak Straits prior to the fishery opening. Generally, the Barling Bay and the East and West Sitkalidak Strait Sections experience early herring harvests, however the early spawning activity may explain the diminished harvest during the early portion of the season. The R/V Resolution deployed a two person ADF&G field crew at Amee Bay within the East Sitkalidak management section (Figure 11). This crew was equipped with a 21-foot skiff, which enabled them to monitor seven sections along the eastside of Kodiak Island. A raft equipped field crew was also flown into Kiliuda Bay. On April 26 the Shearwater Bay Section was closed with a harvest of 143 tons, (GHL 90 tons). On April 30 the Barling Bay Section (GHL of 50 tons) was closed with a harvest of 49 tons. The Outer Kiliuda Section was closed on May 3 with a harvest of 113 tons, (GHL 90 tons). The Inner Ugak Bay Section was closed on May 5 with a harvest of 114 tons, (GHL of 90 tons) and the field crew was moved to the Outer Ugak Bay Section. The Outer Ugak Bay Section was closed on May 7 with a harvest of 40 tons, (GHL 60 tons) with the section being closed prior to reaching the GHL due to an inaccurate catch report provided by the fisher. On May 8 the East and West Sitkalidak Strait Sections were closed prior to reaching the GHL due to poor fishery performance with harvests of 42 tons (GHL 200 tons) and 6 tons (GHL 100 tons) respectively. The Inner Kiliuda Bay and Pasagshak Bay Sections also closed on May 8 with harvests of 146 tons (GHL 90 tons) and 16 tons (GHL 15 tons) respectively. The Three Saints Bay Section was closed on May 12 with a harvest of 31 tons, (GHL of 40 tons). The remaining six sections of the district remained open until June 30. Of the 14 sections with GHL's in the Eastside District, six sections were closed with assistance of ADF&G field crews, four sections were closed by the ADF&G office staff, and the remaining sections were open until June 30. The total GHL for the Eastside District was 900 tons. A total of 701 tons were actually harvested, with 72% of the harvest from purse seine gear and 28% of the harvest from gillnet gear.

Northeast District. There are five sections in the Northeast District and four have GHL's (Figure 10). The Kalsin Bay Section was closed on May 16, with a harvest of 22 tons, (GHL of 10 tons). Harvest also occurred in the Womens Bay Section of 1 ton (GHL of 30 tons) and this section remained open until June 30. The four remaining sections were open through June 30 with no harvest occurring.

Inner Marmot District. There are five sections within the Inner Marmot District and only one section has a GHL (Figure 8). The Anton Larsen Bay, Sharatin Bay, and Kizhuyak Bay Sections were closed prior to the start of the season due to low stock abundance. There was no harvest in the two open sections and they remained open until June 30.

North Mainland District. The North Mainland District is comprised of four sections (Figure 13). One section has a GHL, two sections are exploratory, and one section is offshore. The offshore section is not expected to produce a sac roe herring harvest. The three Mainland Districts experience more extreme weather conditions than the other districts around Kodiak and Afognak Islands. Sea conditions encountered while crossing the Shelikof Strait to reach these districts greatly reduces the mobility of vessels fishing this district. The Mainland Districts frequently experience high winds, low ceilings, and limited visibility, greatly limiting the effectiveness of spotters. Fishing effort in these three districts generally involves only one or two seine combines

and 5-10 gillnet vessels annually. No field crews are stationed in these districts due to the high expense of placing and supplying crews in this remote area. The weather conditions combined with the small number of vessels, which fish these sections, reduces the likelihood that excessive harvests will occur. A total of 8 tons were harvested by gillnetters from the Inner Kukak Bay Section (GHL 25 tons). There were no other harvests from this district and all sections remained open through June 30.

Mid-Mainland District. The Mid-Mainland District is comprised of six sections. Two sections have a GHL, two sections are exploratory, and two sections are offshore. The offshore sections are not expected to produce a sac roe herring harvest (Figure 14). The Inner Katmai Section had a seine harvest of 31 tons (GHL 50 tons) and remained open through June 30. There were no other harvests from this district and all sections remained open until June 30.

South Mainland District. The South Mainland District consists of two management sections, one has a GHL and the second is an exploratory section (Figure 15). These two sections are the farthest from the port of Kodiak. A total of 11 tons were harvested with seine gear from the Wide Bay Section (GHL 95 tons) and both sections remained open through June 30.

Sturgeon/Halibut District. The Sturgeon/Halibut District on the southwest portion of Kodiak Island has no management sections or GHL and consists mostly of offshore areas that are not likely to produce a sac roe herring harvest (Figure 14).

Age Composition and Weight-At-Age

With all purse seine catch samples combined and weighted by the harvest, age-9 herring were predominant comprising of 37% of the total 1997 purse seine harvest. The remaining age classes represented the following percentages of the weighted purse seine harvest: age-3 (7%), age-4 (28%), age-5 (4%), age-6 (8%), age-7 (6%), age-8 (3%) and Age-10+ (6%). In general age-9 and age-4 herring were dominant in the West Afognak and Uganik Districts, while the Eastside District catches were predominantly age-4 and age-10 herring (Table 5). In the KMA age-3 herring are considered "recruit herring", entering into the commercial fishery and spawning for the first time.

With all purse seine catch samples combined and weighted by harvest, age-3 herring averaged 98 grams in weight, age-4 averaged 136 grams, age-5 averaged 164 grams, age-6 averaged 203 grams, age-7 averaged 212 grams, age-8 averaged 224 grams, age-9 averaged 236 grams, age-10 averaged 266, and age-11+ averaged 274 grams (Table 6).

Enforcement Issues

The Alaska Department of Public Safety, Fish and Wildlife Protection (FWP) substantially increased their enforcement coverage of the KMA herring fishery during the last three seasons. As previously mentioned, the FWP vessel M/V Trooper worked jointly with ADF&G in monitoring the fishery and conducting enforcement work, with an ADF&G biologist onboard. Additionally,

the FWP vessel M/V Spiridon and a FWP float equipped Cessna 185 provided surveillance of the fishery.

The presence of FWP greatly reduced the burden on ADF&G field crews, especially during openings, closures, and emergency closures. During the season the majority of the enforcement activity occurred on late (after the closure time) purse seine sets. There were some problems with fishers determining section boundaries within the Uganik District, which will need to be corrected during the next BOF meeting. It is hoped that FWP will continue this level of enforcement activity, which contributed to a more orderly fishery.

1998 Management Plans and Issues

Based on the age class data collected, fishery performance, spawn observations, and juvenile herring observations in 1997, the preliminary GHF for the KMA in 1998 is expected to be approximately 2,500 tons, down from the 1997 GHF of 3,435 tons. The 1998 harvest is expected to comprise of 30-40% age-3 and age-4 herring along with 20-30% age-10 and age-11 herring. The observation of age-3 herring during the 1997 season indicates a fair level of recruitment. The older age classes contribution to the fishery will decline, however the fishery should support harvests of 2,000-2,500 tons over the next few seasons.

The ADF&G will continue to rely greatly on industry spotter pilots, processors, and fishermen to provide information to help manage this fishery. The ADF&G conducted an age structured analysis for the West Afognak District in 1997 to better evaluate the status of the herring stocks and aid in the setting of GHF's for this district and the results should be available during the winter of 1997-98. The ADF&G will again attempt to conduct a test fish program to generate funds for herring research in 1998. Research activity will involve an increase in aerial surveys of closed sections to assess trends in the stock status. Further, to help evaluate the stock status in the Uyak District and to assess the early spawning East and West Sitkalidak Section stocks a purse seine vessel may be contracted to conduct hydroacoustic surveys and collect AWL samples in 1998.

The KMA harvest strategy has been tested with record harvests and high gear levels during the last four years. The competition between fishers is intense and gear conflicts between fishers occasionally occur. A report which reviews the results of the 1997 fishery entitled, "Kodiak Management Area 1997 Commercial Sac Roe Herring Fishery Season Summary" (Gretsch and Brodie 1997) evaluates the BOF approved harvest strategy.

HERRING FOOD/BAIT FISHERY

Historical Perspective

The earliest recorded food/bait herring harvest for the KMA occurred in 1912 (Table 6). In the early 1920's the fishery expanded and large herring were sought for food products, such as salted and pickled herring which were much in demand after World War I. By the late 1920's the demand for herring food products had declined and the fishery switched from a food product to reduction

products, such as fishmeal and oil. During the peak years of the reduction fishery (1934-1950) the average harvest was 31,600 tons, which vastly surpasses the current food/bait herring harvests (Figure 16-17). During the reduction fishery the major harvest areas were located in eastern Shelikof Strait and adjacent bays and straits along the West Side of Kodiak and Afognak Islands. Quotas and harvest weights were measured by barrels (where 250 lbs. of herring equals one barrel) until 1956 when the section of measure was changed to short tons. Historically large, (approximately 70 foot), "sardine seiner" type vessels were used in conjunction with holding pounds to supply herring to five major reduction plants. In addition, small seine and gillnet vessels participated in a portion of the food fishery and delivered to floating and shore based salting and pickling operations.

From the early 1960's to 1973, there were no harvest quotas or closed seasons. Beginning in 1974, an open fishing season was established between August 1 through February 28 which remains in effect; however no regulatory GHL's were in effect until 1979. In 1979 and 1980, the GHL was 12,600 tons for the food and bait season. As a result of the rapidly developing sac roe fishery, the GHL for the food/bait season was reduced to 1,000 tons in 1981 and remained at that level through 1987. Regulatory GHL's for the food/bait herring fishery was replaced with a regulatory harvest strategy in 1988.

Gear used in this fishery includes trawl, gillnet, and seine. Gear for this fishery was first regulated for the 1986/87 season when seine gear was restricted to 100 fathoms in length and 1,025 meshes in depth. Gillnet gear was also restricted to 150 fathoms in length with no depth requirements. For the 1993/94 season, purse seine specifications were increased to 150 fathoms in length and 1,625 meshes in depth. There are no trawl restrictions.

Fishery Characteristics

The current food/bait herring fishery can be characterized as a secondary commercial fishery on herring concentrations located in KMA waters. It is primarily a bait fishery providing a frozen product for longline and crab/cod pot fishers. Effort and harvest levels are at historical lows for the food/bait fishery, while the sac roe fishery supports relatively high levels of effort and harvest. The food/bait fishery is an open-to-entry fishery, while the sac roe fishery has been limited-to-entry since 1981. Existing regulations designate priority status to the sac roe fishery.

Management Plan History

During the fall and winter months of the early 1980's major concentrations of herring were observed in eastern Shelikof Strait and adjacent bays along the west side of Kodiak and Afognak Islands. The biomass exceeded that of known KMA spawning stocks. These herring were targeted by food/bait fishers and questions arose concerning the stock of origin of these fish. In 1986, a stock identification study based on scale pattern analysis was performed on herring harvested from a large biomass located in the east part of the Shelikof Strait (Johnson et al.1988). The study concluded that at least 80% of the East Shelikof herring sampled were of Kamishak Bay spawning stock origin, which is within the Lower Cook Inlet Management Area.

In 1988, the BOF allocated not more than two percent of the previous season's total available spawning biomass from Kamishak to be harvested during Kodiak's food/bait herring fishery. For local Kodiak spawning stocks, which are exploited during the sac roe fishery, the food/bait GHL on those same stocks is 10% of the previous season's sac roe herring harvest.

Problems arose from this management plan because it was difficult to assign harvest from the intermixed stocks to Kodiak or Kamishak. This plan was in affect through the 1992/93 season.

In 1992, the BOF approved the Kamishak Bay District Herring Management Plan (SAAC27.465) which outlines criteria for the management of the Kamishak Bay sac roe herring and the Shelikof Strait food/bait fishery (ADF&G 1996-97). This plan defines allocations to these fisheries based on biomass estimates.

In 1993 the BOF placed into regulation a harvest strategy defining the criteria for managing the Kodiak food/bait herring fishery (5AAC 27.535). This strategy combines the Kamishak stock GHL with the Kodiak stock GHL for food/bait management sections FB 1, FB 4, and FB 5. When this combined GHL is achieved the Shelikof Strait food and bait management sections are closed collectively. This plan alleviates the problem of identifying the spawning stock of a harvest in areas where intermixing may occur.

The allocation of Kamishak Bay herring stocks to the Shelikof Strait food and bait fishery is based on the spawning biomass of age-5 and older herring and not on the biomass of juveniles. The quantity of herring aged four years and younger caught during the food/bait fishery are adjusted to approximate the biomass of a similar number of age-5 herring. Age-4 and younger herring were selected because in the Kamishak spawning stocks, herring are not considered to have attained complete recruitment into the spawning biomass until they have reached age-5.

1997-98 Season Summary

The 1997/98 preliminary allocation for Kamishak herring stocks overwintering in Shelikof Strait was 300 tons. In addition, the GHL for Kodiak stocks in food/bait districts FB 1 and FB 4 was 215 tons. The combined GHL for both stocks affected by (5 AAC 27.465) Kamishak Bay District Herring Management Plan was 515 tons. A "KMA Commercial Food/Bait Herring Fishery Harvest Strategy" is distributed annually, which describes in detail the guideline harvest levels, regulatory changes, and registration requirements (Gretsch et al. 1997). All permit holders, tenders, and buyers are required to register at the Kodiak ADF&G office prior to fishing or purchasing herring. At that time, management plans are issued and catch reporting procedures and current regulations are reviewed. Each landing is sampled for age, weight, and length (AWL) information and skipper interviews are conducted to evaluate which Kodiak sac roe stocks are being impacted.

