STATUS OF BRISTOL BAY HERRING STOCKS IN 1988

By

Fritz Funk

Regional Information Report No. 5J88-02

Alaska Department of Fish and Game
Division of Commercial Fisheries
Juneau, Alaska

February 1988

INTRODUCTION

Although Bristol Bay herring stocks have provided the largest sac-roe herring fishery in Alaska in recent years, stock biomass is declining rapidly because no significant recruitment to the fishery has been observed for seven years. This document describes the available stock assessment information for Bristol Bay herring stocks, reviews the current harvest policy, and describes measures that can be taken to increase the precision of estimates of stock abundance, recruitment and harvest.

SOURCES OF STOCK ASSESSMENT INFORMATION

During the period of foreign fishing prior to the passage of the FCMA in 1976, only catch information actually reported by foreign nations is available. For Bering Sea herring, the primary harvesting nations were Japan and the USSR. Japanese harvest information was made available through INPFC, while both nations provided harvest information during bilateral fishing negotiations. The quality of the harvest information from this period varies widely. The USSR attempted some hydroacoustic stock assessments of overwintering herring in the central Bering Sea in the early 1960's, although the results are only approximate because of the lack of proper calibration techniques.

The National Marine Fisheries Service (NMFS) initiated an onboard observer program in 1977 to estimate the harvest from foreign and joint venture vessels. While observer coverage was low initially, observers have been placed aboard almost all foreign catcher vessels in recent years. Observers are placed only aboard the foreign processing vessels involved in joint venture (JV) operations. NMFS expands the observed groundfish and bycatch species amounts to estimate the total amount harvested in the foreign and joint venture fisheries. Although final detailed bycatch figures are not available until approximately six months after the end of the fishing season, NMFS does receive radio reports of bycatch amounts inseason, aggregated by relatively large reporting areas.

State regulations require fishermen and processors to fill out fish ticket sales receipts identifying the individual fishermen, vessel, processor, species harvested, poundage sold, date landed and location of harvest. The ADF&G uses this information to determine total directed herring harvests by gear and area. During the herring fishing season, radio reports from individual processors are relied upon to monitor the cumulative harvest in relation to the harvest objective. ADF&G requires processors to register on the fishing grounds to ensure compliance with the radio reporting requirement.

The ADF&G conducts sampling programs to estimate the age, length and weight composition of commercial and test fishing catches. Samples of fish are collected from commercial purse seine and gillnet openings, and with small

variable mesh gillnets that ADF&G fishes throughout the spawning season. Individual fish from the samples are weighed and measured, and a scale is removed from each fish for age determination. From this sampling information, ADF&G estimates the age compositions of commercial seine and gillnet harvests and of the total herring spawning run. These age distributions are used to examine the strength of recruiting year classes. In addition the age composition information provides one of the means of estimating stock biomass. Catch-age or "cohort analysis" methods use a time series of age distributions determined from sampling information in combination with an estimate of natural mortality to derive a stock biomass estimate that is largely independent of aerial survey biomass estimates.

The ADF&G conducts aerial surveys to estimate the biomass of herring adjacent to spawning grounds during the spring spawning migration. Detailed descriptions of aerial survey methodology is presented in Lebida and Whitmore (1985). During aerial surveys, ADF&G biologists estimate the surface area of herring schools from aircraft flying at fixed altitudes, assisted by sighting devices with known fields of vision, and record the number of herring schools observed. These estimates are then converted to abundance estimates by relative abundance index (RAI) factors dependent on water depth. RAI conversion factors are calibrated from actual seine harvests of individually aerial surveyed herring schools during test fishing programs.

HARVEST OF BRISTOL BAY HERRING STOCKS, 1928-1987

Prior to the development of roe fisheries in the late 1970's, Bristol Bay herring were primarily exploited by foreign trawl fisheries. Because much of the foreign trawl effort occurred during times of the year when Bristol Bay herring were offshore and likely mixing with other eastern Bering Sea spawning stocks, the foreign harvests of individual Bering Sea spawning stocks cannot be identified. Only the aggregated total Bering Sea harvest is available.

Bering Sea herring commercial harvests were low until the development of the foreign fisheries in the 1950's (Figure 1). The early phase of exploitation involved domestic production of salt-cure product. A salt-cure operation in Dutch harbor operated from 1928-1946, harvesting a few thousand tons annually. Given the current knowledge of herring migratory patterns, these harvests likely came from Bristol Bay spawning stocks. Foreign trawling for herring began in 1950 and continued until provisions of the FCMA ended foreign herring trawling in 1978. The data quality of the harvests reported during these years is uncertain, but a peak harvest of over 150,000 tons was reported in 1968. These large harvests probably caused eastern Bering Sea stocks to decline as foreign reported harvests declined sharply after 1968. Since the large foreign harvests occurred on herring wintering grounds in the central Bering Sea, it is possible that some of the harvest may be attributable to western Bering Sea spawning stocks.

Herring roe harvests of Bristol Bay stocks began in 1977 and increased rapidly during the early years of the fishery, reaching a peak harvest of 26,887 short

tons in 1983 (Figure 2). Harvests have been slowly declining from this level. A detailed description of the 1987 fishery is given by Skrade et al (1987), (Appendix A). The 1988 projected harvest will be 10,900 short tons.

ASSESSMENT OF BRISTOL BAY HERRING STOCKS

Stock Structure

Stock identification studies by Rowell (1986), Walker and Schnepf (1982), Rogers et al (1984), and Rogers and Schnepf (1985) indicate that there are only minor differences detectable among Security Cove, Goodnews Bay and Togiak District spawning herring stocks. Aerial survey observations of ripe herring moving west along the beach toward Cape Newenham, suggest that at least in some years there is a large amount of interchange among these stocks. Because current harvest policy specifies that herring be managed based on biomasses observed adjacent to spawning grounds, Togiak, Security Cove and Goodnews Bay are managed separately. Abundance cycles for stocks from all three areas appear to be synchronous, also suggesting that the stocks could be treated as a single biological unit. Herring stocks from Nelson Island, Nunivak Island, Cape Romanzoff and Norton Sound appear to be distinct from Bristol Bay spawning stocks.

Biomass

Stock reconstructions based on reported catch-age distributions from 1959-1981 suggest that eastern Bering Sea herring biomasses have been much larger than the current biomass (Wespestad, 1982). These reconstructions indicate that eastern Bering Sea herring biomass has been greater than 1 million metric tons at times, and possibly as high as 2 million metric tons (Table 1). Since the analyses for the time period in which the large biomasses occurred are based on foreign catch data which came largely from the central Bering Sea, it is possible that these biomasses reflect some western Bering Sea spawning stocks as well. Wespestad (1982) used relatively low natural mortality rates in deriving his catch-age estimates of biomass. Low estimates of natural mortality produce low estimates of stock biomass.

Recent Bristol Bay herring spawning biomasses have been on the order of 100,000-200,000 metric tons (Figure 3), based on aerial survey estimates. The current biomass is probably below the low levels observed in the early 1970's, after heavy foreign fishing removals, and is declining.

Recruitment Patterns

Stock reconstructions using catch-age techniques performed on data for the

entire Bering Sea indicate that the 1957 year class was unusually large and supported the huge foreign herring trawl fisheries of the 1960's (Wespestad 1982). The 1956 and 1958 year classes also appeared to be strong, but their apparent strength could be attributed to small aging errors from the very strong 1957 year class. Bristol Bay stocks comprised an average of 79% of the 1981-1987 total eastern Bering Sea herring aerial survey biomass estimates. Wespestad's (1982) estimates of spawning and recruitment biomasses for the entire eastern Bering Sea were reduced by this factor so that they could be directly compared with the more recent estimates from aerial surveys which can be applied specifically to Bristol Bay stocks. This method assumes that Bristol Bay stocks comprised approximately the same proportion of the Bering Sea biomass from 1959-1980 as from 1981-1987. After adjusting Wespestad's (1982) age 4 biomasses for the 1959-1976 year classes by 79%, a combined estimate of recruit year class strength for the 1959-1983 Bristol Bay year classes was constructed (Figure 4).

