REVIEW OF THE 1998 LOWER COOK INLET AREA COMMERCIAL HERRING FISHERY

REPORT TO THE ALASKA BOARD OF FISHERIES

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INTRODUCTION

Commercial herring fishing has historically occurred in four of the five management districts established in Lower Cook Inlet (Figures 1 and 2). Herring fishing first occurred in the Southern District in 1914 with development of a gillnet fishery within Kachemak Bay (Figure 2). Eight saltries, six near Halibut Cove, were operating during the peak of the fishery. A purse seine fishery in Kachemak Bay began in 1923, but after three successive years of average annual harvests approaching 8,000 tons (1 short ton = 2,000 pounds), herring populations, and the fishery, collapsed.

The next Lower Cook Inlet herring fishery began in 1939 and was centered in the Resurrection Bay and Day Harbor areas of the Eastern District (Figure 2). Product from this purse seine fishery was used exclusively for oil and meal reduction. Peak harvests occurred during 1944-1946 and averaged 16,000 tons each year. After this time period, stocks sharply declined, apparently due to over-exploitation.

Japanese market demand for salted herring roe resulted in development of a sac roe fishery in the 1960s. The relatively high prices paid to fishermen caused rapid expansion of the fishing fleet and harvest. Conservative management strategies and guideline harvest levels were established by the department to decrease the risk of a stock collapse and to sustain this fishery. Since 1973, most sac roe harvests have occurred within the Kamishak District. The fishery was closed for five years, beginning in 1980, when stocks appeared to be in decline. The fishery reopened in 1985, and harvests have been allowed each year since that time. However, the stock is again declining and fishing will not occur in 1999.

1998 SEASON OVERVIEW

Just under 300 tons of Pacific herring were landed in the Kamishak Bay District during 1998 (Figure 1; Tables 1 and 2). The department closed the fishery on April 26 following consecutive district wide openings without significant harvests. This was the second consecutive year the herring harvest fell short of the preseason guideline, and was the smallest harvest recorded since this fishery began in 1973 (Table 1). Fifty of the 75 Lower Cook Inlet permit holders participated in the 1998 fishery, yielding 27 deliveries. Six of the eight registered processors purchased herring this season, and reported roe recoveries averaged about 9.3%. Based on an average price of $200-$250 per ton, without post-season adjustments, the total exvessel value of the 1998 harvest was estimated to be $60,000-$75,000, the lowest in the history of this fishery (Table 2).

The total herring spawning biomass in Kamishak Bay District, estimated from aerial surveys and postseason age composition analysis, was 5,000-10,000 tons. While a more precise estimate cannot

be made, all available information indicates spawning biomass is at a low level. Age composition, heavily dominated by age-4 through age-6 herring, which comprised about 68% of total biomass, was similar to preseason expectations.

No fishing was allowed in the other Lower Cook Inlet districts. Herring were not observed in sufficient quantity in the Southern District (Figure 2) to open the fishery in 1998. The Outer and Eastern Districts (Figure 2) were closed to purse seining this season since large numbers of young, age-3 and age-4, herring are know to occur within this area; roe recoveries in past years have consistently been below 10%; and, probably for these two factors, the industry shows little interest in operating within these districts.

MANAGEMENT SUMMARY - 1998 HERRING SEASON

Assessment Methods

Aerial surveys were conducted throughout the herring-spawning season to determine relative abundance and distribution of herring in the Kamishak Bay and Southern Districts. Data collection methods were consistent with those used in previous seasons (Otis et al. *in press*). Numbers and distribution of herring schools, location and extent of milt, and visibility factors affecting survey results were recorded on index maps for each survey. Three standard conversion factors were used to estimate herring biomass based on each 538 ft^2 (50 m^2) of school surface area sighted and water depth: 1) 1.52 tons for water depths of 16 ft or less), 2) 2.56 tons for water depths between 16 and 26 ft, and 3) 2.83 tons for water depths greater than 26 ft (Lebida and Whitmore 1985).

Except for a four-day storm in mid-April, survey conditions in the Kamishak Bay District throughout the early part of the season were generally good. During this time, few surveys were hampered by low cloud ceilings, fog, or high winds. However, poor weather persisted during May and June, after the fishery had been closed, which prevented surveying for long periods. During 1998, only 14 surveys were completed in the Kamishak Bay District, and three in the Southern District. No comprehensive surveys of the Outer and Eastern Districts were conducted this season.