For the 1997/98 season a total of 756 tons were harvested in the KMA. From 1970 through 1997 the food/bait harvest has ranged from 5 tons to 837 tons (Figure 17). Eight vessels and five buyers/processors registered for this fishery. Purse seine gear accounted for 68% of the total harvest and trawl gear 32%. The total exvessel value was approximately \$260,000.

The Kodiak spawning stocks GHL was 292 tons, which represents 10% of the previous spring's sac roe herring harvest on a stock by stock basis. The total GHL for the KMA was 592 tons (300 tons Kamishak allocation and 292 tons Kodiak stocks).

The KMA food/bait herring season began August 1, 1997 and remained open until February 28, 1998. The initial fishing periods were 24 hours per day and seven days a week. Seven emergency orders (E.O.'s) were issued during the season which listed closed fishing areas, established fishing periods, closed districts or sections after the GHL was harvested, and adjusted the duration of fishing periods.

The first emergency order established fishing periods and listed the closed areas which included the South Afognak (Food/Bait District #3), North Afognak (Food/Bait District #2), Uyak (Food/Bait District #5), Inner Marmot (Food/Bait District #10), Alitak (Food/Bait District #7), and the Raspberry Strait and Malina Bay Sections of the West Afognak District. These districts and sections were closed as the herring stocks within these areas have declined during the last five to six years and a closure is necessary to prevent further exploitation during the food/bait fishery.

The second emergency order was issued on August 21, 1997 and closed the Paramanof Bay and Foul Bay Sections of the West Afognak District. These sections are part of the Shelikof Strait fishery and are managed for a harvest on Kamishak and Kodiak stocks that had a combined GHL of 515 tons. Skipper interviews combined with AWL samples indicated that local herring stocks (Paramanof-Foul Bays) were likely harvested with a catch of approximately 87 tons and the GHL for these sections was 87 tons. The department did not wish to take the entire GHL for the Shelikof Strait fishery (515 tons) within these two sections and a closure was issued to prevent overexploitation of these local stocks.

The third emergency order closed the Northeast District on August 29, 1997 with a harvest of 119 tons and the GHL was 2 tons for the district. This harvest occurred during the night of August 28 and permit holders failed to report their catch until the morning. With a small GHL for the district the department is dependent on the permit holders to cooperate in sharing information to manage this fishery. As a result of the harvest within the Northeast District on September 2, 1997 the fourth emergency order was issued which restricted daily fishing periods to 12 hours from 8:00 AM to 8:00 PM. This fishing period schedule restricts fishing time to daylight hours with the intent of slowing the fishery harvest rates down. On September 4, 1997 the fifth emergency order was issued which closed the three Mainland Districts to food/bait herring fishing. These districts had small GHL's and there was concern that managing for such low tonnage's was not practical with the problems experienced in the Northeast District.

The sixth emergency order closed the Shelikof Strait fishery on September 25, 1997 with a total harvest of 537 tons and the GHL was 515 tons, with the bulk of the harvest coming from the Uganik District (F/B 4). As previously mentioned the 87 tons harvested within the Paramanof Bay Section is included in the total 537 ton harvest. As stated in the Kamishak Bay District Herring Management Plan (5 AAC 27.465) the quantity of age-4 and younger herring harvested is adjusted to a similar number of age-5 herring. This estimated adjusted harvest totaled 655 tons. During this fishery herring harvested were primarily age-2 through age-5 (Table 8). The final Kamishak Bay herring forecast was received on October 3, 1997, which reduced the initial allocation of 300 tons

to 200 tons for the Shelikof Strait Food/Bait Herring Fishery. The 1997 fishery was managed on the 300 ton allocation and the fishery was closed before the final forecast was received in Kodiak.

The seventh emergency order closed the Eastside District on October 2, 1997 with a harvest of 99 tons and the GHL was 70 tons. Permit holders were more cooperative in providing catch information from this district, which aided management.

1998/99 Management Plans and Issues

The success of purse seine gear in this fishery during the last five years along with strong market conditions for Kodiak bait herring will likely encourage additional effort next season. On-grounds monitoring by the ADF&G may be necessary as gear levels escalate. Improvements in catch reporting will be needed with increasing effort levels to help limit harvests to guideline levels. The current wording of the regulation concerning the Kodiak food/bait herring fishery harvest strategy needs to be updated. Lastly the allocation for the Shelikof Strait fishery from the Kamishak Bay herring forecast needs to be finalized prior to the start of the Kodiak food/bait fishery.

HERRING SUBSISTENCE/PERSONAL USE FISHERY

Fishery Characteristics

The subsistence and personal use fishery for herring is regulated only during the sac roe herring fishery season, April 15 through June 30. During this time period, a permit is required for individuals who are not sac roe commercial fishermen to harvest herring. Sac roe commercial fishermen may retain herring from their lawfully taken commercial catch to fulfill their subsistence or personal use needs. Most this catch is used for food, sport fishing bait, and fertilizer.

1997 Season Summary

A total of 16 permits were issued, 4 permits were returned with harvest data, and 3 permits were returned that were not fished. The total harvest was approximately 2,400 pounds with the harvest coming from the Uyak, Inner Marmot, and Northeast Districts.

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Table 1. Historical commercial harvest data and effort levels for the sac roe herring fishery Kodiak Management Area, 1964-1997.

Year	Total Harvest (Tons)	Harvest by Gear Type		Number of Vessels Making Landings		Total	Number of Processors
		Seine (Tons)	Gillnet (Tons)	Seine	Gillnet		
1964	568	568	0	5	0	5	2
1965	657	657	0	8	0	8	2
1966	2,769	2,769	0	11	0	11	4
1967	1,662	1,662	0	5	0	5	4
1968	2,001	2,001	0	10	0	10	4
1969	1,130	1,130	0	21	0	21	9
1970	342	342	0	13	0	13	5
1971	284	284	0	4	0	4	2
1972	215	215	0	4	0	4	1
1973	831	831	0	11	0	11	4
1974	868	868	0	26	0	26	4
1975	8	8	0	2	0	2	3
1976	5	5	0	1	0	1	1
1977	338	338	0	11	0	11	3
1978	904	881	23	28	7	35	7
1979	1,735	1,457	278	57	125	182	8
1980	2,383	2,009	374	92	109	201	9
1981	2,065	1,596	469	79	114	193	9
1982	1,771	1,447	324	45	67	112	6
1983	2,318	1,797	521	41	64	105	7
1984	2,163	1,691	472	39	69	108	7
1985	1,968	1,244	724	34	81	115	7
1986	1,558	1,111	447	31	71	102	8
1987	2,146	1,591	555	29	62	91	8
1988	2,171	1,304	867	33	76	109	6
1989	2,249	1,513	736	37	83	120	6
1990	2,347	1,644	703	27	63	90	6
1991	2,432	1,697	735	32	64	96	6
1992	4,283	3,260	1,023	40	74	114	6
1993	4,929	4,203	726	41	86	127	6
1994	5,893	4,976	917	66	57	123	15
1995	4,604	3,837	767	73	71	144	17
1996	3,386	2,322	1,064	57 ^a	74	131	15
1997	3,235	2,629	606	64 ^b	59	123	10
Average 1964-1997	1,948	1,585	363	32	43	75	6
Average 1992-1996	4,619	3,720	899	55	72	128	12
Average 1987-1996	3,444	2,635	809	44	71	115	9

^a Approximately 20 vessels participated in the fishery but made no deliveries.

^b Approximately 19 vessels participated in the fishery but made no deliveries.

Table 2. Summary of Commercial Fisheries Entry Commission status of sac roe herring fishery limited entry permits, Kodiak Management Area, 1990-1997.

Gear Type	Year							
	1990	1991	1992	1993	1994	1995	1996	1997
Gillnet								
Permanent	72	74	97	95	99	94	94	96
Interim Entry	27	28	11	8	8	5	9	7
Total Gillnet Permits	99	102	108	103	107	99	103	103
Purse Seine								
Permanent	47	48	59	66	69	65	68	70
Interim Entry	25	22	13	12	14	13	13	11
Total Seine Permits	72	70	72	78	83	78	81	81
Combination (Seine or Gillnet)								
Permanent	2	2	2	2	2	2	2	2
Combined Total								
Permanent	121	124	158	163	170	161	164	168
Interim Entry	52	50	24	20	22	18	22	18
Total Permits	173	174	182	183	192	179	186	186

Table 3. Sac roe herring fishery summary of season length, guideline harvest level (GHL), harvest data by gear type, percentage of harvest by gear type, number of landings, and exvessel earnings, Kodiak Management Area, 1979-1997.

Year	Season Length (Days)	G-H-L (Tons)	Total Harvest (Tons)	Harvest by Gear Type		Percent Harvest by Gear Type		Number of Landings by Gear Type		Units of Gear Making Landings		Average Catch by Gear Type		Average Earnings		Price per Ton (\$)	Exvessel Total Value (\$)
				Seine (Tons)	Gillnet (Tons)	Seine	Gillnet	Seine	Gillnet	Seine	Gillnet	Seine (Tons)	Gillnet (Tons)	Seine (\$)	Gillnet (\$)		
1979	36	2,400	1,735	1,457	278	84%	16%	-	-	57	125	26	2	\$38,342	\$3,336	\$1,500	\$2,602,500
1980	35	2,400	2,383	2,009	374	84%	16%	-	-	92	109	22	3	\$15,068	\$2,368	\$690	\$1,644,270
1981	48	2,400	2,065	1,596	469	77%	23%	207	406	79	114	20	4	\$14,647	\$2,983	\$725	\$1,497,125
1982	59	2,400	1,771	1,447	324	82%	18%	138	191	45	67	32	5	\$17,686	\$2,660	\$550	\$974,050
1983	51	2,400	2,319	1,797	522	77%	23%	164	284	41	64	44	8	\$35,063	\$6,525	\$800	\$1,855,200
1984	54	2,400	2,163	1,691	472	78%	22%	138	212	39	69	43	7	\$34,687	\$5,472	\$800	\$1,730,400
1985	59	2,000	1,968	1,244	724	63%	37%	118	348	34	81	37	9	\$32,928	\$8,044	\$900	\$1,771,200
1986	61	1,690	1,558	1,110	448	71%	29%	132	385	31	71	36	8	\$34,016	\$5,994	\$950	\$1,480,100
1987	61	1,640	2,146	1,591	554	74%	26%	122	411	29	62	55	9	\$54,862	\$8,935	\$1,000	\$2,146,000
1988	59	2,065	2,171	1,304	867	60%	40%	169	555	33	76	40	11	\$51,370	\$14,830	\$1,300	\$2,822,300
1989	76	2,415	2,249	1,513	736	67%	33%	171	627	37	83	41	9	\$34,749	\$7,535	\$850	\$1,911,149
1990	75	2,375	2,347	1,644	703	70%	30%	156	544	27	63	61	11	\$51,756	\$9,485	\$850	\$1,994,950
1991	83	2,510	2,432	1,697	735	70%	30%	169	587	32	64	53	11	\$45,077	\$9,762	\$850	\$2,067,200
1992	77	2,720	4,283	3,260	1,023	76%	24%	185	706	40	74	82	14	\$40,750	\$6,912	\$500	\$2,141,500
1993	77	3,525	4,928	4,203	726	85%	15%	237	294	41	86	103	8	\$56,382	\$4,643	\$550	\$2,710,950
1994	71	4,550	5,893	4,976	917	84%	16%	285	485	66	57	75	16	\$60,315	\$12,870	\$800	\$4,714,400
1995	73	4,480	4,604	3,837	768	83%	17%	280	642	73	71	53	11	\$66,858	\$13,759	\$1,272	\$5,856,288
1996	69	4,180	3,386	2,322	1,064	69%	31%	202	890	57	74	41	14	\$81,474	\$28,757	\$2,000	\$6,772,000
1997	70	3,435	3,325	2,023	1,302	71%	29%	153	438	64	59	41	13	\$49,000	\$16,000	\$1,000	\$3,000,000
Averages																	
1979-1997	59	2,697	2,990	2,660	1,490	78%	22%	170	420	40	70	40	9	\$40,920	\$7,000	\$800	\$2,000,000
Five Year																	
1992-1996	73	3,651	4,612	3,720	1,300	80%	20%	238	602	60	62	60	13	\$60,000	\$10,000	\$1,000	\$3,000,000
Ten Year																	
1987-1996	72	3,048	3,444	2,888	1,300	74%	26%	190	574	48	61	60	12	\$49,000	\$10,000	\$800	\$3,000,000

Table 4. Sac roe herring fishery guideline harvest level (GHL) by management section, harvest by gear type, total harvest, and the date each management section was closed, Kodiak Management Area, 1997.