A strong year class was produced in 1962, although it was less than 25% of the strength of the very strong 1957 year class. Moderately strong year classes occurred in 1967 and 1972-1974. The 1972-74 year classes supported the developing Bristol Bay herring roe fishery in the late 1970's and early 1980's. The 1977 year class is the only year class of any strength that has been observed in recent years. In almost all cases, periods of extremely weak recruitment occurred between the strong year classes. Since herring survive to maximum ages in excess of 10 years, this means that although spawning stock biomasses have been high for extended periods, strong year classes are only rarely produced. There appears to be very little direct evidence of a relationship between the number of spawners and the number of recruits (Figure 5). This strongly suggests that environmental factors control recruitment strength. Based on 25 years of recruitment strength measurements, moderately strong year classes would be expected to occur every five years, on the average.

Stock Assessment Outlook for 1988

The returning biomass to Bristol Bay is estimated to be approximately 54,500 short tons, which would allow for a 10,900 ton harvest at a 20% exploitation rate (Skrade et al 1987). This estimate is based on the 1987 aerial survey results and age composition, and estimates of age-specific natural mortality for 1987-1988 derived from the 1977-1987 aerial survey results. The age composition will be dominated by the 1977 and 1978 year classes which will be aged 11 and 10 respectively in 1988 (Figure 6). The 1988 projected biomass is less precise than in earlier years because of the dominance of older aged fish and the increased variability in natural mortality rate with age. Both the rate of natural mortality and its variability increase with age in Pacific herring. No significant recruitment was observed in 1987, indicating that all year classes from 1979-1984 are extremely weak. This six year span of low recruitment is not unusual by historical standards, where the interval between moderately strong year classes has averaged 5 years. If no substantial recruitment is observed during 1988, Togiak stocks will likely be very close to or below the 35,000 ton threshold in 1989. If this does occur then the fishery

would likely be reduced to low levels or closed entirely.

HARVEST POLICY

The Board of Fisheries has adopted a management plan (Appendix B) for the Bristol Bay herring fishery that specifies exploitation rates of up to 20% be allowed if the stock is at or above its threshold biomass. The threshold biomass for Bristol Bay herring was set at 35,000 tons. Below the threshold biomass level, no fishery is allowed. Although there is no relationship between spawners and recruits evident in the historical data, at very low stock levels a correlation must exist, because insufficient numbers of eggs will be deposited to produce a strong year class even with excellent survival.

An exploitation rate of up to 20% is considered to be appropriate for herring by most management agencies on the west coast. Although fish populations with similar life history strategies are successfully exploited at higher rates, herring are lower in the food chain than these species and are an important forage fish for other important species. To allow for these other processes, herring exploitation rates have been kept somewhat below maximum potential rates.

Computation of a maximum sustainable yield (MSY) in the usual sense would be misleading for herring populations, since stock levels are so strongly driven by environmentally-related, variable recruitment. The 20% exploitation rate is thought to allow for a reasonable harvest of a year class over a long time period, spreading the reproductive potential of large year classes over the intervals of unfavorable environmental conditions for recruitment.

TRAWL BYCATCH CONCERNS

With the April 1987 closure of Bering Sea area 511 when the tanner crab (C. bairdi) prohibited species catch (PSC) limit was reached, yellowfin sole JV effort moved northward into the area near the Togiak herring spawning grounds. Although the reported herring harvests were low in 1987, concern was expressed for future years since a significant amount of JV trawl effort occurred along known herring post-spawning migration routes. Other potential bycatch problem areas include domestic cod and pollock fisheries in the Unimak Pass area during the summer months when Togiak herring stocks are moving through the area. Former concerns about herring bycatch in JV pollock midwater trawl fisheries in the central Bering Sea have largely disappeared because the JV effort has intensified so that the quotas are reached before the time that herring arrive on the wintering grounds. Midwater trawl pollock fisheries during the winter months in the international zone of the Bering Sea could also have significant herring bycatches. The issue paper in Appendix C describes herring trawl bycatch concerns and possible solutions.

Recognizing that herring migration routes occur both inside and outside the three-mile state jurisdictional limit, the Board of Fisheries is working with the North Pacific Fishery Management Council on joint solutions to herring bycatch problems. The Board has advised the NPFMC of their concerns (Appendix D). The NPFMC received a proposal in December 1987 from the Bristol Bay Herring Marketing Coop (BBHMC) to close all of Bristol Bay to trawling to eliminate herring and salmon bycatches. The NPFMC elected to place FMP amendments dealing with the herring bycatch issue on an extended cycle, and has directed its Bycatch Committee to work on solutions to the problem to be taken up in future plan amendment cycles. The Division of Commercial Fisheries is attempting to secure voluntary cooperation from the JV catcher vessels to avoid herring bycatch problems if they should arise in 1988 by providing as much information as possible to the JV catcher fleet regarding the timing and migration routes of the 1988 Togiak herring run. Initial response to requests for voluntary cooperation have been positive (Appendix E).

ADDITIONAL STOCK ASSESSMENT INFORMATION NEEDED

Aerial Survey Calibration

While aerial survey biomass estimates are relied upon for managing herring fisheries under the Board of Fisheries exploitation rate framework in several areas, several critical factors are needed to make aerial survey estimates more reliable. It is of critical importance to calibrate biologists' aerial survey estimates of herring school sizes against known school sizes. The degree of overlap between biomasses observed on the spawning grounds on successive days is unknown, but is required in order to make season total estimates of biomass. Biologists' visual estimates of the surface area of herring schools are often imprecise because of the large number and irregular shape of herring schools. Automated pattern recognition techniques are capable of measuring surface areas and could greatly increase the precision of aerial survey estimates. New technology needs to be incorporated into aerial survey projects to provide these critical improvements in reliability.

Estimation of Residence Time

Aerial survey biomass estimates are made on specific days throughout the herring spawning season. In order to estimate the season total size of the herring spawning stock, biomass estimates from surveys on successive days are not additive, since individual schools of herring may reside on the spawning grounds for extended periods of time, and not all herring schools arrive on the spawning grounds at the same time. In order to combine biomass estimates from successive aerial surveys, an estimate of the residence time or "turnover rate" of herring schools on the spawning grounds is required. This project would obtain spawning ground residence time estimates by tracking the rate of movement of sonic tags implanted in individual herring as they move through the spawning area. Sonic tagging methodology is a routine method of tracking

movements that has been applied to a wide variety of fish species. The project would charter a commercial herring seine vessel to obtain fish for tagging just before the herring move onto the spawning grounds. Small vessels could be used for tracking the sonic tags. The cost of this program is estimated to be approximately $45,000 annually for a two year period.

Hydroacoustic Calibration of Aerial Survey Estimates

Aerial surveys rely on estimates of school surface area to estimate the biomass of individual schools. While some attempts are made to correct for water depth in various areas, the shape of herring schools underwater is not known and plays a large role in determining the accuracy of the biomass estimates. This project would use side-scanning sonar to determine the sub-surface depth profile of individual herring schools while they were being simultaneously surveyed and photographed from the air. Test fishing on individual schools would be used to standardize the underwater acoustic profiles and aerial survey biomass estimates. The cost of this program is approximately $15,000 annually for a two year period.