In the Kamishak District, commercial landings were sampled to determine age, size, and sexual maturity of herring (Figure 4a). In addition, test fishing by volunteer purse seine fishers was done to collect samples for roe recovery analysis prior to the fishery. For the third consecutive year, the department used program receipts to fund a late-season (mid-May) survey to gather data on the post fishery spawning population (Hilsinger 1997). These data helped document shifts in age composition toward younger fish after the commercial fishery and facilitated evaluating the relative strength of recruiting year classes.

SPAWNING POPULATION

Kamishak Bay District

During the 1998, season aerial surveys to estimate biomass in the Kamishak Bay District were conducted from April 15 through May 13. Herring were first observed April 21, and the greatest daily biomass observation was made on May 13 (939 tons). Post-season data analysis from aerial surveys, test fishing, and commercial harvests resulted in a total spawning biomass estimate of between 5,000 and 10,000 tons, considerably lower than the preseason forecast (Table 2).

About 14% of the total biomass was composed of herring age 9 and older. Age-7 and age-8 herring represented 15%, age-5 and age-6 herring 55%, and newly recruited age-3 and age-4 herring 16% of the total spawning population.

Only limited spawning was observed this season with most sightings recorded between April 21 and May 7. All sightings were relatively small in size. The heaviest spawning observed occurred south of Bruin Bay on April 21 when about 0.7 linear miles of milt was seen.

Southern District

Only three aerial surveys of the Southern District were conducted in 1998. They occurred on May 6, May 14, and May 21, resulting in a cumulative biomass estimate of 178 tons. Most herring were observed in Mallard and Tutka bays, and the peak biomass estimate of 93 tons was made May 14 in Mallard Bay. No age composition samples were collected from the Southern District in 1998.

Outer and Eastern Districts

No aerial surveys of the Outer and Eastern Districts were conducted during the 1998 season. Both the size of this area and the characteristically poor weather in the Gulf of Alaska make aerial

biomass estimation in these two districts impractical. However, incidental observations of herring in June during the early part of the salmon season confirmed the presence of herring in these two districts again this season.

COMMERCIAL FISHERY

NOTE: Proposal #48 seeks to establish a standard method of measure for catch weight and roe percentage for Cook Inlet sac roe herring fisheries.

Kamishak Bay District

Kamishak Bay was reopened to commercial herring fishing in 1985 after a five-year closure due to a severe decline in abundance. Herring stocks appeared to rebuild quickly during the closure, and since 1985, the Kamishak Bay District has been regulated to achieve a 10-20% exploitation rate mandated by the Board of Fisheries. By 1989, fishing efficiency had increased to a level where intensive regulatory management was required to maintain harvests within guideline levels, to direct the fishery at herring aggregations with good roe, and to protect younger age herring from harvest. Management during the last nine years has stabilized the average harvest at one-half of the record high catch of 6,132 tons set in 1987 (Table 2).

The 1998 spawning biomass in the Kamishak Bay District was projected to be 19,800 tons. Based on this run, and using a 10% exploitation rate, about 1,980 tons was expected to be available for harvest. Harvest allocation in accordance with the regulatory management plan provided 1,780 tons for the Kamishak Bay sac roe fishery after subtracting 200 tons for the Shelikof Strait food and bait fishery. The Kamishak Bay Herring Management Plan also directs the department to target harvests on older age classes and limit exploitation of younger herring.

Test fishing by volunteer purse seine fishers produced the first samples of the season on April 20. The sample was taken near Contact Point and was comprised of relatively large, ripe herring (average weight 220 g, average mature roe percentage 10.6%). Based on these results, the fleet was put on one-hour advance notice effective 8:00 a.m. on April 21. Age composition analysis indicated that over 45% of the herring sampled were age-8 or older, followed in abundance by age-5 and then age-6 herring. This suggested that herring present on the grounds were older, repeat spawners that could be targeted for harvest. The sample also suggested that spawning was imminent and that smaller (i.e., younger) herring already were beginning to appear on the grounds. Managers were concerned that further delay of a fishery opening could result in reduced roe recoveries due to an increase in the incidence of younger (immature) herring and an increase in the number of spawned herring. Additionally, the weather and tide stage were favorable for fishing,

aerial spotting, and tender pumping activities. Therefore, on April 21 at 8:00 a.m., a 30-minute fishing period was announced for Management Areas 5, 6, and 7 commencing by field announcement some time between 8:55 and 9:05 a.m. The field announcement on SSB and VHF radio was used to reduce the possibility of early sets and keep the fishery orderly. As the opening began, the fleet converged into a small area inside Contact Point near the mouth of Bruin Bay. About 15-20 commercial spotter aircraft were present during the opening.