Statistical Area	Management Section	GHL (Tons)	Seine Harvest (Tons)	Gillnet Harvest (Tons)	Total Harvest (Tons)	Date Management Section Closed
North District						
NA10	Shuyak Island	20	0.0	0.0	0.0	30-Jun
NA20	Delphin Bay	Closed	0.0	0.0	0.0	-
NA30	Perenosa Bay	Closed	0.0	0.0	0.0	-
NA40	Seal Bay	Closed	0.0	0.0	0.0	-
NA50	Tonki Bay	Closed	0.0	0.0	0.0	-
District Total		20	0.0	0.0	0.0	
West Arm District						
WA10	Raspberry Strait	Closed	0.0	0.0	0.0	-
WA20	Malina Bay	Closed	0.0	0.0	0.0	-
WA31	Paramanof Bay	700	537.3	148.5	685.8	17-Apr
WA32	Foul Bay	100	183.3	0.0	183.3	15-Apr
WA40	Devils Inlet/Bluefox B.	20	0.0	0.0	0.0	30-Jun
WA50	Offshore W. Afognak	a	0.0	0.0	0.0	30-Jun
District Total		820	720.6	148.5	869.1	
South Afognak District						
SA10	Izhut Bay	Closed	0.0	0.0	0.0	-
SA20	Kitoi Bay	Closed	0.0	0.0	0.0	-
SA30	MacDonalds Lagoon	Closed	0.0	0.0	0.0	-
SA40	Danger Bay	Closed	0.0	0.0	0.0	-
SA50	Litnik	Closed	0.0	0.0	0.0	-
SA60	Duck Bay	Closed	0.0	0.0	0.0	-
District Total		Closed	0.0	0.0	0.0	
Uganik District						
UG10	Kupreanof	10	0.0	0.0	0.0	30-Jun
UG20	Viekoda Bay	75	3.5	52.9	56.4	14-May
UG21	Terror Bay	250	224.9	26.7	251.6	17-Apr
UG30	Village Island	250	323.7	12.8	336.5	15-Apr
UG31	W. Uganik Pass	20	166.3	2.8	169.1	19-Apr
UG32	NE. Arm Uganik	30	100.7	0.0	100.7	18-Apr
UG33	E. Arm Uganik	125	104.1	16.2	120.3	21-Apr
UG34	S. Arm Uganik	180	225.6	11.8	237.4	23-Apr
UG40	Offshore Uganik	a	0.0	0.0	0.0	30-Jun

-Continued-

Table 4. (page 2 of 3)

Statistical Area	Management Section	GHL (Tons)	Seine Harvest (Tons)	Gillnet Harvest (Tons)	Total Harvest (Tons)	Date Management Section Closed
Uyak District						
UY10	Offshore Uyak	Closed	0.0	0.0	0.0	-
UY20	Harvester Island	Closed	0.0	0.0	0.0	-
UY30	Inner Uyak Bay	Closed	0.0	0.0	0.0	-
UY31	Larsen Bay	Closed	0.0	0.0	0.0	-
UY32	Browns Lagoon	Closed	0.0	0.0	0.0	-
UY40	Zachar Bay	Closed	0.0	0.0	0.0	-
UY50	Spiridon Bay	Closed	0.0	0.0	0.0	-
District Total		Closed	0.0	0.0	0.0	
Alitak District						
AL10	Outer Alitak	Exploration	0	0	0	30-Jun
AL20	Inner Alitak	Exploration	1	0	1	30-Jun
AL21	Inner Deadman Bay	40	0.0	0.0	0.0	30-Jun
AL22	Outer Deadman Bay	50	10.2	0.0	10.2	30-Jun
AL30	Sulua Bay	240	72.9	126.3	199.2	16-May
AL31	Portage Bay	75	91.8	2.1	93.9	2-Jun
AL40	Lower Olga/Moser	15	0.0	0.0	0.0	30-Jun
AL41	N.Upper Olga Bay	10	0.0	0.0	0.0	30-Jun
AL50	Upper Olga Bay	40	0.0	0.0	0.0	30-Jun
AL60	Geese/Twoheaded	15	11.5	4.0	15.5	30-Jun
District Total		390	187.4	132.4	319.8	
Sturgeon/Halibut District						
SH10	Sturgeon/Halibut	Exploration	0.0	0.0	0.0	30-Jun
East Side District						
EA10	Kaiugnak	20	0	0	0	30-Jun
EA20	SW. Sitkalidak	20	0.0	0.0	0.0	30-Jun
EA21	Three Saints Bay	40	15.3	15.5	30.8	12-May
EA22	Newman Bay	20	0.0	0.0	0.0	30-Jun
EA23	W.Sitkalidak Bay	100	0.0	5.9	5.9	8-May
EA24	Barling Bay	50	15.4	33.2	48.6	30-Apr
EA30	E.Sitkalidak Strait	200	10.0	32.2	42.2	8-May
EA31	Tanginak Anchorage	15	0.0	0.0	0.0	30-Jun
EA40	Outer Sitkalidak	Exploration	0.0	0.0	0.0	30-Jun
EA41	Boulder Bay	Exploration	0.0	2.4	2.4	30-Jun
EA42	Shearwater Bay	90	75.7	67.0	142.7	26-Apr
EA43	Outer Kiliuda Bay	90	106.1	6.7	112.8	3-May
EA44	Inner Kiliuda Bay	90	121.0	24.7	145.7	8-May
EA50	Outer Ugak Bay	60	38.9	1.0	39.9	7-May
EA51	Inner Ugak Bay	90	112.7	1.0	113.7	5-May
EA52	Pasagshak Bay	15	13.1	2.9	16.0	8-May
District Total		910	318.2	192.3	510.5	

-Continued-

Table 4. (page 3 of 3)

Statistical Area	Management Section	GHL (Tons)	Seine Harvest (Tons)	Gillnet Harvest (Tons)	Total Harvest (Tons)	Date Management Section Closed
North Marmot District						
NE10	Womens Bay	30	0.0	0.8	0.8	30-Jun
NE20	Kalsin Bay	10	22.0	0.0	22.0	16-May
NE30	Middle Bay	10	0.0	0.0	0.0	30-Jun
NE40	Inshore Chiniak	10	0.0	0.0	0.0	30-Jun
NE50	Offshore Chiniak	Exploration	0.0	0.0	0.0	30-Jun
District Total		60	22.0	0.8	22.8	
Inner Marmot District						
IM10	Monashka Bay	Exploration	0.0	0.0	0.0	30-Jun
IM20	Anton Larsen Bay	Closed	0.0	0.0	0.0	-
IM30	Sharatin Bay	Closed	0.0	0.0	0.0	-
IM40	Kizhuyak Bay	Closed	0.0	0.0	0.0	-
IM50	Spruce Island	10	0.0	0.0	0.0	30-Jun
District Total		10	0.0	0.0	0.0	
North Mainland District						
NM10	Hallo Bay	Exploration	0.0	0.0	0.0	30-Jun
NM20	Inner Kukak	25	0.0	8.1	8.1	30-Jun
NM30	Outer Kukak	a	0.0	0.0	0.0	30-Jun
NM40	Missak Bay	Exploration	0.0	0.0	0.0	30-Jun
District Total		25	0.0	8.1	8.1	
Mid Mainland District						
MM10	Inner Katmai	50	31.4	0.0	31.4	30-Jun
MM20	Outer Katmai	a	0.0	0.0	0.0	30-Jun
MM30	Alinchak	30	0.0	0.0	0.0	30-Jun
MM40	Puale Bay	Exploration	0.0	0.0	0.0	30-Jun
MM50	Portage Bay	Exploration	0.0	0.0	0.0	30-Jun
MM60	Outer Portage-Puale	a	0.0	0.0	0.0	30-Jun
District Total		80	31.4	0.0	31.4	
South Mainland District						
SM10	Wide Bay	95	11.0	0.0	11.0	30-Jun
SM20	Lower Shelikof	Exploration	0.0	0.0	0.0	30-Jun
District Total		95	11.0	0.0	11.0	
Grand Total		3,335	2,929.4	695.8	3,234.9	

^a These are offshore management sections which are not expected to yield herring of sac roe quality.

^b These sections are more applicable to the food/bait fishery. (See Herring Food/Bait Management Plan).

Table 5. Percent age composition of sac roe herring samples from the commercial seine harvest by section, Kodiak Management Area, 1997.^a

Section	Harvest (tons)	Ages										n
		2	3	4	5	6	7	8	9	10	11+	
Paramanof Bay	686	-	1.4	9.5	3.8	5.8	7.1	5.1	62.5	3.2	1.2	827
Foul Bay	183	-	1.4	10.6	6.5	4.6	7.8	8.5	56.4	2.3	1.6	562
Viekoda Bay	56	-	73.9	23.6	1.9	0.2	-	0.2	-	-	-	364
Terror Bay	252	-	18.9	30.1	7.2	5.5	5.5	1.9	26.7	2.1	1.4	411
Village Islands	336	-	1.4	5.9	2.8	8.5	9.9	4.0	63.8	2.6	0.9	423
W. Uganik Passage	169	-	4.6	25.7	12.5	6.1	8.9	3.5	36.5	1.3	0.5	536
E. Arm Uganik	120	-	10.2	10.5	3.6	7.2	12.0	4.2	47.4	3.0	1.5	331
S. Arm Uganik	237	-	3.2	5.3	3.7	7.8	9.2	3.0	62.0	3.5	1.8	485
Sulua Bay	199	-	14.8	24.3	3.6	23.9	1.8	1.4	12.7	14.4	2.8	493
Portage Bay	94	-	6.5	29.9	2.1	32.1	0.7	1.4	5.8	14.5	6.5	137
Three Saints Bay	31	-	32.6	53.5	0.8	3.0	0.8	-	0.8	6.8	1.3	364
Barling Bay	49	-	4.5	67.7	2.4	15.6	2.0	-	3.1	4.1	0.3	288
Shearwater Bay	143	-	6.3	75.3	0.9	5.4	0.4	0.4	1.4	8.5	0.9	422
Outer Kiliuda Bay	113	-	3.7	69.9	0.7	5.9	0.3	0.6	1.3	16.1	1.1	795
Inner Kiliuda Bay	146	-	4.0	74.3	0.7	5.9	0.0	0.5	1.3	12.3	0.3	1,026
Outer Ugak Bay	40	-	1.4	94.6	0.5	1.6	0.1	0.1	-	1.0	0.3	561
Inner Ugak Bay	114	-	4.2	93.1	1.2	0.9	-	-	-	0.1	0.1	542
Kalsin Bay	22	0.2	14.6	82.0	0.8	0.8	0.8	-	-	0.5	-	362
Inner Katmai	31	0.7	29.4	25.3	10.4	17.2	3.5	5.5	7.1	0.5	-	394
All samples combined 19 sections ^b	3,021	0.0	7.2	28.2	4.0	8.1	5.6	3.1	37.0	5.0	1.3	9,323

^a Of the 30 management units exploited in 1997, samples were collected from 19 (66%). These 19 units yielded 3,021 tons or 93% of the management areas total harvest of 3,235.

^b All samples combined data, weights the percent of the harvest by section to the age class data to estimate the combined purse seine age composition.

Table 6. Average weight-at-age (g) from the commercial seine harvest for the sac roe herring fishery, by section, Kodiak Management Area, 1997.^a

Section	Harvest (tons)	Average Weight-at-Age (g)										n
		2	3	4	5	6	7	8	9	10	11+	
Paramanof Bay	686	-	91	134	161	194	221	234	247	259	273	826
Foul Bay	183	-	92	127	157	200	211	233	240	250	274	561
Viekoda Bay	56	-	82	116	124	150	-	196	-	-	-	364
Terror Bay	252	-	84	117	147	183	206	207	222	243	243	410
Village Islands	336	-	100	141	174	196	212	223	240	239	268	422
W. Uganik Passage	169	-	93	133	156	184	201	220	237	241	280	536
E. Arm Uganik	120	-	90	129	160	190	216	228	239	241	245	331
S. Arm Uganik	237	-	91	135	162	190	203	220	240	251	263	485
Sulua Bay	199	-	113	145	189	235	243	289	293	318	323	492
Portage Bay	94	-	117	159	175	234	227	243	288	313	324	137
Three Saints Bay	31	-	116	146	165	241	200	-	321	319	374	362
Barling Bay	49	-	117	155	178	225	254	-	294	321	434	288
Shearwater Bay	143	-	116	140	184	233	268	335	278	318	285	421
Outer Kiliuda Bay	113	-	117	149	163	247	289	299	307	318	328	792
Inner Kiliuda Bay	146	-	110	144	159	235	246	262	305	309	351	1,026
Outer Ugak Bay	40	-	111	142	211	227	288	243	-	283	317	561
Inner Ugak Bay	114	-	101	136	162	192	-	-	-	334	277	539
Kalsin Bay	22	76	94	132	141	173	203	-	-	264	-	362
Inner Katmai	31	39	86	128	164	191	226	240	248	273	-	388
All samples combined 19 sections ^b	3,021	51	98	136	164	203	212	224	236	266	274	9,303

^a Of the 30 management units exploited in 1997, samples were collected from 19 (66%). These 19 units yielded 3,021 tons or 93% of the management area's total harvest of 3,235 tons.

^b All samples combined data, weights the percent of the harvest by section to the age class data to estimate the overall weight at age data.

Table 7. Historical food and bait herring harvest for the Kodiak Management Area, 1912-1997.