Aerial Survey Pattern Recognition

Biologists' visual estimates of the surface area of herring schools are often imprecise because of the large number and irregular shape of herring schools. Automated pattern recognition techniques are capable of measuring surface areas of irregular shapes and could greatly increase the precision of aerial survey estimates. An aircraft-mounted standard recording video camera would be used to obtain analog electronic images of aerial survey flight paths. Analog images would be converted and stored digitally on microcomputer optical disk storage devices. Image enhancement software would be used to more easily discriminate herring schools from background patterns. An automated computer package would be assembled, using existing pattern recognition software components, to identify herring schools, measure surface areas, and compute image density. Image densities would be converted to herring school densities by calibration from point estimate images of known biomass. The cost of this program is estimated to be $50,000 for the first year, with $20,000 for subsequent years.

Environmental Influences on Herring Recruitment

Control of herring recruitment success appears to be heavily influenced by environmental effects, provided that threshold levels of spawning activity are present. In order to increase the precision with which successful year classes can be predicted, the mechanisms affecting herring recruitment success need to be identified. Acquiring this knowledge requires physical and biological oceanographic expertise and logistical support beyond the present scope of Division of Commercial Fisheries activities. Support from several large oceanographic research vessels would be required because of the large area of Bristol Bay that would have to be monitored. Intensive effort would be

required over a short time period, because of the need to sample large areas almost simultaneously in order to track the distribution and survival of larvae, and the physical and biological factors that affect herring larvae.

The University of Alaska is presently involved in the federally funded APPRISE (Association of Primary Production with Recruitment In a Subarctic Ecosystem) project which is currently investigating similar recruitment mechanisms in the Gulf of Alaska. Extension of the project and potential funding for extending the project to investigate Bristol Bay herring recruitment is under discussion with the federal Minerals Management Service (MMS) for application to oil environmental impact studies in the Bristol Bay area. The Division of Commercial Fisheries submitted a proposal to MMS during 1987 to perform limited recruitment investigations from its shore-based camps in Bristol Bay during the herring spawning season in 1988-89, but did not receive approval for the project. MMS will likely award a contract to perform recruitment-related studies to a university or other agency better suited for physical and biological oceanographic and ecosystem studies. The Division of Commercial Fisheries is continuing to follow this opportunity and may be able to assist the MMS-funded project with shore-based logistics and stock assessment information from existing projects.

Domestic Groundfish Observer Program

With the rapid replacement of foreign and joint venture trawl fisheries in the Bering Sea by wholly domestic effort, the ability of fishery management agencies to monitor target and incidental trawl catches is rapidly disappearing. Federal observers formerly provided estimates of prohibited species catches, including herring catches, by foreign and JV groundfish trawl vessels. No similar mechanism is in place for domestic groundfish vessels. The limited observer coverage available is entirely insufficient to project catches by the entire groundfish fleet. It is critically important that adequate domestic observer coverage be provided.

LITERATURE CITED

Lebida, R.C., and D.C. Whitmore 1985. Bering Sea herring aerial survey manual. Bristol Bay Data Report No. 85-2, Alaska Department of Fish and Game, Anchorage, 33p.

Rogers, D.E., K.N. Schnepf, and P.R. Russell 1984. Feasibility of using scale analysis methods to identify Bering Sea herring stocks. Univ. Wash. Fish. Res. Inst. Rep. No. FRI-UW-8402, 48 p.

Rogers, D.E., and K.N. Schepf. 1985. Feasibility of using scale analysis methods to identify Bering Sea herring stocks. Univ. Wash. Fish. Res. Inst. Rep. No. FRI-UW-8501, 47 p.

Rowell, K.A. 1986. Feasibility of using scale patterns to describe growth and identify stocks of Pacific herring (Clupea harengus pallasi) from four spawning locations in the eastern Bering Sea.

Skrade, J.R., R.C. Lebida, and K. Brennan 1987. Preliminary review of the Togiak herring fishery, 1987. Bristol Bay Data Report No. 87-4, Alaska Department of Fish and Game, Anchorage, 22 p.

Walker, R.V., and K.N. Schnepf 1982. Scale pattern analysis to estimate the origin of herring in the Dutch Harbor fishery. Univ. Wash. Fish. Res. Inst. Rep. No. FRI-UW-8219, 21 p.

Wespestad, V.G. 1982. Cohort analysis of catch data on Pacific herring in the eastern Bering Sea, 1959-1981. NOAA Technical Memorandum NMFS F/NWC-24, Northwest and Alaska Fishery Center, Seattle, 18 p.

Table 1.--Estimated biomass (1,000 t) of Pacific herring in the eastern Bering Sea by age group, total biomass, and spawning biomass, 1959-81. (From Wespestad 1982)

Age	1959	1960	1961	1962	1963	1964	1965	1966	1967
					1,000 t				
1	257.	74.	60.	35.	152.	36.	20.	18.	27.
2	790.	308.	88.	72.	42.	183.	43.	24.	21.
3	238.	829.	324.	93.	73.	44.	192.	45.	25.
4	57.	230.	811.	316.	88.	70.	43.	188.	44.
5	48.	59.	234.	830.	325.	89.	72.	44.	194.
6	31.	45.	57.	222.	793.	315.	86.	69.	43.
7	14.	27.	39.	48.	190.	700.	286.	78.	61.
8	11.	11.	22.	32.	36.	154.	584.	240.	65.
9	1.	7.	8.	16.	22.	25.	118.	451.	185.
10	0.	1.	5.	5.	10.	14.	17.	83.	314.
Sum	1,446.	1,589.	1,647.	1,669.	1,731.	1,630.	1,461.	1,238.	979.
Sp.B.	255.	597.	1,020.	1,451.	1,338.	1,376.	1,255.	1,125.	899.

Age	1968	1969	1970	1971	1972	1973	1974	1975	1976
1	109.	19.	16.	18.	9.	43.	54.	76.	3.
2	33.	130.	23.	20.	21.	11.	51.	64.	90.
3	22.	33.	122.	24.	20.	22.	9.	50.	67.
4	24.	17.	25.	95.	22.	13.	18.	8.	45.
5	45.	18.	16.	12.	73.	12.	10.	15.	8.
6	186.	37.	14.	10.	5.	45.	10.	7.	14.
7	38.	123.	24.	8.	2.	4.	32.	6.	3.
8	51.	25.	62.	13.	1.	2.	3.	21.	3.
9	49.	32.	11.	31.	1.	1.	1.	2.	14.
10	126.	26.	15.	4.	2.	0.	1.	0.	1.
Sum	684.	459.	328.	234.	156.	153.	189.	248.	248.
Sp.B.	524.	293.	213.	170.	106.	80.	87.	103.	139.

Age	1977	1978	1979	1980	1981
1	8.	54.	4.	0.	0.
2	4.	10.	65.	4.	0.
3	89.	4.	11.	68.	5.
4	61.	82.	3.	8.	67.
5	31.	62.	73.	2.	8.
6	7.	24.	55.	64.	2.
7	13.	7.	20.	47.	46.
8	3.	11.	5.	16.	31.
9	2.	2.	8.	4.	10.
10	9.	0.	0.	0.	0.
Sum	227.	255.	245.	214.	168.
Sp.B.	179.	171.	171.	169.	156.

Sp.B. = Spawning biomass.