The 30-minute fishing period resulted in 14 deliveries and a catch of only 164 tons. Mature roe recoveries averaged 9.6%. Although spawning was documented in several locations during an aerial survey of the fishery, no large biomass of herring was sighted. However, management staff were concerned that delaying the fishery could result in lower roe recovery, decreased opportunity to avoid harvest of younger herring, and increased chances of weather and tide conditions becoming unfavorable for fishing. Therefore, they opened the entire Kamishak District on April 22 from 9:00 a.m. until 11:00 a.m. While the fleet of about 50 purse seine vessels was capable of catching the remaining harvest of 1,614 tons in less than 2 hours, the older herring present on the grounds in late-April probably represented only a small segment of the total run, and their relatively small biomass was expected to keep the catch below the guideline. Furthermore, we felt that providing the industry with a larger fishing area and more time would allow fishers to be more selective in landing herring since they had more opportunity to locate marketable herring. Department biologists also hoped to gain more information on herring distribution and relative abundance within the district.

Catch reports from the two-hour April 22 fishing period indicated a harvest of just 134 tons from 13 deliveries, which brought the cumulative catch from both periods to 298 tons. Since the proportion of males was relatively high, and average roe recoveries was only 9.0%, the department announced at 2:00 p.m. that the fishery would not reopen that day and that any opening the next day was unlikely. Given the poor harvest and small biomass within Kamishak District, much of the fleet left for Togiak District, where herring were beginning to arrive.

The department resumed aerial surveys and test fishing activities on April 23. A sample obtained north of Amakdedori Creek yielded an average roe recovery of 9.5% and a mean herring weight of 220 grams, while samples from two sets around Nordyke Island produced only spawned out and juvenile herring. This suggested that potential roe recovery from available herring was only marginally acceptable for industry standards and that younger were beginning to arrive.

Information collected over the next two days, from additional aerial surveys and test fishing boats searching the area between Douglas Reef and Contact Point, indicated that few new herring had arrived. All available information now indicated the run of large, old herring was well below forecasted levels. Water temperatures were increasing, having been recorded as high as 6° C at Nordyke Island, the weather had remained calm and sunny, and tides were building, yet no large biomass of older herring had been found and inshore migration of young, newly recruited herring was underway. Therefore, the department closed the 1998 Kamishak District herring fishery on April 25.

Postseason analysis of age samples indicated the abundance of age-10 herring was much less than forecasted. This was not entirely unexpected because the survival rate of this age class is difficult to predict. With the sharp decline of this exceptionally strong cohort, the spawning population is now dominated by age-4, -5, and to -6 herring (68% of total biomass).

Of the eight companies registered to purchase herring in Kamishak District during 1998, only six took deliveries. Based on an average price of $200-250 per ton (without postseason adjustments), the total exvessel value of the fishery is estimated to be $60,000-$75,000, the lowest value ever recorded (Table 2). The final harvest of 297.8 tons, based on fish tickets, fell short of the preseason guideline by 1,482 tons, and was the lowest catch obtained since the fishery began in 1973 (Table 1).

According to the existing regulatory management plan, the Kamishak District herring fishery harvest is not to exceed 20% of the available biomass. In 1998, only 3%-6% of the estimated spawning biomass was harvested, based on a total harvest of 298 tons and a total biomass estimate of 5,000-10,000 tons.

Southern District

Management of the Southern District sac roe fishery was changed in 1989 to allow for a limited harvest of 150-200 tons to obtain age, weight, length, and roe recovery information. Herring had not been fished in the Southern District since 1979 when poor stock conditions forced an area-wide closure. Only one fishery has occurred in this district since 1979. It took place in Mallard Bay during a 2.5 hr opening in 1989. Ten vessels harvested 170 tons of herring with an average roe recovery of 8.9% (Table 1).

This past season, aerial surveys of the Southern District, conducted between May 6 and May 21, resulted in a cumulative biomass estimate of 178 tons. This estimate was considered to be very conservative due to the low number of surveys flown in 1998. Nonetheless, a commercial herring harvest was not allowed in 1998 because of the low herring abundance observed.

Outer and Eastern Districts

NOTE: Proposals #47 seeks to allow dipnets as a legal gear type to catch herring for personal use in the Lower Cook Inlet management area.