Year	Tons	Year	Tons	Year	Tons
1912	20	1941	40,084	1970	8
1913	0	1942	16,791	1971	44
1914	0	1943	35,352	1972	50
1915	0	1944	26,835	1973	178
1916	70	1945	31,114	1974	40
1917	138	1946	47,506	1975	5
1918	118	1947	50,743	1976	No data
1919	260	1948	46,428	1977	No data
1920	46	1949	0	1978	399
1921	945	1950	44,133	1979	125
1922	1,483	1951	4,299	1980	381
1923	322	1952	1,389	1981	18
1924	4,823	1953	725	1982	326
1925	9,997	1954	0	1983	33
1926	2,681	1955	0	1984	123
1927	2,593	1956	13,524	1985	102
1928	625	1957	21,219	1986	213
1929	No data	1958	1,711	1987	217
1930	622	1959	3,831	1988	340
1931	1,000	1960	0	1989	345
1932	3,594	1961	0	1990	313
1933	2,313	1962	0	1991	215
1934	60,000	1963	0	1992	312
1935	No data	1964	310	1993	837
1936	24,748	1965	35	1994	677
1937	27,659	1966	198	1995	507
1938	24,522	1967	300	1996	651
1939	38,601	1968	15	1997	756
1940	22,677	1969	11		

Table 8. Age, weight, and length summary of the commercial food/bait herring fishery samples by district and gear type, Kodiak Management Area, 1997.

<i>District, Stat. Area, Sample #</i>	<i>Gear Type</i>	Ages										Average	N
		2	3	4	5	6	7	8	9	10	11+		
Northeast, (F/B 9), Sample #1	Seine	1.0	11.2	79.4	3.8	2.1	0.3	0.0	1.0	1.0	0.0		286
Eastside, (F/B 8), Sample #1	Seine	0.0	15.6	61.5	1.0	4.2	1.0	0.0	5.2	10.4	1.0		96
Eastside, (F/B 8), Sample #2	Seine	0.0	1.0	44.9	4.4	4.4	2.9	1.5	18.0	22.4	0.5		205
West Afognak (F/B 1), Sample #1	Seine	3.6	23.1	14.7	9.6	4.8	10.5	7.8	22.2	2.1	1.5		333
Uganik, (F/B 4), Sample #1	Seine	7.3	38.5	38.0	10.1	2.8	1.7	0.6	1.1	0.0	0.0		179
Uganik, (F/B 4), Sample #2	Seine	9.4	22.8	34.0	16.1	3.3	3.3	3.0	5.8	0.6	1.5		329
Uganik, (F/B 4), Sample #3	Trawl	18.1	27.1	22.9	10.6	4.0	7.4	4.4	4.2	0.7	0.5		568
		Average Weight-at-Age (g)											
Northeast, (F/B 9), Sample #1	Seine	105	159	177	194	220	277	0	292	325	0	179	286
Eastside, (F/B 8), Sample #1	Seine	0	159	188	229	287	311	0	325	344	349	214	96
Eastside, (F/B 8), Sample #2	Seine	0	209	208	243	329	314	347	395	401	417	298	205
West Afognak (F/B 1), Sample #1	Seine	90	137	165	217	241	266	273	292	312	341	218	333
Uganik, (F/B 4), Sample #1	Seine	90	134	178	197	219	237	319	280	0	0	161	177
Uganik, (F/B 4), Sample #2	Seine	93	136	176	203	231	284	271	292	282	361	182	329
Uganik, (F/B 4), Sample #3	Trawl	89	128	165	203	226	250	263	269	314	280	164	568
		Average Length-at-Age (mm)											
Northeast, (F/B 9), Sample #1	Seine	193	214	222	230	241	260	0	265	267	0	223	286
Eastside, (F/B 8), Sample #1	Seine	0	222	229	250	256	259	0	268	273	272	236	96
Eastside, (F/B 8), Sample #2	Seine	0	240	238	252	270	261	283	282	284	281	260	205
West Afognak (F/B 1), Sample #1	Seine	176	202	215	232	239	245	251	253	256	262	229	333
Uganik, (F/B 4), Sample #1	Seine	180	201	220	223	230	238	250	247	0	0	211	179
Uganik, (F/B 4), Sample #2	Seine	180	208	224	231	242	251	249	256	251	275	222	329
Uganik, (F/B 4), Sample #3	Trawl	182	203	219	232	241	246	248	252	258	247	215	568

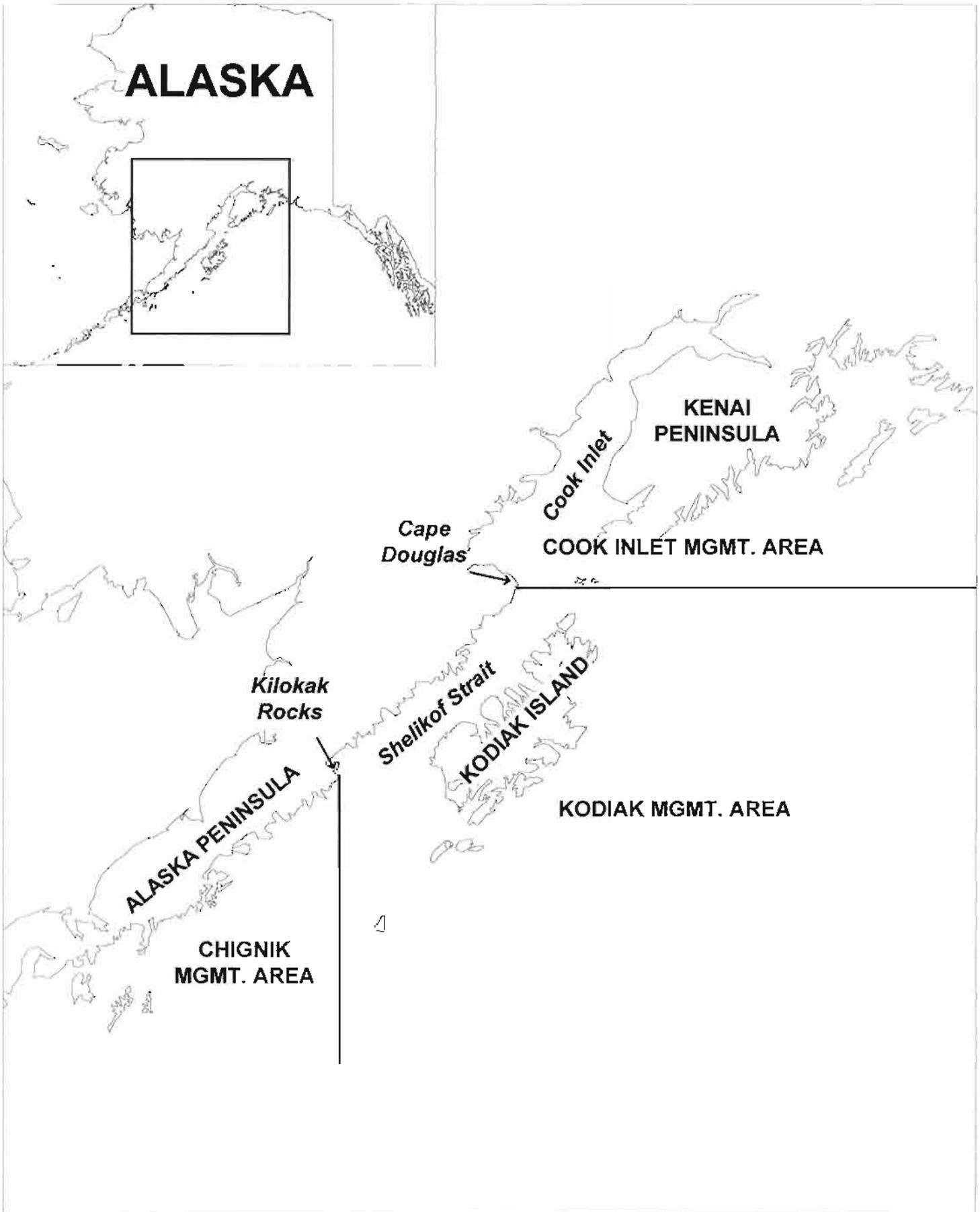


Figure 1. Map of southwestern Alaska emphasizing the Kodiak Management Area and its relationship to surrounding management areas.

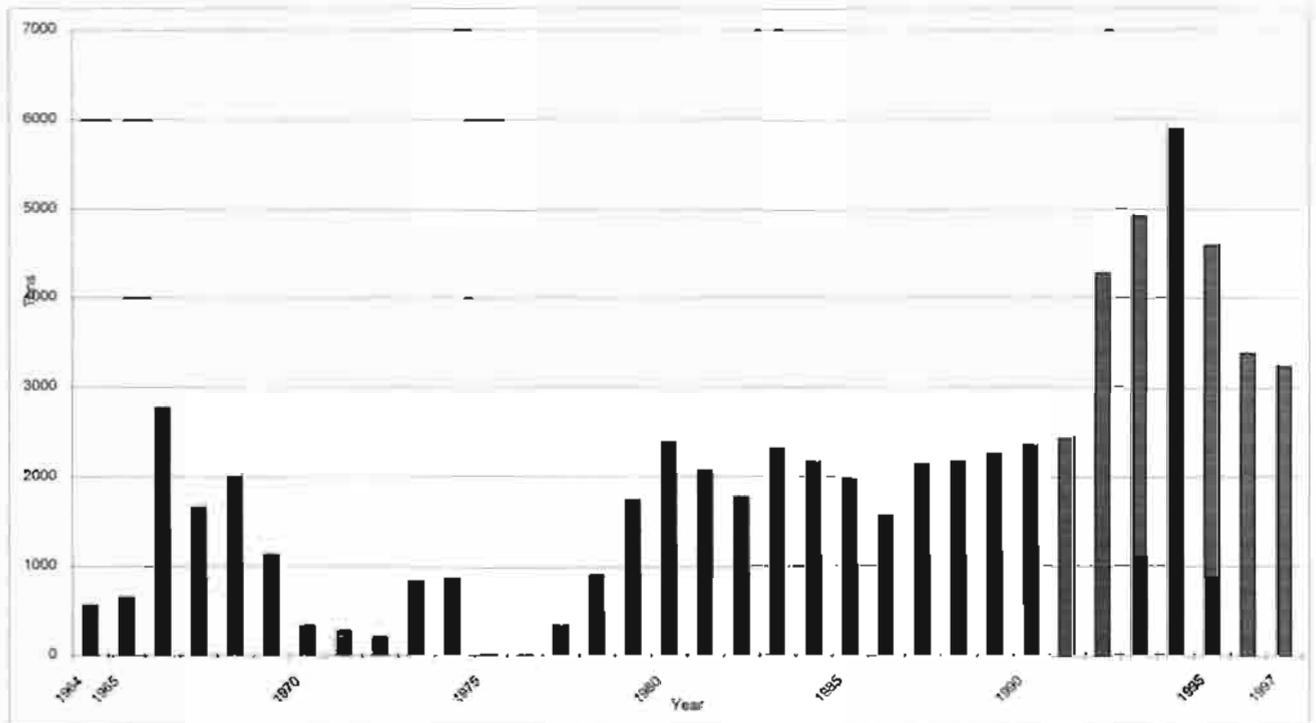


Figure 2. Historical sac roe herring harvest for the Kodiak Management Area, 1964-1997.

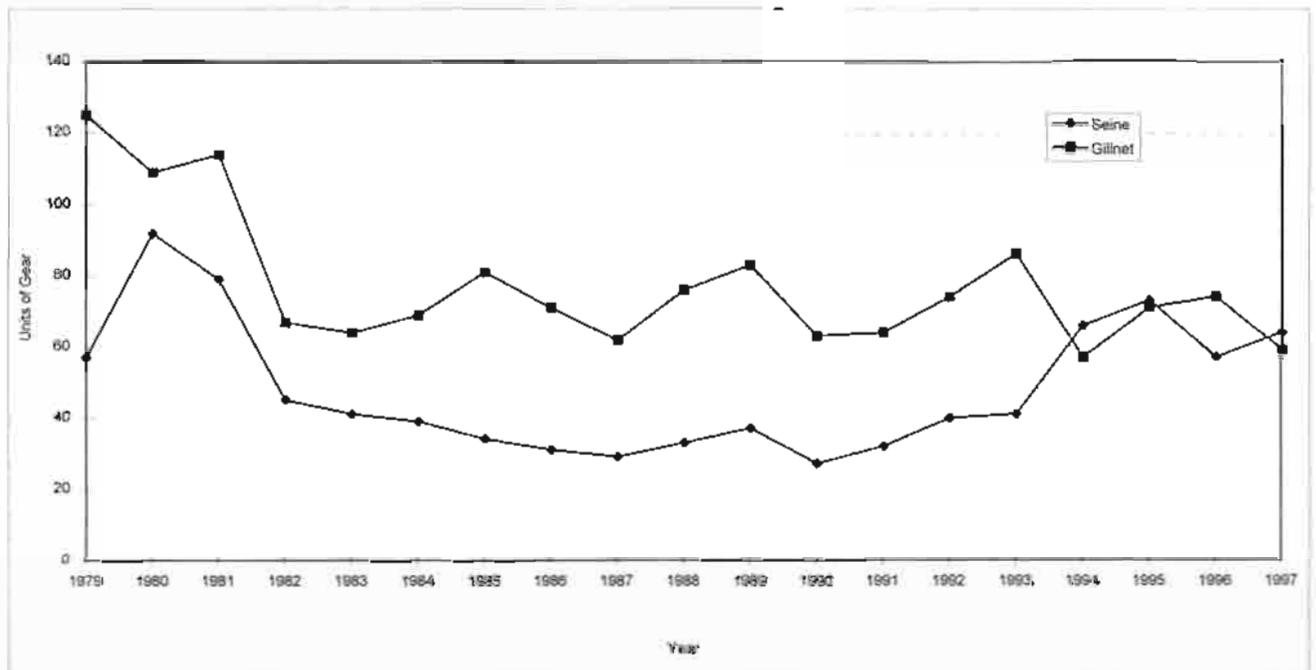


Figure 3. Number of units of each gear type which made landings in the Kodiak Management Area sac roe herring fishery, 1979-1997.