FIGURE 1

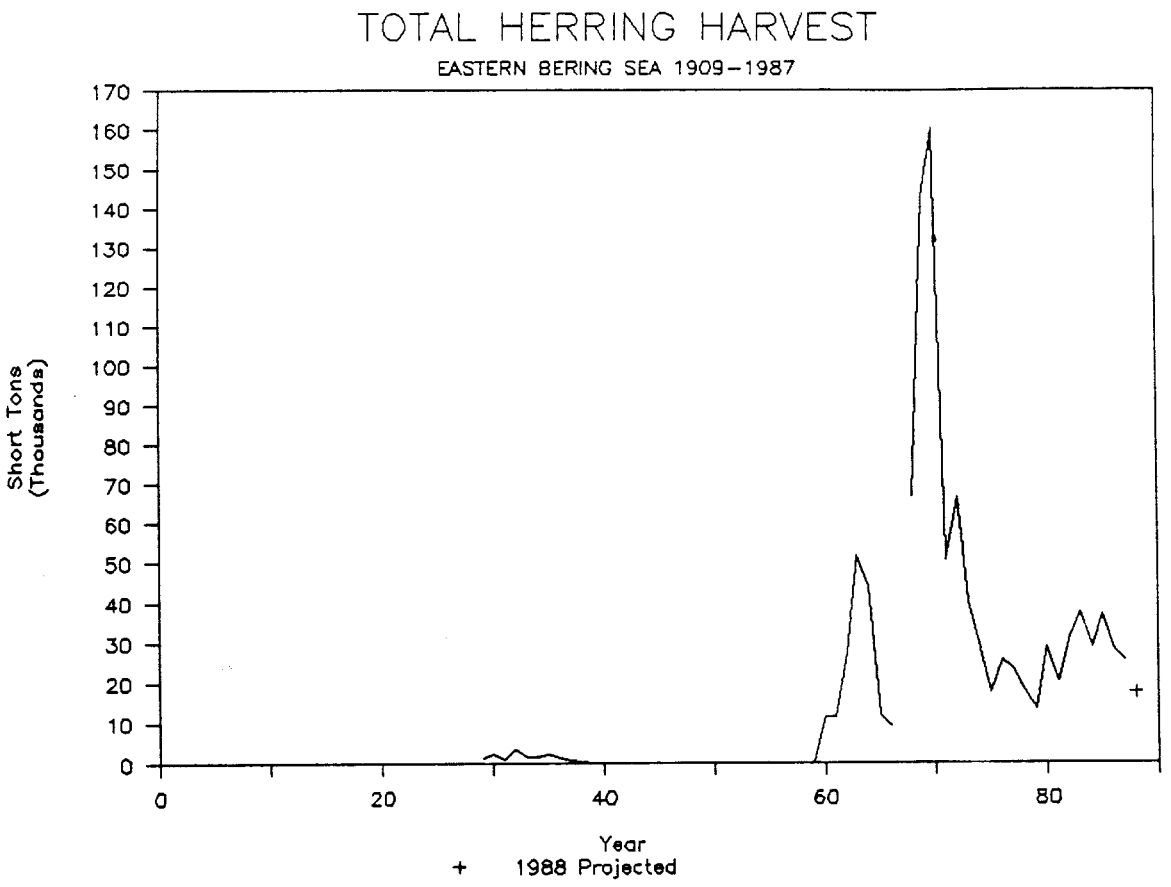

TOTAL HERRING HARVEST
EASTERN BERING SEA 1909-1987
Short Tons (Thousands)
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
0
20
40
60
80
Year
+ 1988 Projected

FIGURE 2

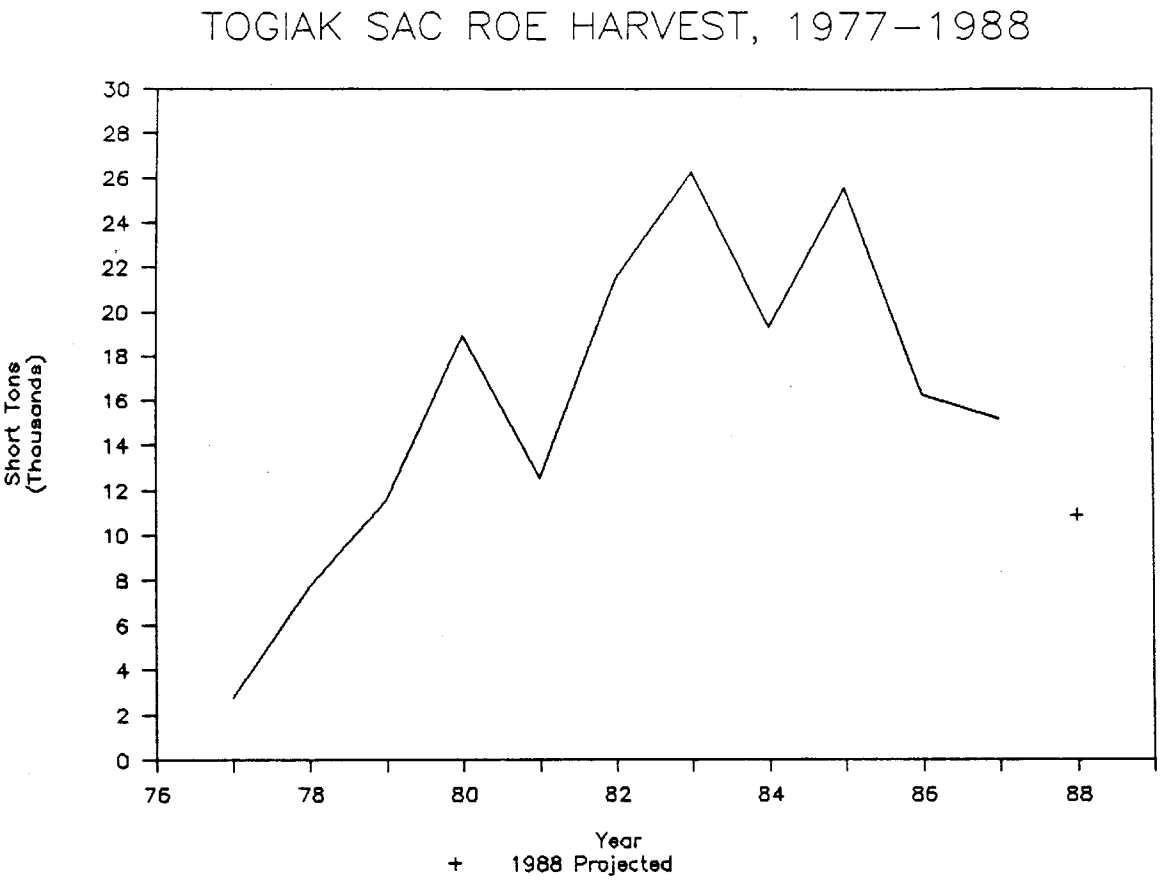

TOGIAK SAC ROE HARVEST, 1977–1988
Short Tons (Thousands)
30
28
26
24
22
20
18
16
14
12
10
8
6
4
2
0
76
78
80
82
84
86
88
Year
+ 1988 Projected