During the early years of sac roe herring fishing in Lower Cook Inlet, seining within the Outer and Eastern Districts primarily occurred in Resurrection Bay. Following a period of suspected overexploitation, herring stocks throughout Lower Cook Inlet generally declined after 1973. Concern over this decline led the Alaska Board of Fish and Game, in 1974, to establish a quota of 4,000 tons for all Lower Cook Inlet and to allocated 1,000 tons each of this quota to harvests from Outer and Eastern districts. Since stock abundance continued to decline, these quotas were never taken, and Outer and Eastern Districts were closed to herring fishing from 1975-1984.

In 1985, the sac roe fishery was allowed to resume in the Outer and Eastern Districts on a very limited basis, even though no noticeable change in spawning biomass had been observed. Because of low stock abundance, guideline harvest levels were set at 150-200 tons for each of four management areas created within these two districts (Figure 2). Fishing effort in 1985 was minimal and the bulk of the 216 ton harvest once again occurred in Resurrection Bay (Table 1).

Since 1985, only limited and sporadic harvests have occurred in these two districts, and most of the harvest and the observed biomass have been comprised of age-3 and -4 herring. Unlike the Southern and Kamishak Bay Districts, samples from the Outer and Eastern Districts have contained as much as 14% age-2, juvenile herring. Although sampling has been limited, no discernable shift to older herring has been observed, suggesting that these districts may be feeding and rearing areas for juvenile herring spawned within Prince William Sound.

In both 1991 and 1992, the Outer and Eastern districts were opened to purse seining for six-hours each day over a three-week period. Four purse seine vessels and one spotter aircraft participated in 1991 and one boat and spotter aircraft put forth a very limited effort in 1992. Despite continued opportunities for exploratory fishing, the industry expressed no further interest in trying to develop a sac roe fishery in this area due to the large proportion of juvenile herring encountered and the marginally acceptable roe recoveries from mature herring landed. These districts have not been opened to fishing since 1992.

OUTLOOK AND MANAGEMENT STRATEGY FOR 1999

The sac-roe herring fishery in Kamishak Bay will remain closed in 1999 because herring biomass has continued to decline in recent years and may now be below the regulatory threshold of 8,000 tons for which commercial harvests can occur. The department's current assessment of Kamishak District herring stock size is 6,000 to 13,000 tons, and no indication of exceptionally strong recruitment into the spawning population was observed in 1998 (Figures 3 and 4). Although the 1993 year class (age-5 herring in 1998; age-6 herring in 1999) is relatively abundant, and is expected to represent about 38% of the spawning biomass in 1999 (Figure 4), it appears to be only one quarter to one third the size of the very strong 1988 year class that supported the fishery for most of the past seven years. The department feels it is in the best interest of the resource and the commercial fishery to protect the remaining spawning population until it rebuilds. While it is not

possible to accurately predict how long it will take the stock to rebuild, it is encouraging to note that research vessels targeting other species in Lower Cook Inlet this past summer found what appeared to be high densities of age-1 juvenile herring (Alisa Abookire, USGS-BRD, personal communication).

For the past several years, age-structured-analysis has been used to forecast Kamishak herring abundance and set harvest guidelines for the upcoming season (Otis et al. 1997). This assessment technique uses information on age composition of the catch and run, as well as estimates of survival and recruitment, to follow trends in herring abundance. Biomass estimates produced by this type of analysis depend heavily upon the availability of periodic, independent measures of total spawning biomass, which are used to scale abundance trends (Otis et al. *in press*). For Kamishak District herring, aerial survey information provides these independent measures of biomass. Unfortunately, this is a very difficult area to survey, due to harsh weather and water conditions, and it has been six years since the department has been able to obtain what is thought to be a comprehensive and accurate aerial survey index of herring abundance. Lack of a good aerial survey index over such a long time period increases the level of uncertainty in abundance forecasts. While attempts were made to compensate for missing aerial survey data by enhancing the quality of other data, assessments for both 1997 and 1998 appear to have overestimated actual spawning biomass. Poor commercial catches, well short of expected harvest guidelines, were made in both these years, despite district-wide openings. While storms and price disputes may also have been contributing factors to poor catches in some years, declining herring biomass appears to be the primary cause.