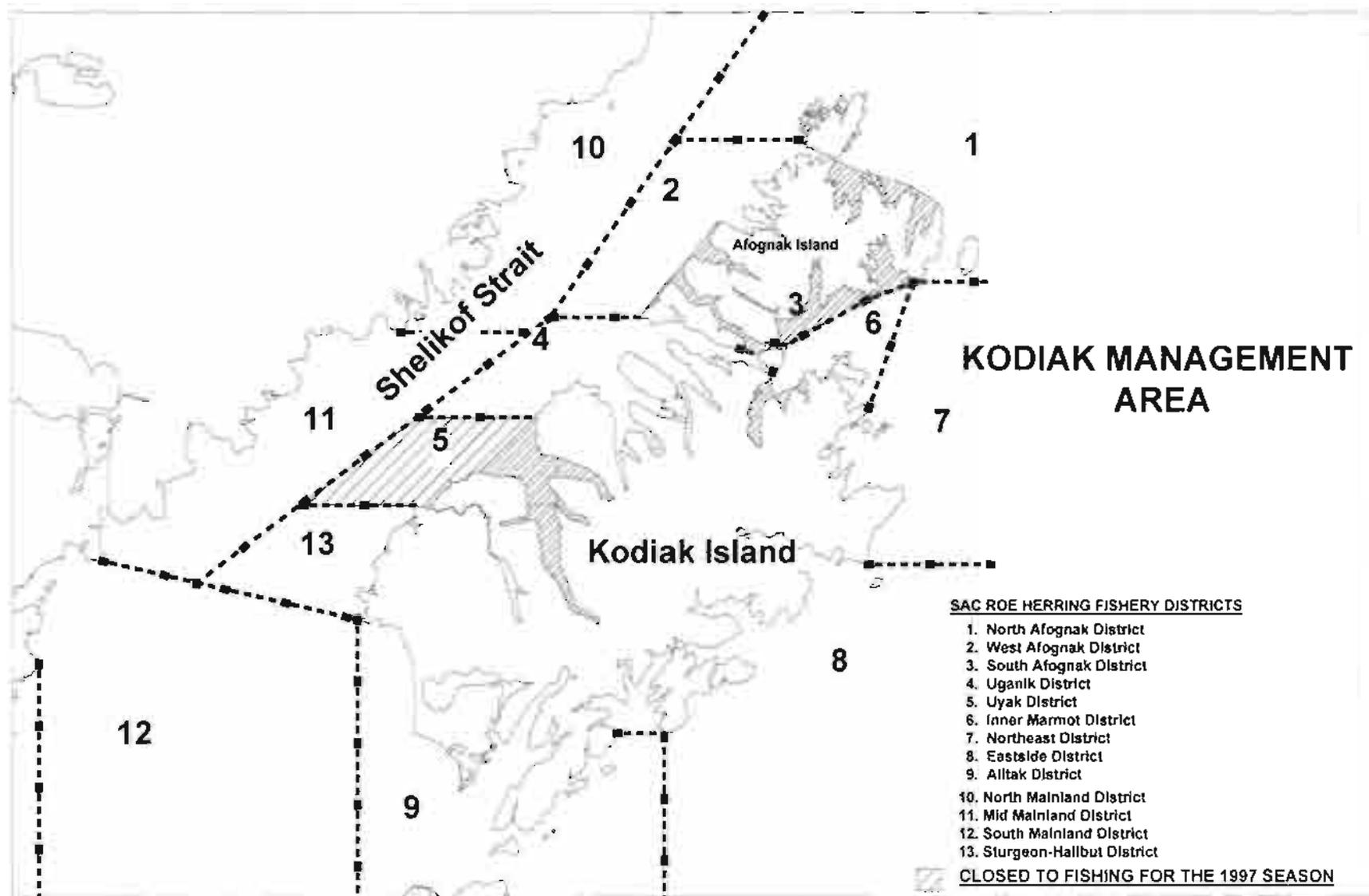


Figure 4. Map of the Kodiak Management Area illustrating the sac roe herring fishery districts and areas closed to fishing.

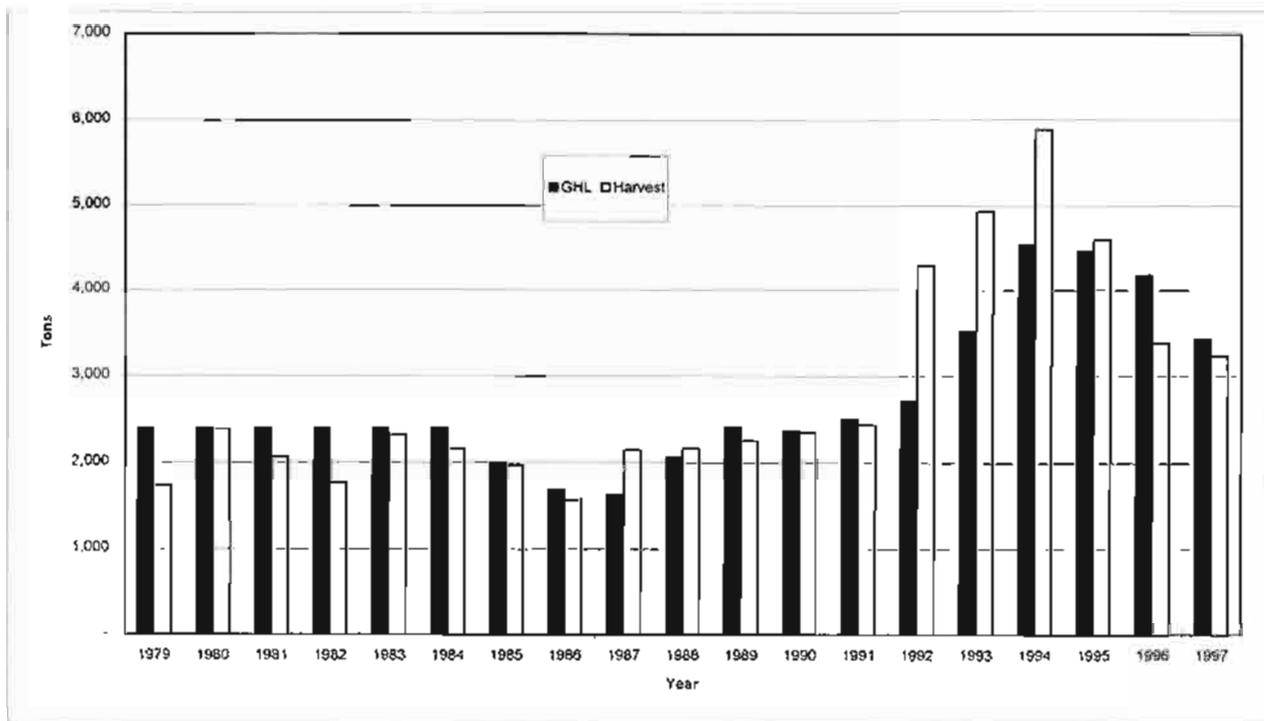


Figure 5. Comparison of the guideline harvest level (GHL) to the sac roe herring harvest in the Kodiak Management Area, 1979-1997.

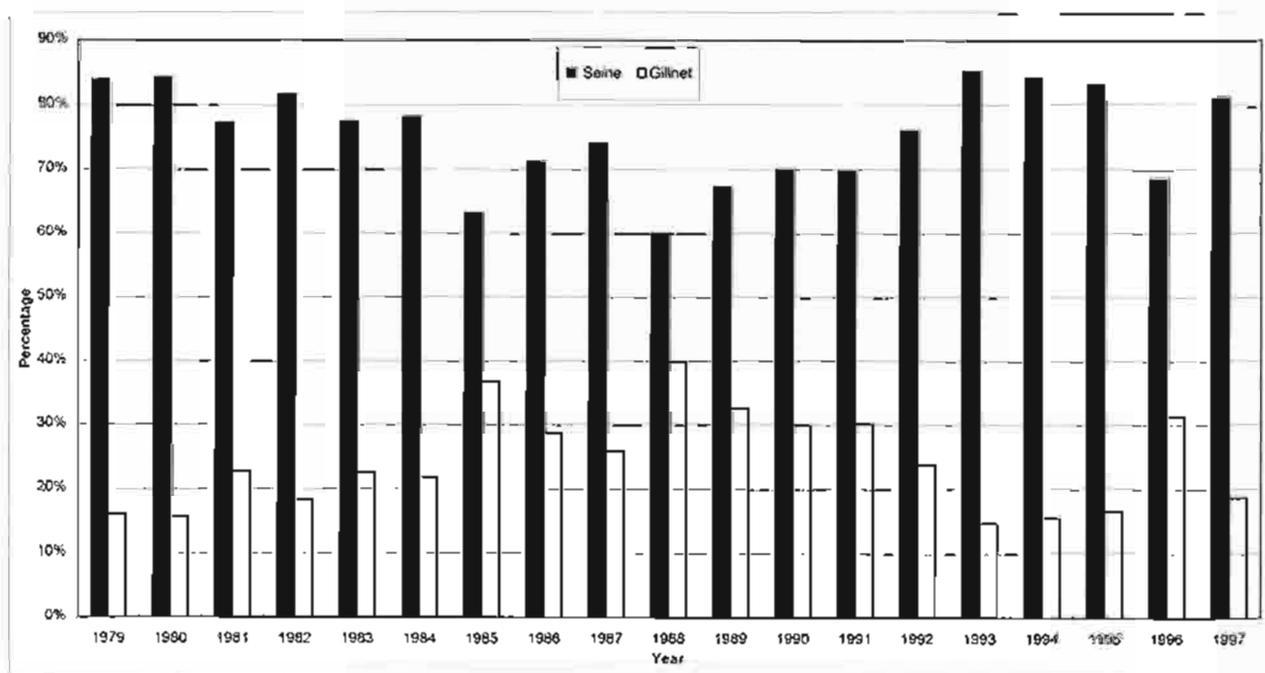


Figure 6. Percent of the sac roe herring harvest by gear type for the Kodiak Management Area, 1979-1997.

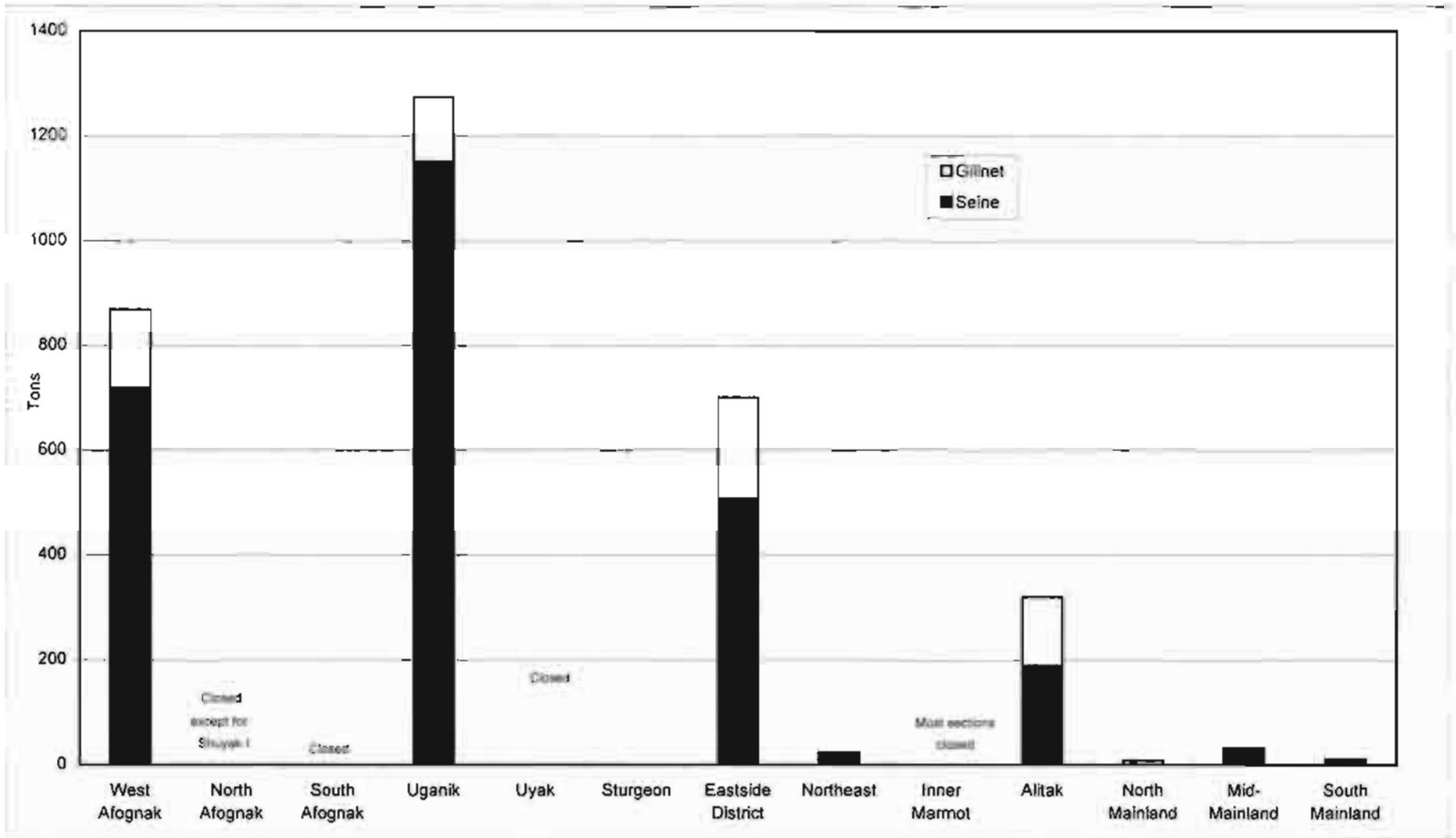


Figure 7. Sac roe herring harvest by district and gear type for the Kodiak Management Area, 1997.