FIGURE 3

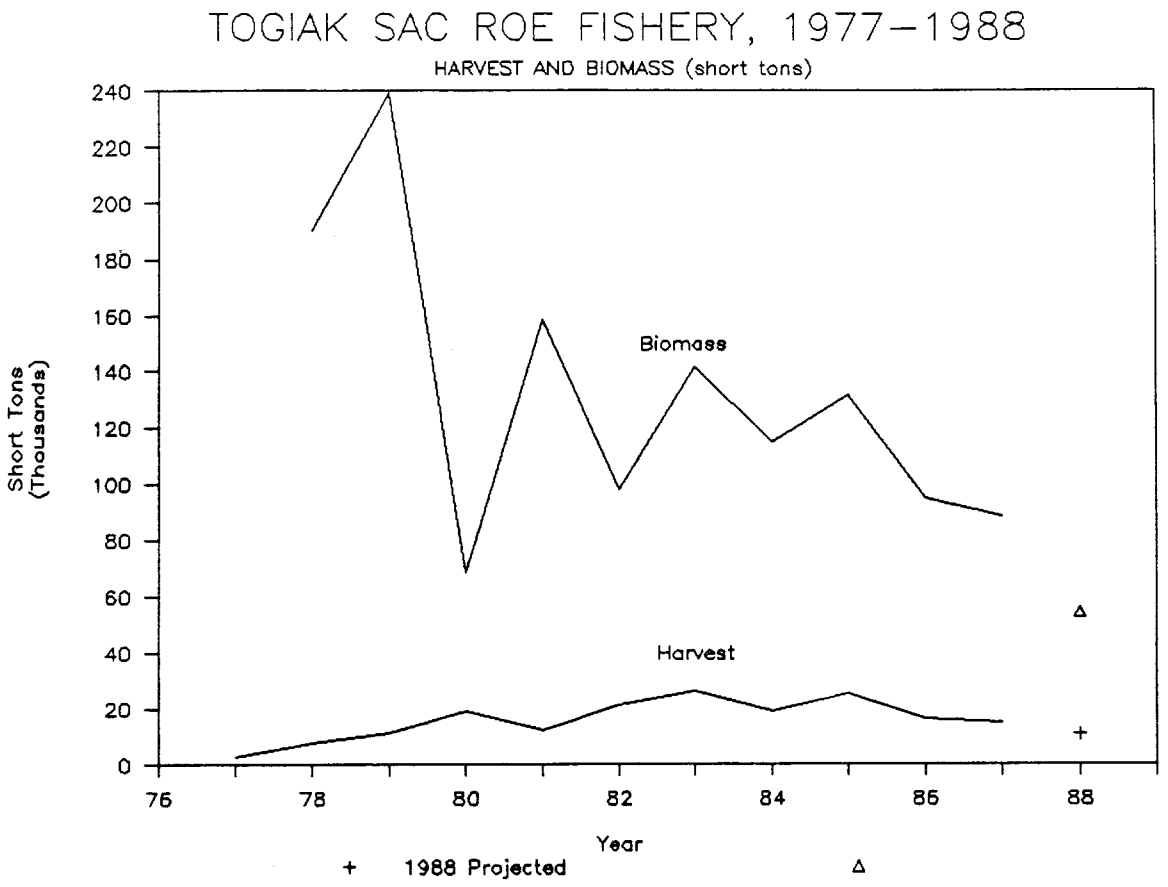

TOGIAK SAC ROE FISHERY, 1977–1988
HARVEST AND BIOMASS (short tons)
Short Tons (Thousands)
240
220
200
180
160
140
120
100
80
60
40
20
0
Biomass
Harvest
Δ
+
76
78
80
82
84
86
88
Year
+ 1988 Projected
Δ

FIGURE 4

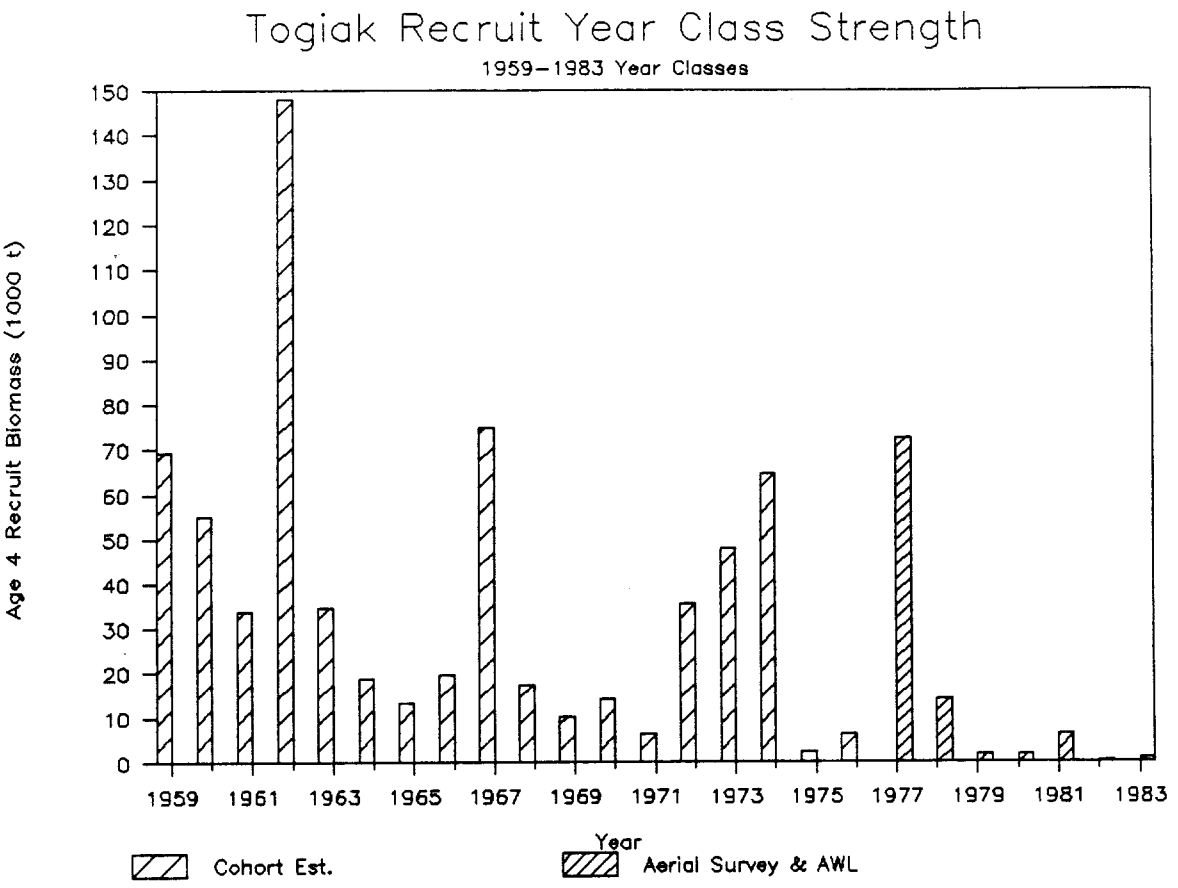

Togiak Recruit Year Class Strength
1959–1983 Year Classes
Age 4 Recruit Biomass (1000 t)
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
1959
1961
1963
1965
1967
1969
1971
1973
1975
1977
1979
1981
1983
Year
Cohort Est.
Aerial Survey & AWL