The department will continue to conduct assessment work in Kamishak District in 1999. However, without a commercial fishery, it will be more difficult to obtain representative age composition information. Although the department will try to conduct test fishing with chartered commercial seine vessels throughout the duration of the run, available funding is limited and some volunteer assistance from the commercial purse seine fleet may be sought. The department will also continue to conduct aerial surveys throughout the spawning season, mid-April to early-June, as conditions permit.

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Table 1. Commercial catch of Pacific herring (tons), by district, Lower Cook Inlet, 1973-1998.

Year	Southern	Kamishak	Eastern	Outer	Total
1973	204	243	831	301	1,579
1974	110	2,114	47	384	2,655
1975	24	4,119	-	-	4,143
1976	0	4,842	-	-	4,842
1977	291	2,908	-	-	3,199
1978	17	402	-	-	419
1979	13	415	-	-	428
1980	-	-	-	-	-
1981	-	-	-	-	-
1982	-	-	-	-	-
1983	-	-	-	-	-
1984	-	-	-	-	-
1985		1,132	204	12	1,348
1986	-	1,959	167	28	2,154
1987	-	6,132	584	202	6,918
1988	-	5,548	0	57	5,605
1989	170	4,801	0	0	4,971
1990	-	2,264	-	-	2,264
1991		1,992	-	-	1,992
1992	-	2,282	-	-	2,282
1993	-	3,570	-	-	3,570
1994	-	2,167	-	-	2,167
1995	-	3,378	-	-	3,378
1996		2,984			2,984
1997		1,746			1,746
1998		298			298
Average					
1973-1997	104	2,633	262	141	2,807
1978-1987	15	2,008	318	81	2,253
1988-1997	170	3,073	0	29	3,096

Table 2. Estimated herring biomass and commercial purse seine catch of herring, average roe recovery, number of permits fished, and exvessel value (dollars), Kamishak Bay District, Lower Cook Inlet, 1980-1998.

Year	Biomass Estimate[a] (tons)	Commercial Catch (tons)	Average Roe %	No. of Permits Fished	Exvessel Value[b] (millions)
1980	-	Closed	-	-	-
1981	5,130	Closed	-	-	-
1982	4,835	Closed	-	-	-
1983	4,750	Closed	-	-	-
1984	2,885	Closed	-	-	-
1985	12,188	1,132	11.3	23	1
1986	24,042	1,959	10.4	54	2.2
1987	29,200	6,132	11.3	63	8.4
1988	47,901	5,548	11.1	75	9.3
1989	37,785	4,801	9.5	75	3.5
1990	28,658	2,264	10.8	75	1.8
1991	17,256	1,992	11.3	58	1.3
1992	16,431	2,282	9.7	56	1.4
1993	28,805	3,570	10.2	60	2.2
1994	25,300	2,167	10.6	61	1.5
1995	21,998	3,378	9.8	60	4
1996	20,925	2,984	10.1	62	6
1997	25,300	1,746	9.3	45	0.4
1998	19,800	298	10.1	50	0.07
1980-97 Avg.[d]	20,788	3,073	10.4	59	3.3

[a] Biomass estimates prior to 1988 are based directly on aerial survey observations are considered conservative; estimates after 1987 are based on the preseason forecast upon which the fishery was managed.

[b] Exvessel values exclude postseason retroactive adjustments, unless otherwise no

[c] Includes retroactive adjustment.

[d] Average excludes 1980 when no data were available.