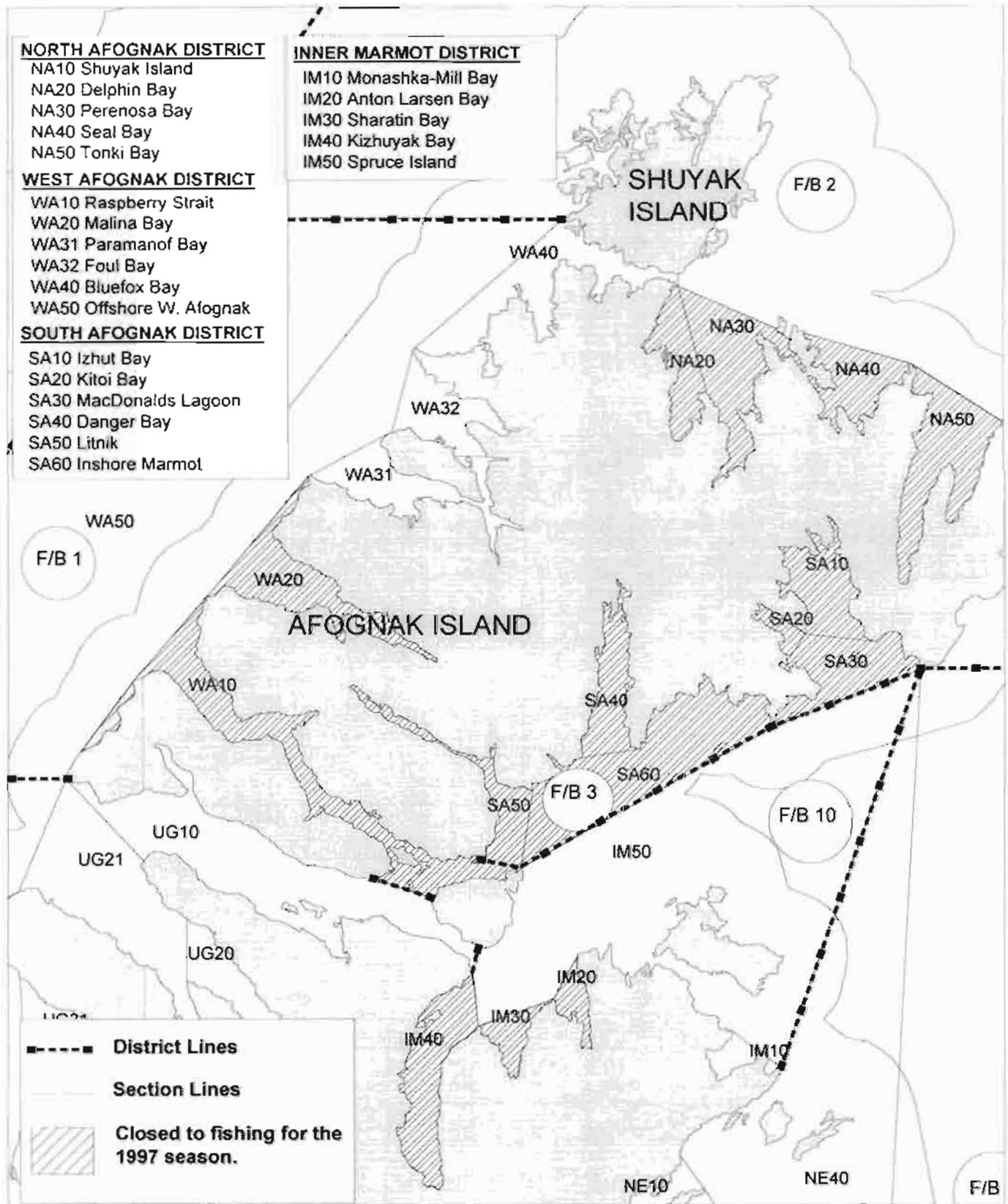


Figure 8. Statistical chart showing the North Afognak, West Afognak, South Afognak, and Inner Marmot Districts and Sections.

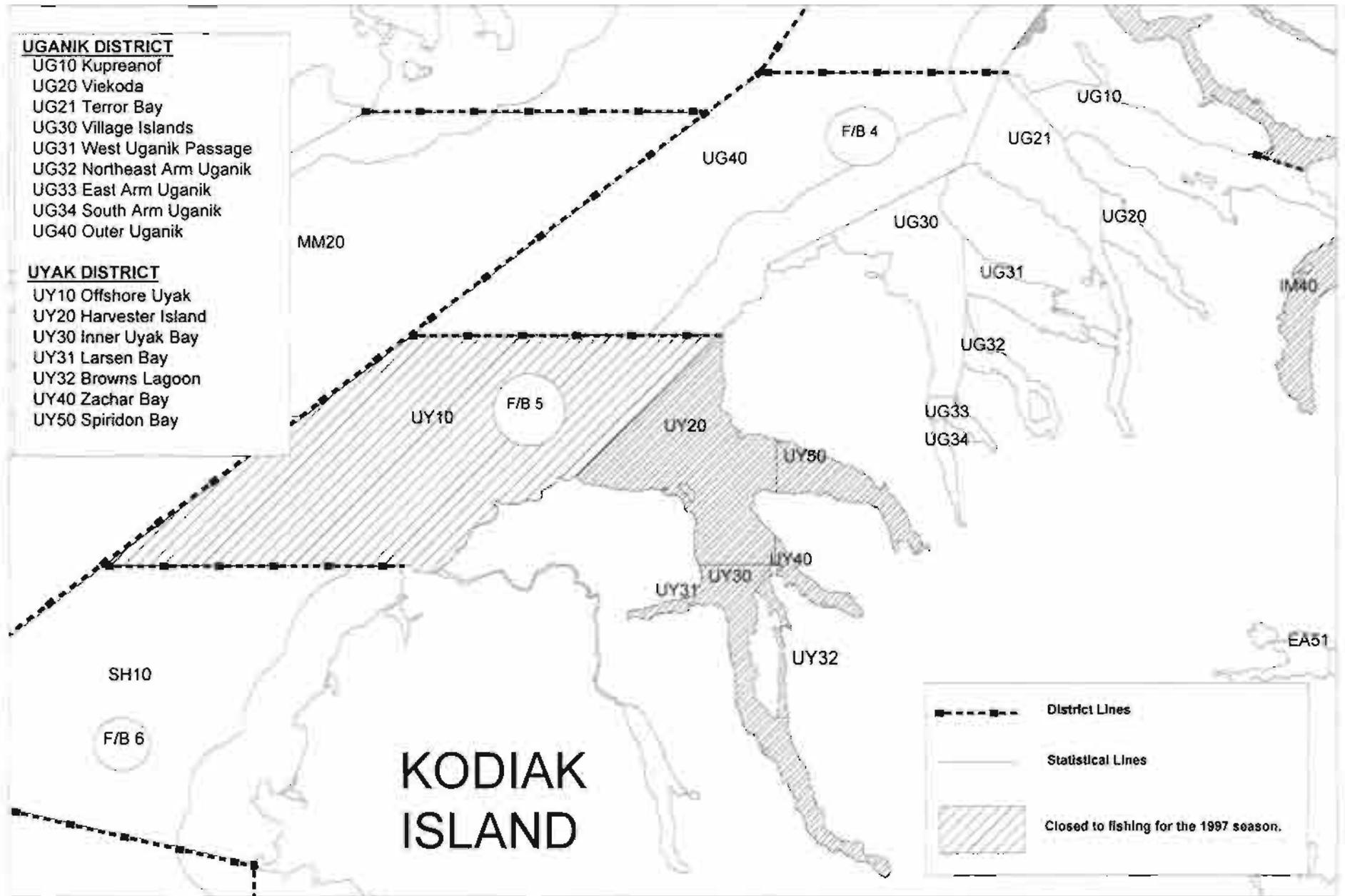


Figure 9. Statistical chart showing the Uganik and Uyak Districts and Sections.

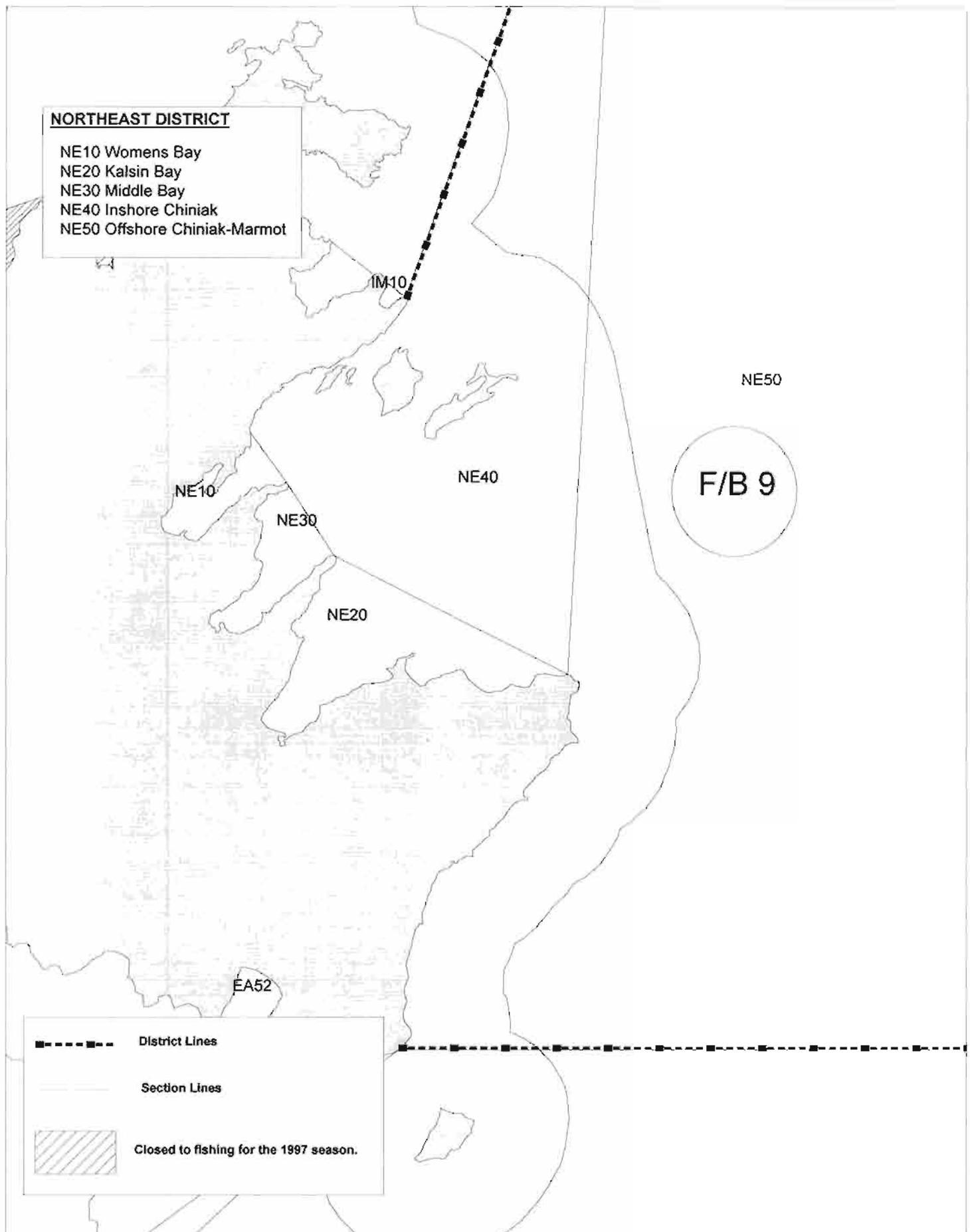


Figure 10. Statistical chart showing the Northeast District and Sections.