FIGURE 5

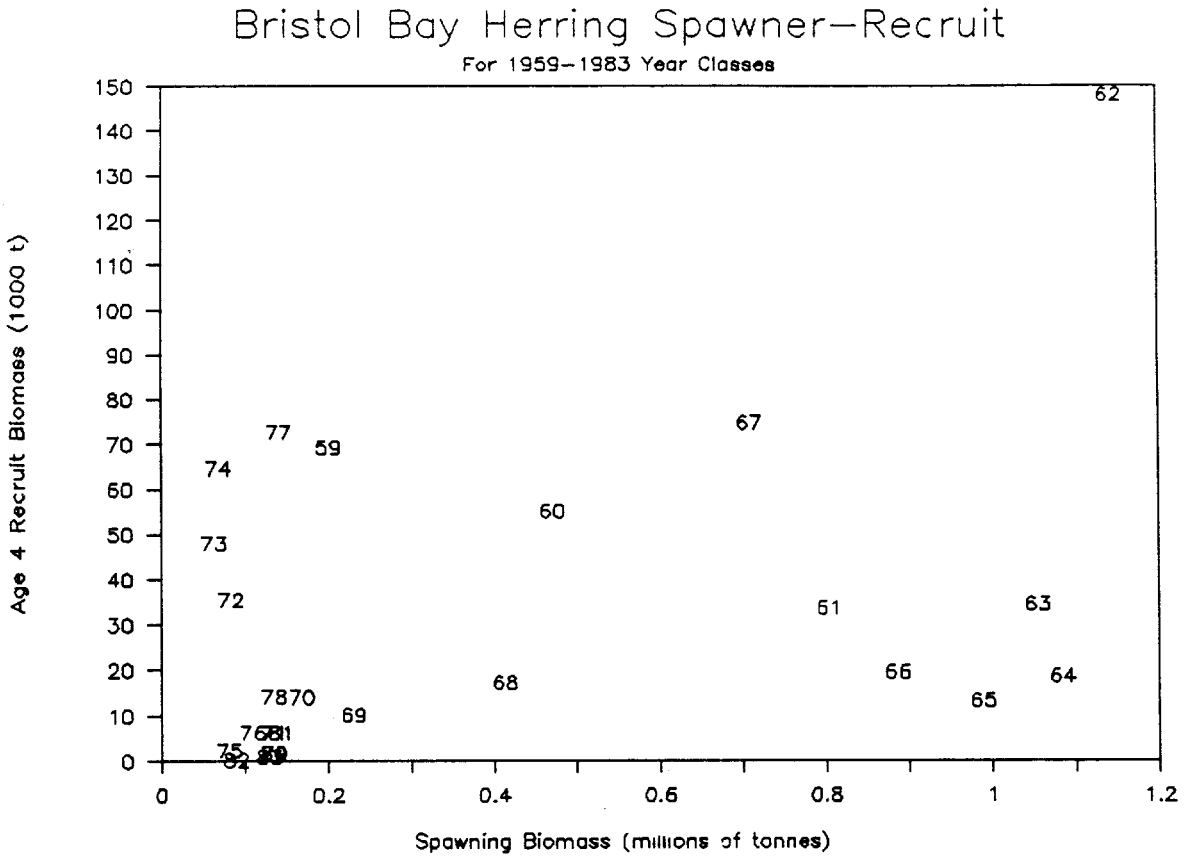
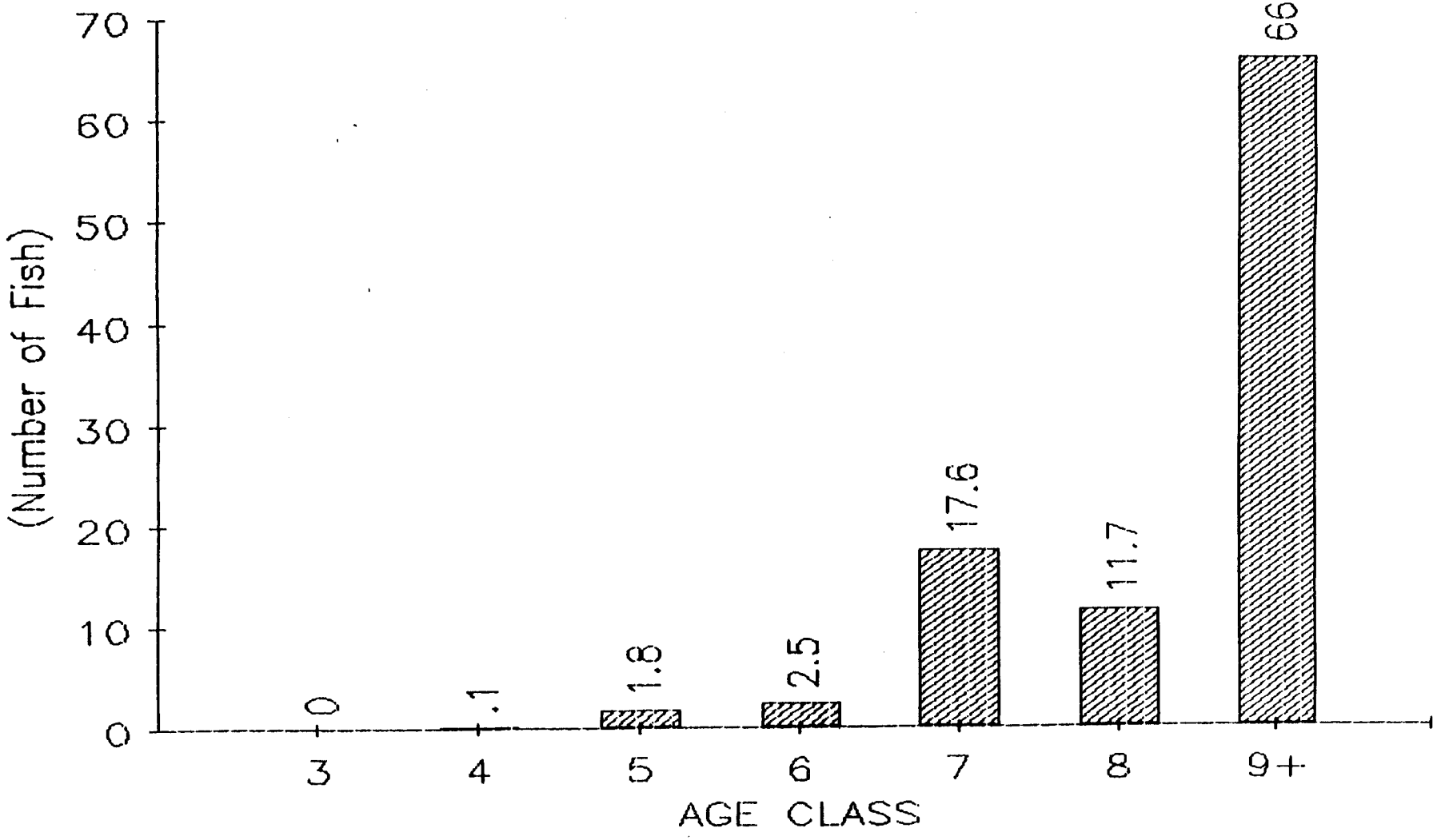

Bristol Bay Herring Spawner–Recruit
For 1959–1983 Year Classes
Age 4 Recruit Biomass (1000 t)
Spawning Biomass (millions of tonnes)
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
0
0.2
0.4
0.6
0.8
1
1.2
62
67
77
59
74
60
73
72
61
63
66
64
68
65
7870
69
7681

FIGURE 6

BRISTOL BAY
PACIFIC HERRING SPAWNING BIOMASS
1988 MINIMAL PROJECTION

(Biomass = 54,500 st...20% Harvest = 10,900 st)



NOTE: Use projection estimate with extreme caution.

APPENDICES

APPENDIX A

ALASKA DEPARTMENT OF FISH AND GAME
DIVISION OF COMMERCIAL FISHERIES

BRISTOL BAY AREA
DATA REPORT NO. 87-4

Preliminary Review of the Togiak Herring Fishery -1987-

Annual Herring Management Report
to the Board of Fisheries

Anchorage, Alaska
November, 1987

STAFF

Area Management Biologist.....Jeffrey R. Skrade
Research Project Leader.....Robert C. Lebida (Ret.)
Management Assistant.....Kevin Brennan

Regional Office: 333 Raspberry Road, Anchorage, Alaska 99518-1599
Area Office: P.O. Box 230, Dillingham, Alaska 99576

TABLE OF CONTENTS

HERRING FISHERY - SEASON SUMMARY

Stock Status

Assessment Methods:

Aerial surveys were flown throughout the Pacific herring spawning season to determine relative abundance, distribution, and biomass of Pacific herring. Occurrence and extent of milt, numbers of fishing vessels, and visibility factors affecting survey quality were also recorded. Data collection methods were similar to those used since 1978. Weather and sea conditions were generally fair to good in the early part of the season, but unfavorable conditions and turbid water hampered survey coverage during the latter part of May and early June.

Standard conversion factors of 1.52 (water depths of 16 feet (ft) or less), 2.56 (water depths between 16 and 26 ft) and 2.83 st/538 ft^2 (water depths greater than 26 ft) were used to convert estimated herring school surface areas to biomass.