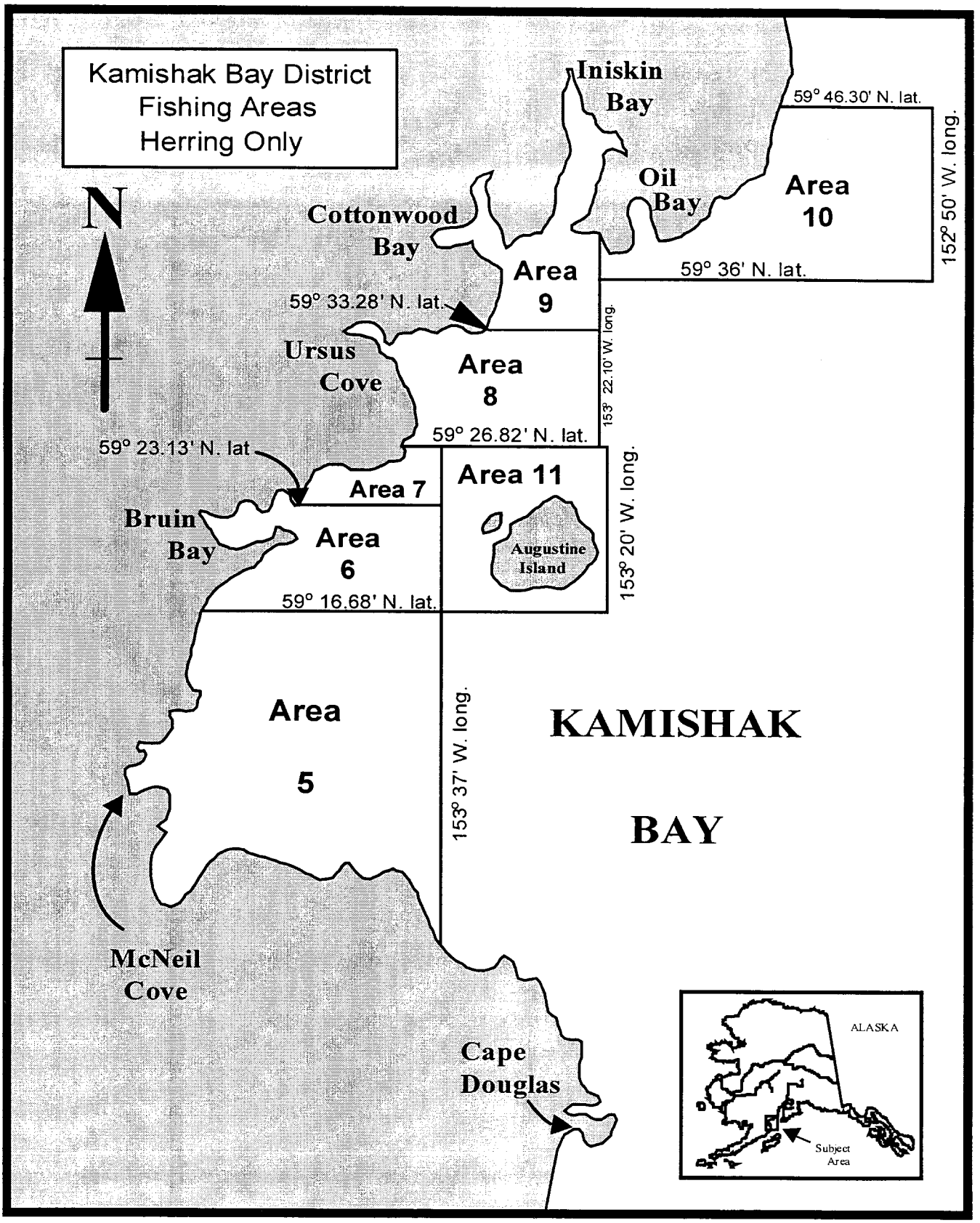

Figure 1. Commercial herring fishing areas, Kamishak Bay District, Lower Cook Inlet.