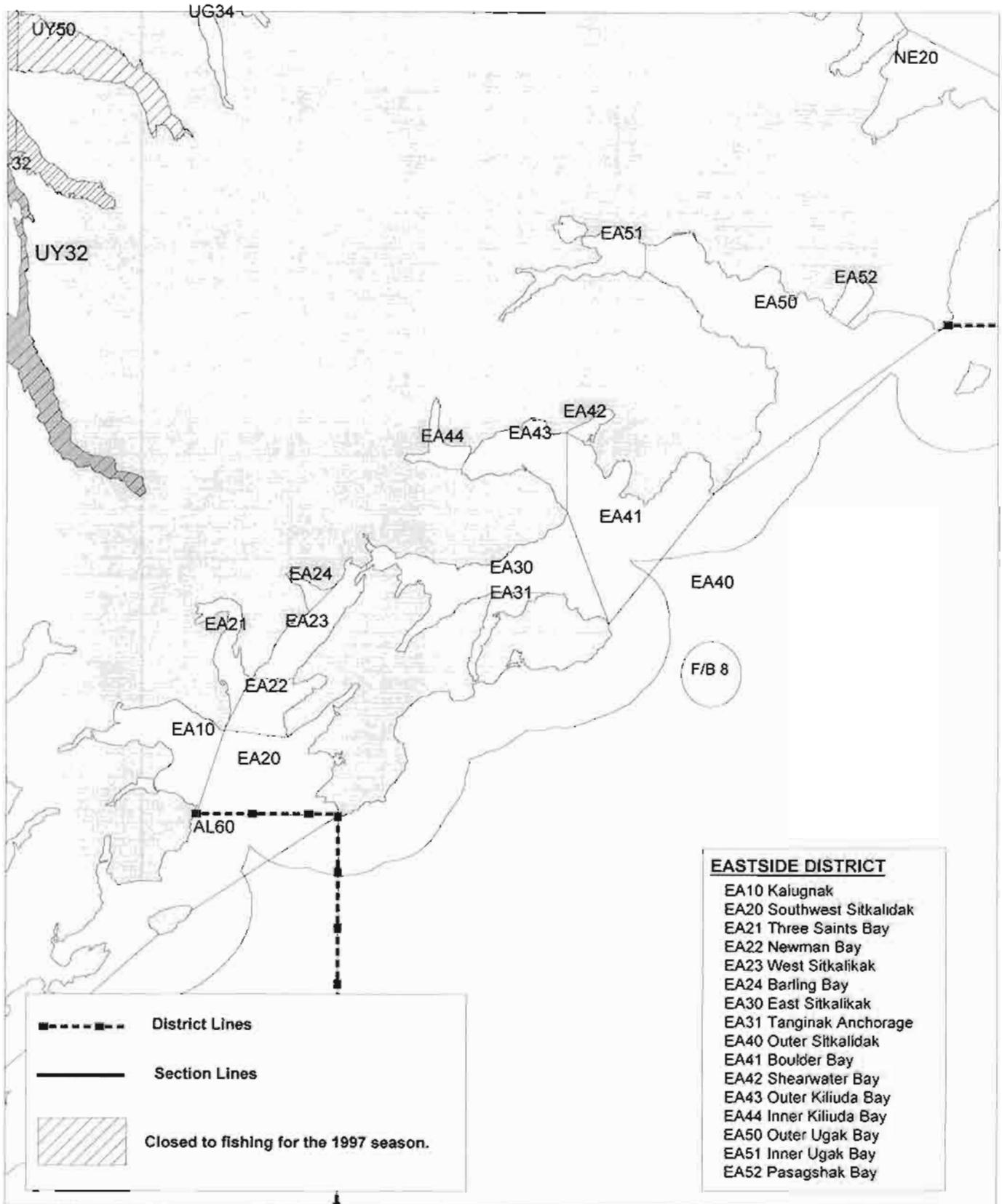


Figure 11. Statistical chart showing the Eastside District and Sections.

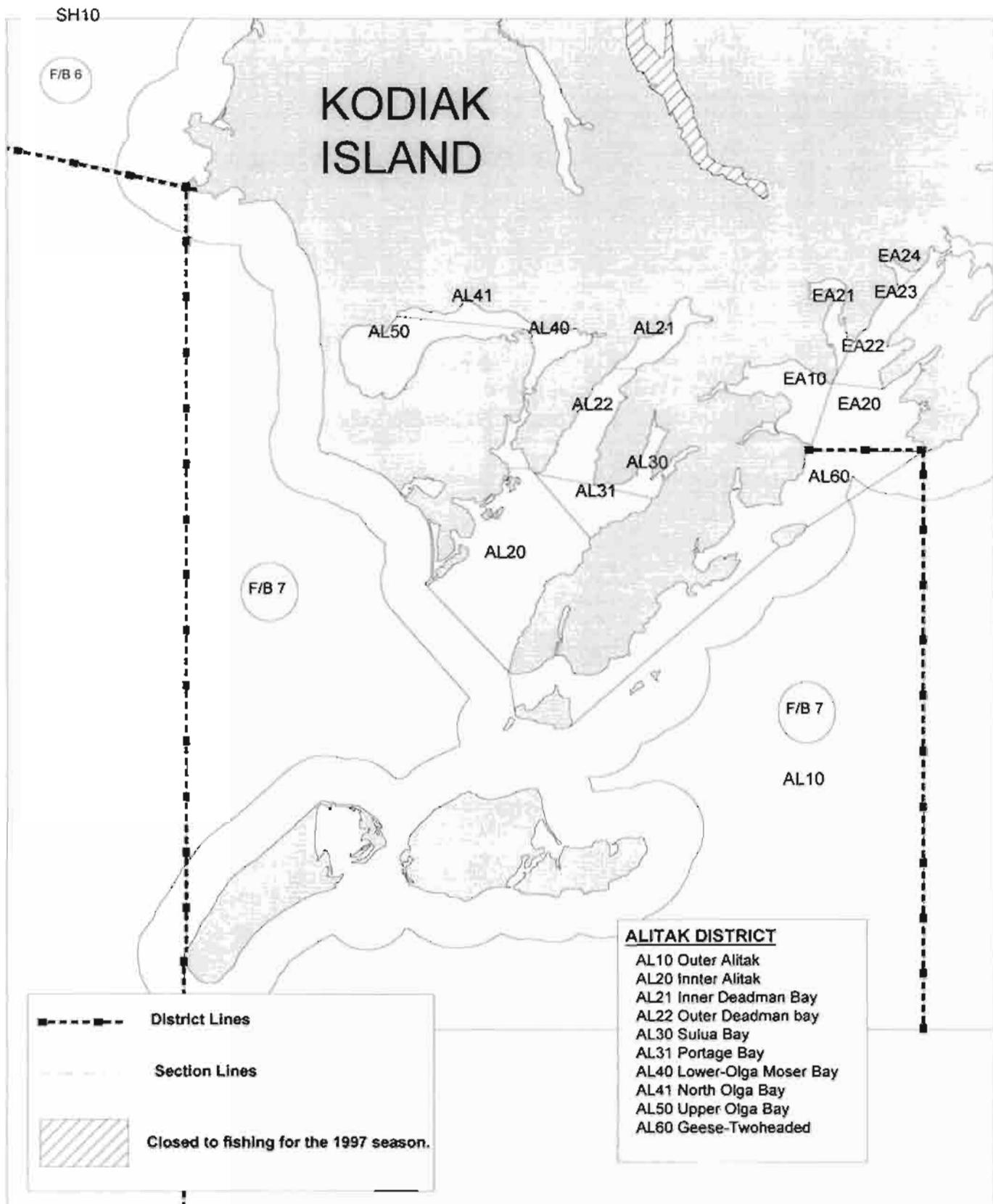


Figure 12. Statistical chart showing the Alitak District and Sections.

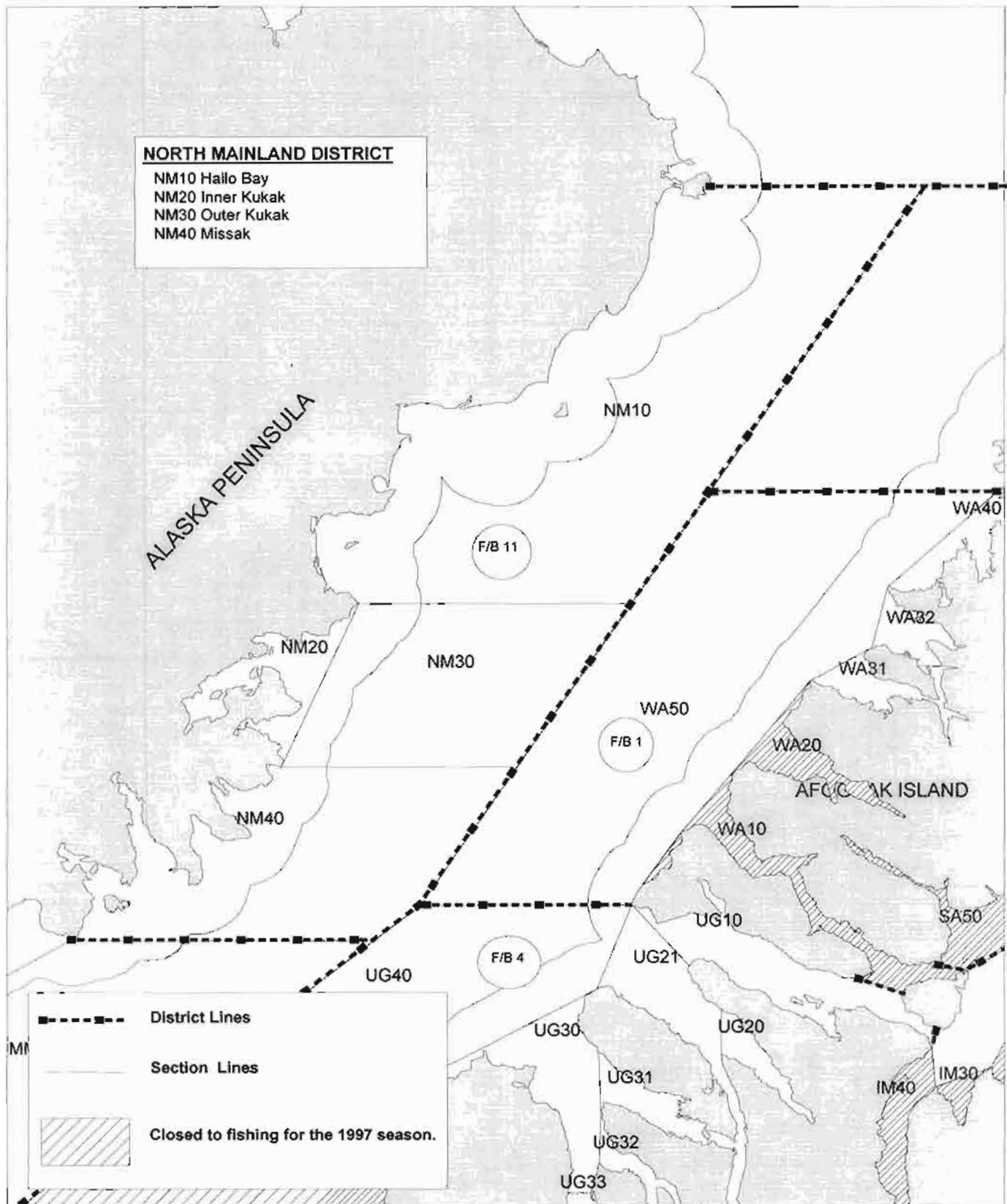


Figure 13. Statistical chart showing the North Mainland District and Sections.