Test fishing with variable mesh gill nets and sampling of commercial landings were conducted to determine age, size, and sexual maturity of herring and to estimate occurrence and relative abundance of other schooling fishes. Additionally, volunteer purse seine and gill net vessels collected Pacific herring samples. This information was used during post-season analysis to interpret and modify aerial survey biomass data.

Ground surveys were also conducted to obtain information on the distribution and density of kelp beds and herring spawn disposition.

Spawning Population:

A total of 23 aerial surveys were flown on 19 days during the 1987 season, from April 20 - May 14 with herring first observed April 24. Biomass peaked on

3 - 7. These sightings are an index only and do not represent the total deposition that occurred over the season.

Spawning appeared to be well distributed throughout the district with good egg deposition on the aquatic plants. Areas of heavy spawning included the Anchor Point/Rocky Point area and west of Right Hand Point. Heavy subtidal spawning was observed offshore in Ungalikthluk Bay and on the west side of Tongue Point.

There was no commercial fishery for capelin at Togiak in 1987. One report of capelin gilled in a purse seine was received by the staff, but no sightings of schools or spawning were observed.

Commercial Fishery:

Commercial herring fishing has been regulated by emergency order since 1981 to eliminate wastage problems and achieve exploitation rate objectives. Five commercial openings were allowed during April 27 - May 6, 1987 for a total fishing time of 5.5 hours for purse seine vessels and 36 hours for gill net gear (Table 1). Total catch was 15,204 st (Table 1). This was a slightly below average (average = 17,500 st)(Table 2) Pacific herring catch for the Togiak District and the highest reported in the State for 1987.

Fishing time was regulated by gear type under Board of Fisheries directive, as in the past 5 years. When commercial purse seine openings were less than 24 hours, gill net openings were three times as long. When purse seine openings were 1 hour or less, gill net openings were at least 5 hours in duration.

Purse seine vessels accounted for 83% (12,565 st) of the total landed catch and gill net vessels accounted for 17% (2,638 st)(Table 1). 41% of the total catch was taken west of Togiak Bay by purse seine vessels with the majority of the gill net catches (85%) taken from Togiak Bay eastward. For the first time

roe recovery from purse seine catches was 8.9% and average recovery from gill net catches was 8.6%.

Value of harvested Pacific herring to fishermen was estimated to be $8.8 million (Table 6). Prices paid ranged from a low of $500 per st at 10% recovery to a high of $700 per st. Average price was $650 per st for 10% roe recovery with an increase or decrease of $66 per st for each percentage point above or below 10%. Average price for food and bait herring was $153 per st with prices ranging from a low of $50 to a high of $220 per st.

Prices given for sac roe herring may be misleadingly low. Most companies paid an on-the-grounds base price and a post-season settlement is paid upon finalization of the price with the foreign market. An increase of up to 30% of the estimated exvessel value is possible.

Spawn on kelp harvests were also regulated by emergency order. A plan adopted by the Board of Fisheries in 1984 allows a harvest quota of up to 350,000 pounds (lbs.) or the equivalent of 1,500 st of spawning herring, with a 2 - 3 year rotational harvest of the areas picked.

Five commercial herring spawn on kelp openings were allowed during April 29 - May 4 (26 hours total picking time) resulting in a total harvest of 307,307 lbs. (153 st) (Table 4). Since several K areas (Figure 2) did not contain marketable quantities of spawn on kelp and to protect beaches picked in 1986 from over-exploitation, the harvest was allowed in only two areas (K-9 = 135,782 lbs. (68 st), K-10 = 171,525 lbs. (85 st). The herring equivalent of the spawn on kelp harvest was calculated at 1,295 st. Five companies purchased spawn on kelp from 187 pickers, an 8% decrease in pickers from 1986 (Table 5). Exvessel value of the total harvest was estimated to be approximately $0.2 million Table 6). Average price was $0.54 per lb. The 1987 spawn on kelp harvest was about 5% less than the average harvest for the 1978 - 1987 period (average = 161 st) (Table 5).

By mid-May, aerial surveys indicated that most herring had spawned and were departing the district. Without a significant biomass of new or younger age fish entering the fishery, and with nearly all of the fishing fleet gone, no further openings were allowed.

In general, management of the herring sas roe fishery has greatly benefitted by adoption of emergency order procedures and Board of Fisheries harvest directives. Wastage has been reduced, catch reporting has been timely and accurate, and stock assessment capabilities have been improved. Increased mobility provided by a chartered helicopter has continually aided in efforts to monitor and manage the fishery.

A capelin fishery again failed to materialize in the Togiak District during 1987. Although some companies expressed interest in taking capelin, none were harvested. Capelin abundance was obviously well below the 1986 level when the last commercial fishery for that species took place. Because of the complication of recovering spent herring migrating in the district and poor weather conditions in the latter part of May, no aerial survey estimates of capelin were possible. No capelin spawning was reported or observed in 1987.

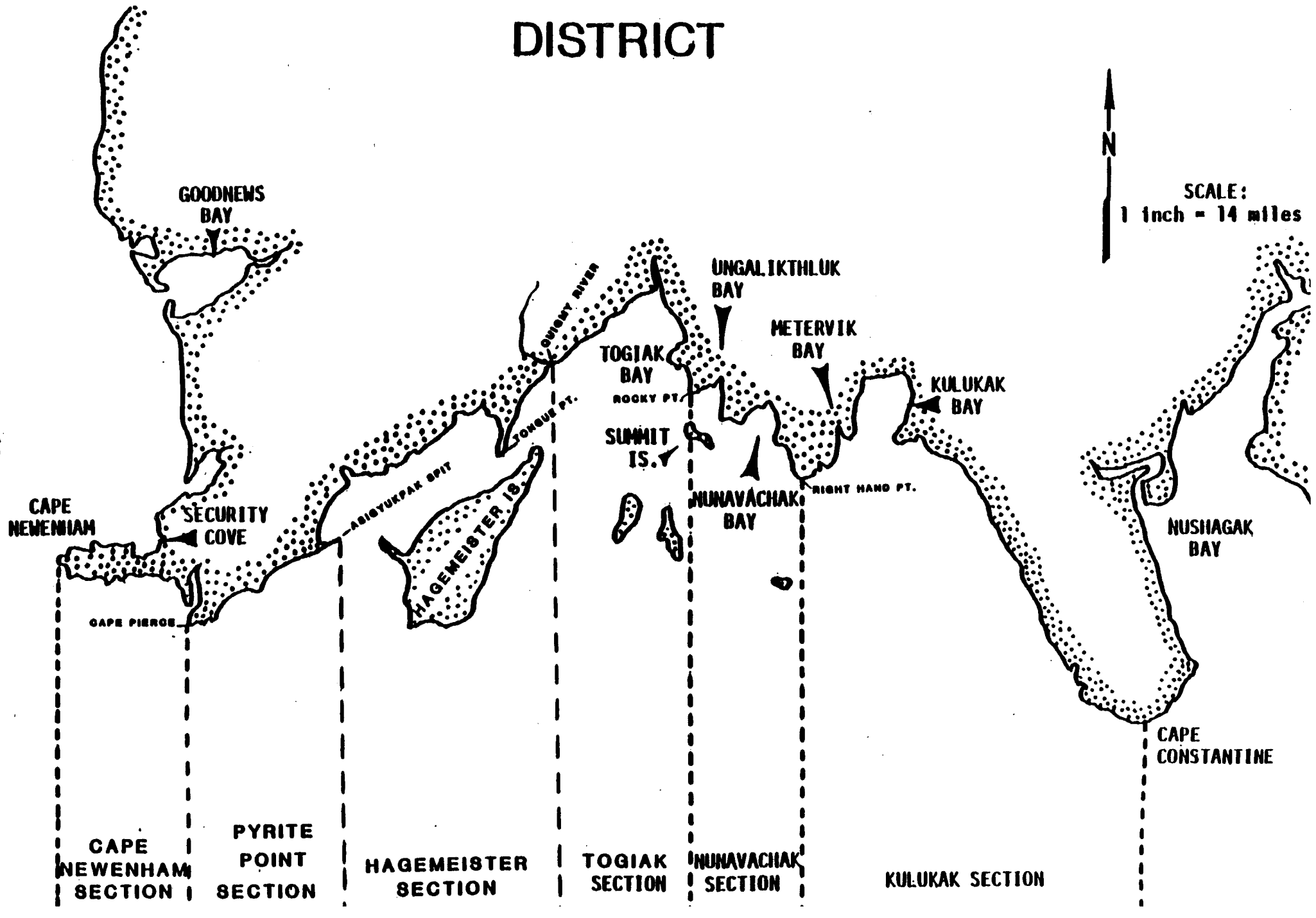
The Fish and Wildlife Protection patrol vessels, Trooper and Public Safety I were on the grounds this season. Enforcement problems concerned nets fishing after the closures and vessels setting their gear prior to the openings. In addition to their enforcement duties, the Fish and Wildlife vessels assisted in retrieving lost and abandoned gear, search and rescue, aiding vessels in distress, investigating oil spill and pollution reports, and dealing with numerous licensing and registration problems. Protection vessels also enhanced the Department's management efforts by transporting personnel and supplies on several occasions. Inter-departmental cooperation was excellent.