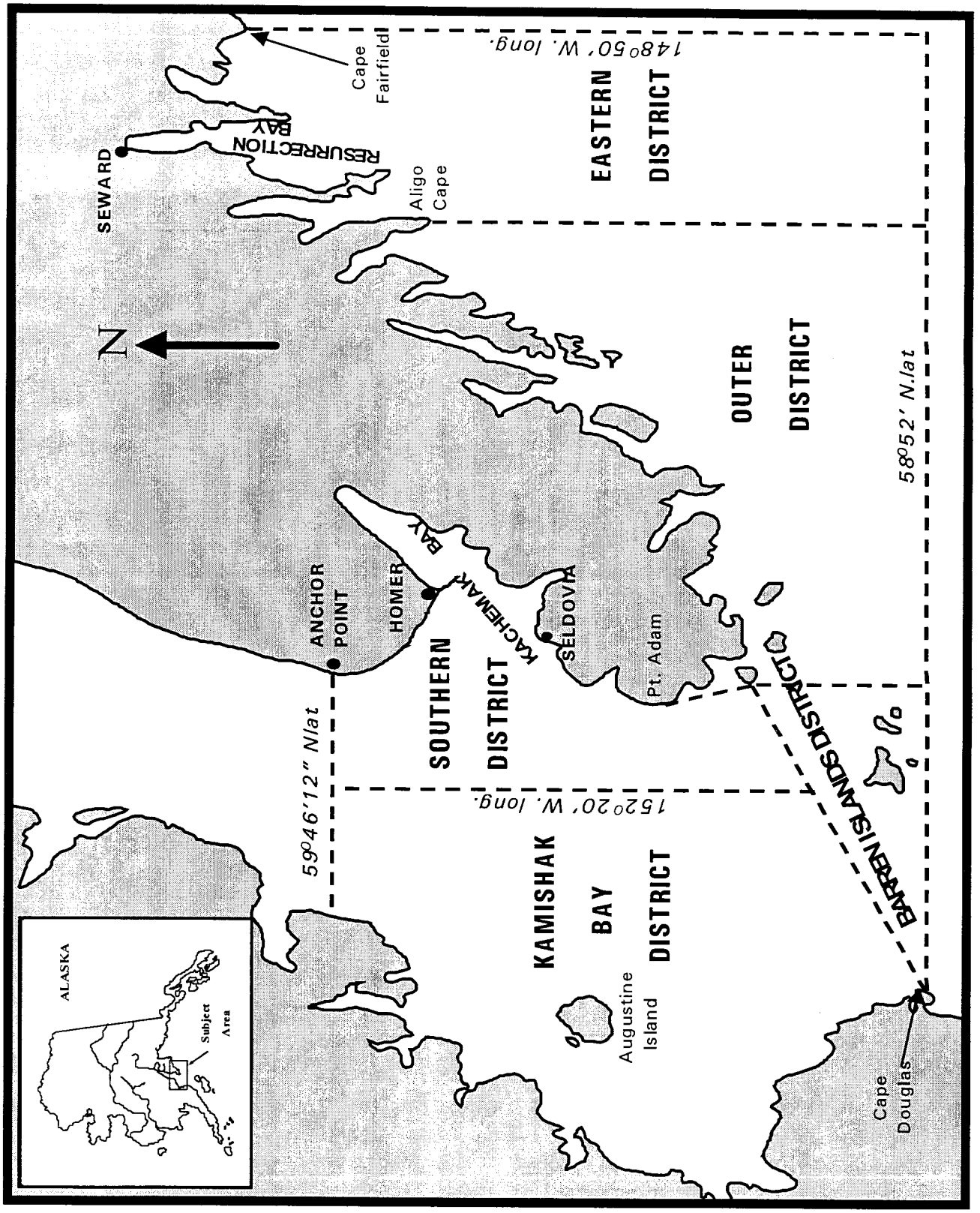

Figure 2. Commercial herring fishing areas, Kamishak, Barren Islands, Outer, Eastern, and Southern districts, Lower Cook Inlet.

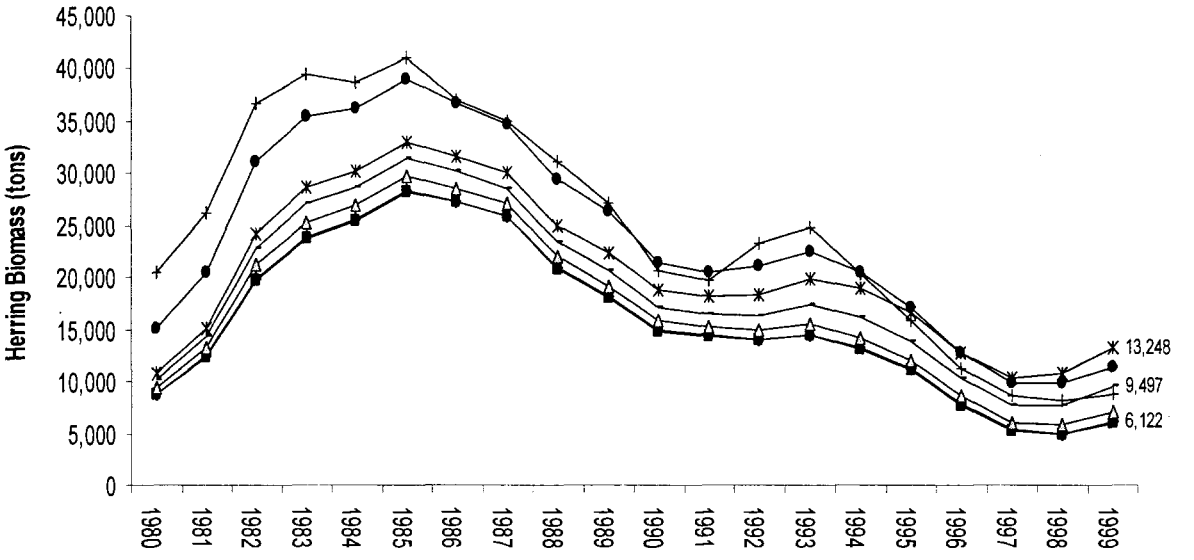

Figure 3. Historical Kamishak Bay herring biomass trend showing probable range of values (and approximate midpoint) based on the most current information available in the age structured analysis forecast model.