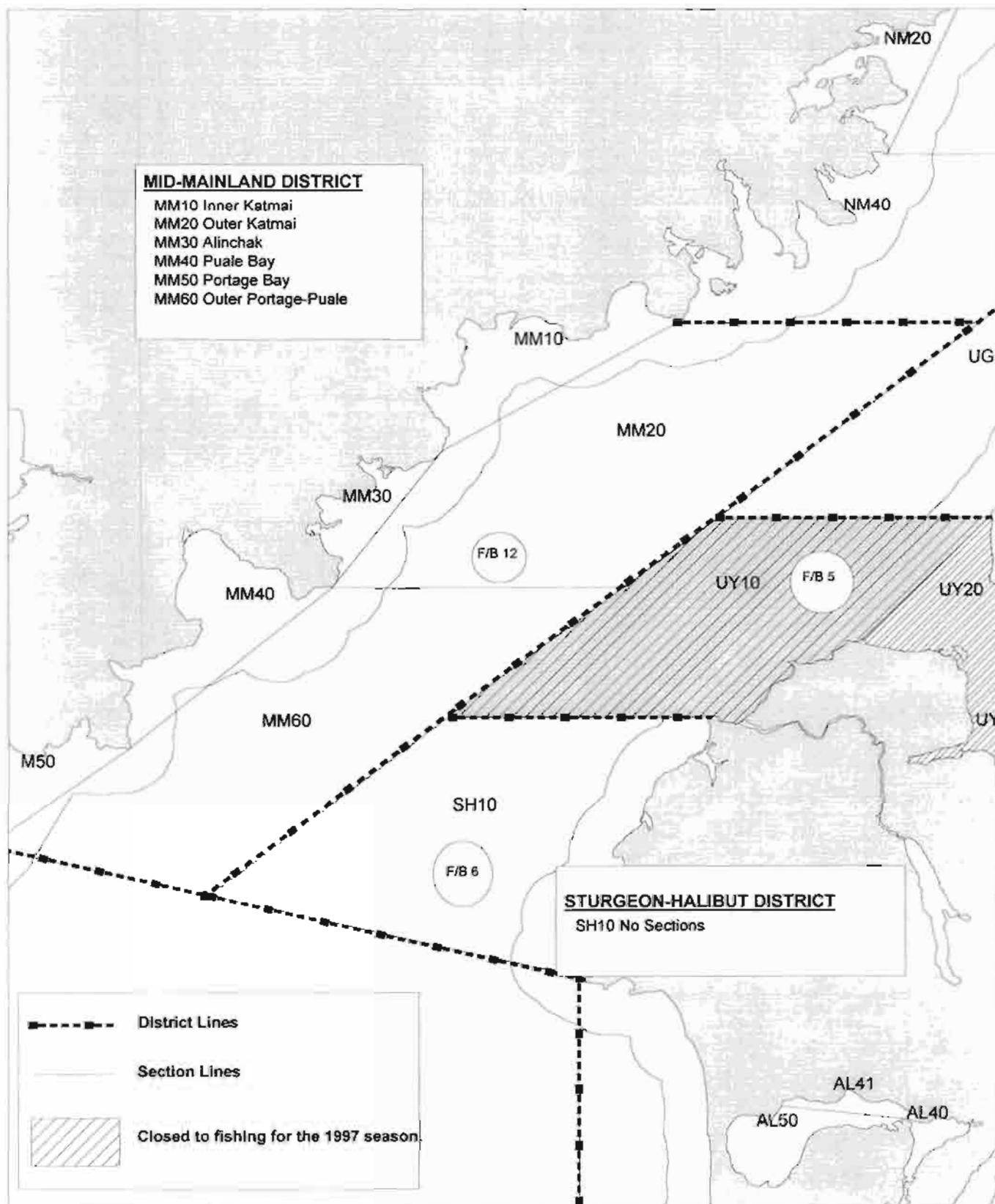


Figure 14. Statistical chart showing the Mid-Mainland and Sturgeon District and Sections.

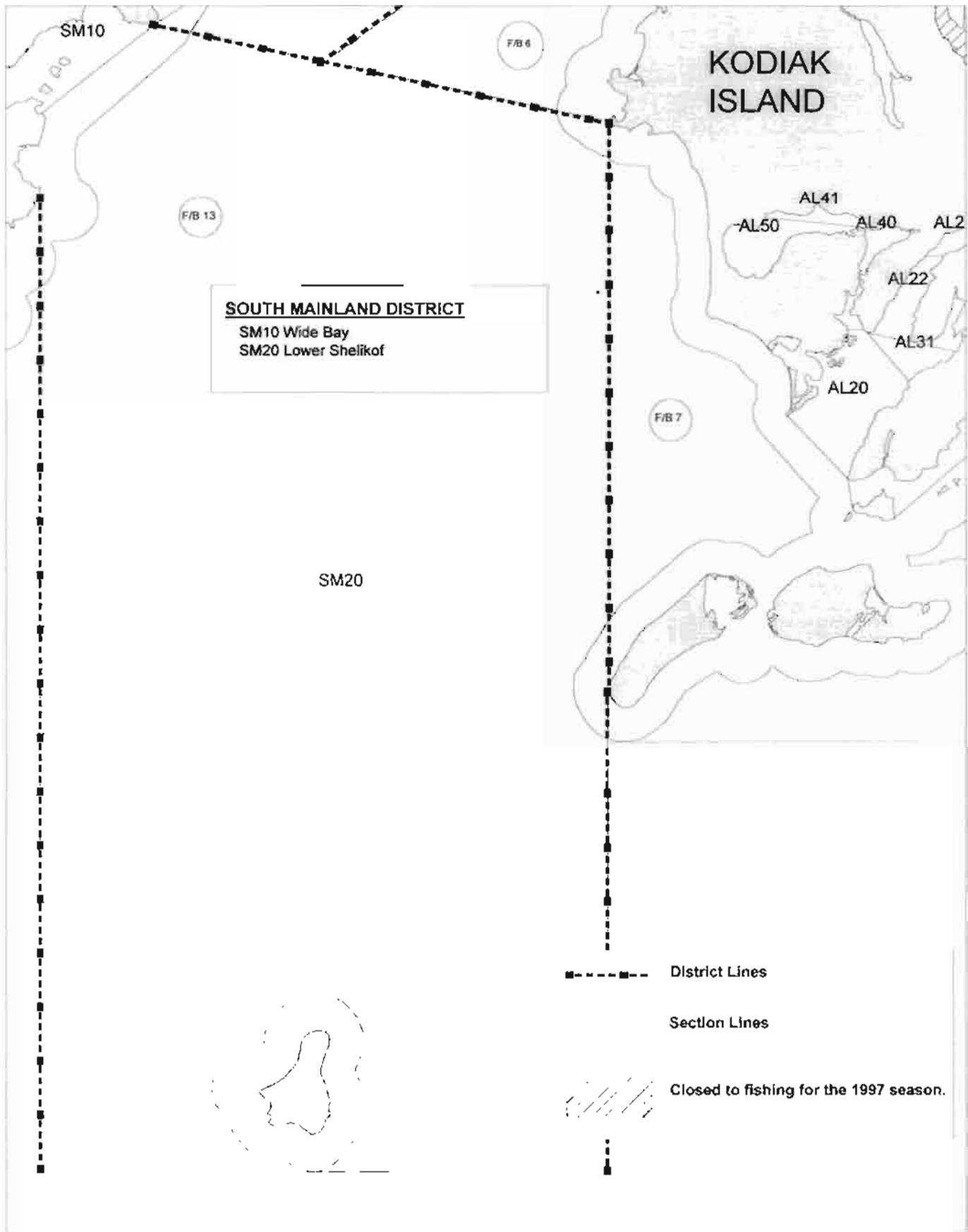


Figure 15. Statistical chart showing the South Mainland District and Sections.

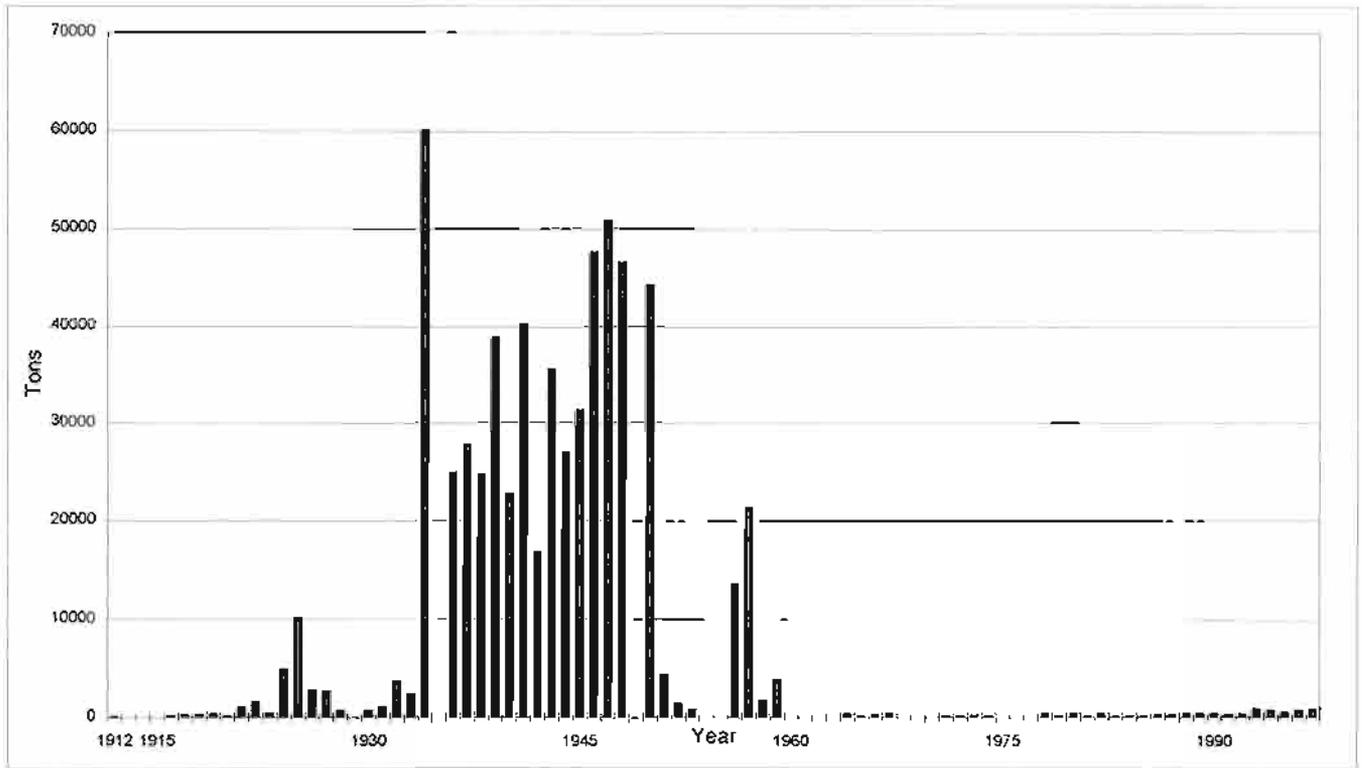


Figure 16. Historic food/bait herring harvest for the Kodiak Management Area, 1912-1997.

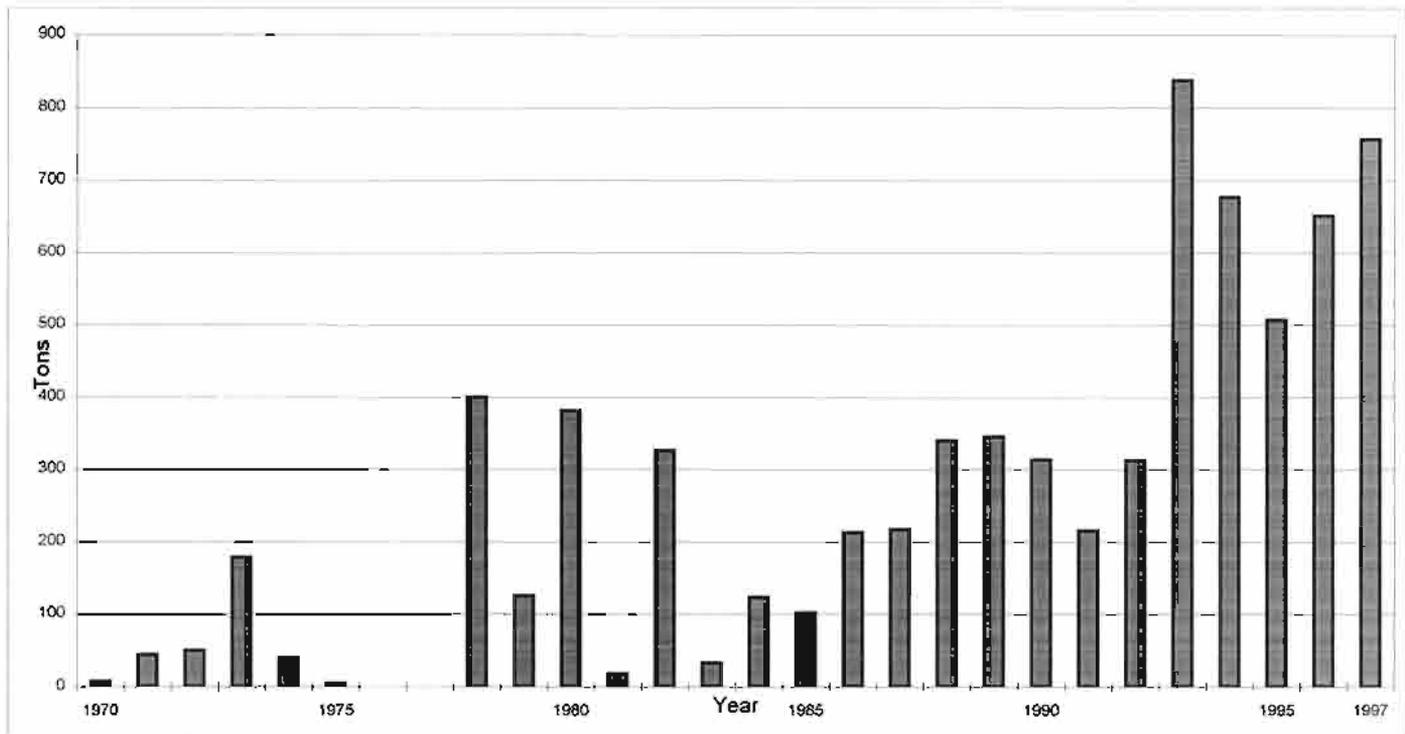


Figure 17. Historic food/bait herring harvest for the Kodiak Management Area, 1970-1997.

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