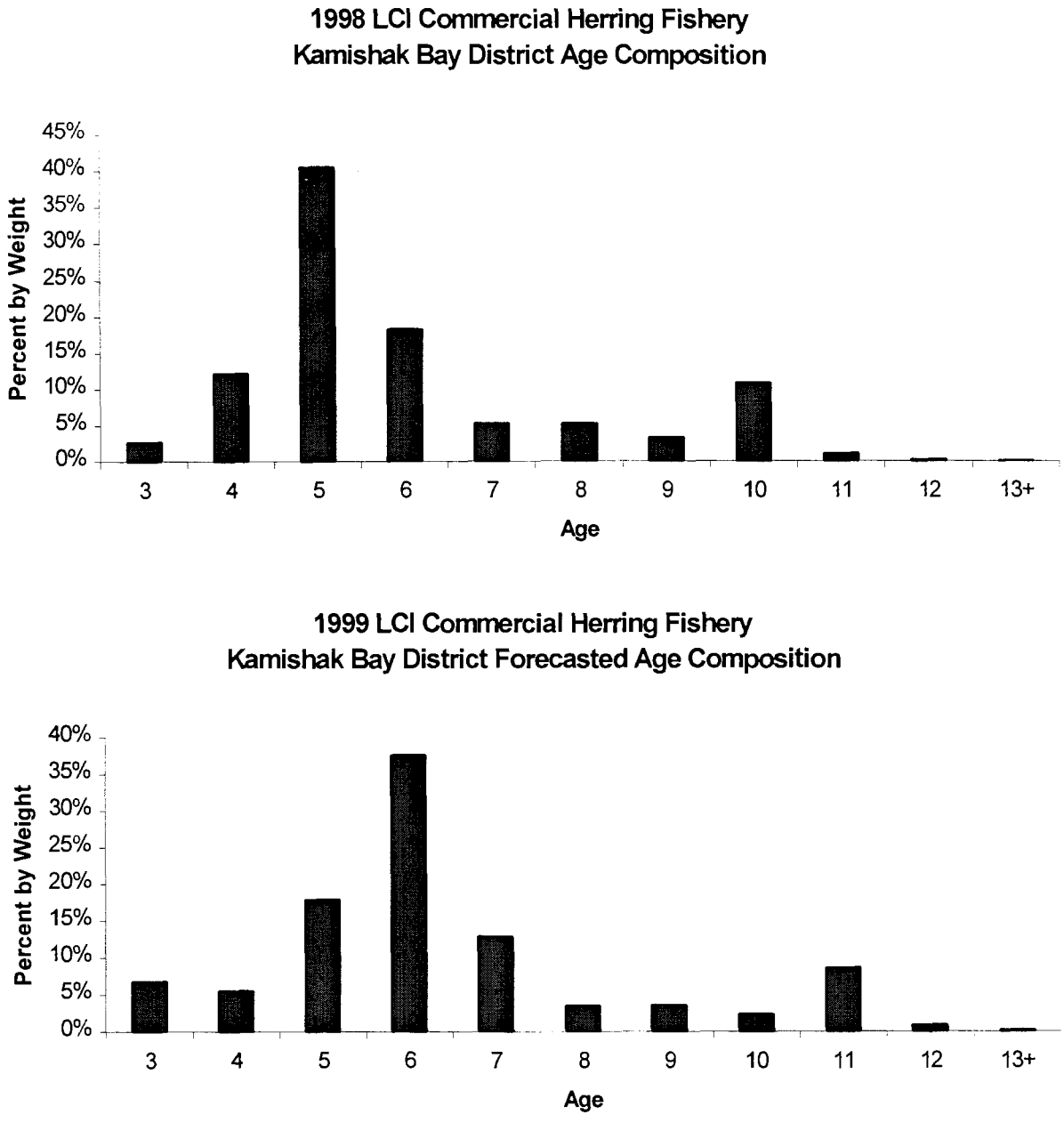

Figure 4. Observed age composition of the Pacific herring commercial sac roe harvest, Kamishak Bay District, Lower Cook Inlet, 1998 and 1999 predicted age compostion.

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