As initiated in 1981, different management strategies will be applied to early run, old age Pacific herring (age 5 and above) and late run, young age Pacific herring (age 4 and below) if these two population components arrive on the grounds at sufficiently different times. Magnitude and age composition of the run will be monitored during the spawning season by aerial surveys, test fishing, and commercial catch sampling. Emergency order authority will be used to adjust the occurrence and length of fishing periods in relation to stock stength and spawning.

The 1988 projected minimal return, based upon the 1987 Pacific herring spawning escapement, is 54,500 st which would allow a minimal harvest of about 10,900 st at a 20% exploitation rate. No fishing will be allowed until older age fish reach a total observed biomass of 5,500 st, and spawning has started. This will allow a normal onshore migration, assure commencement of spawning, increase roe quality and content, and minimize waste. Harvest of old age Pacific herring will be 10 to 20% of the estimated biomass. Spawn on kelp harvests will also be allowed during this period in areas judged to have sufficient spawn deposition and an adequate kelp standing crop. A more conservative approach will be taken in managing harvests of young, newly recruited Pacific herring since these fish will contribute to future harvests and provide future spawning stock. A minimum observed biomass of 22,000 st of younger age herring must be present before fishing will be allowed. Additional spawn on kelp openings may also be permitted during this period if additional spawn deposition and the remaining kelp standing stocks are at levels which allow further harvest.

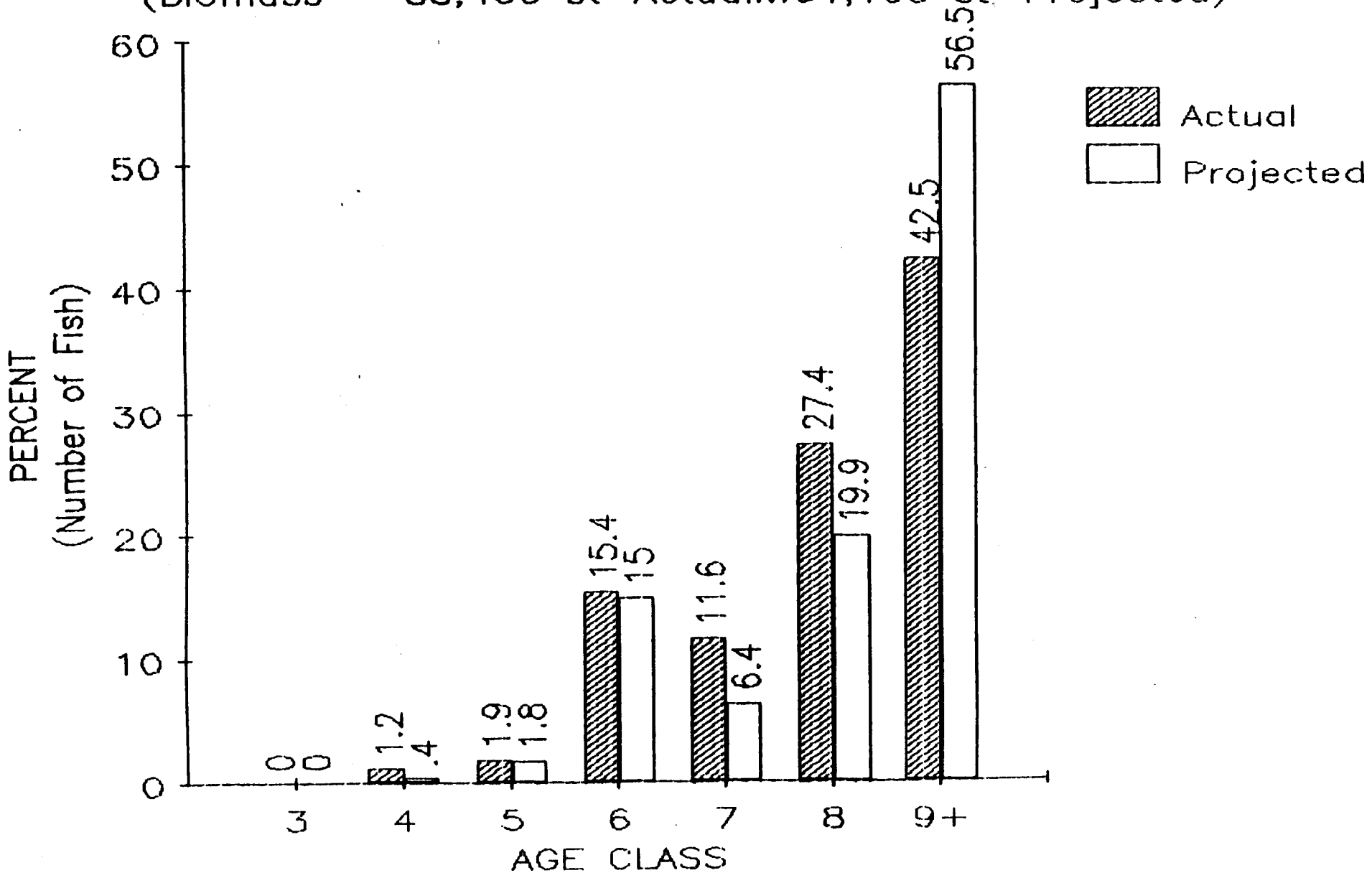
FIGURE 1.

TOGIAK HERRING FISHING DISTRICT



1987 BRISTOL BAY
PACIFIC HERRING AGE COMPOSITION

(Biomass = 88,400 st–Actual...61,100 st–Projected)



TABLES

Table 2. Commercial catch of herring by gear type and product, Togiak District, Bristol Bay, 1968-87.

Year	Number of Processor	Units of Gear 2/		Percent Catch 1/				
				Gear		Product		
		Gill Net	Purse Seine	Gill Net	Purse Seine	Sac Roe	Food/ Bait	Total Catch in Short Tons 3/
1968	2	35	2	75	25	100	0	90
69	2	22	1	38	62	100	0	47
70	3	16	1	67	33	100	0	28
71 4/	-	-	-	-	-	-	-	-
72	1	18	1	40	60	100	0	80
1973	2	26	1	100	0	100	0	51
74	3	10	1	16	84	100	0	123
75	2	39	0	100	0	100	0	56
76 4/	-	-	-	-	-	-	-	-
77	6	43	6	11	89	100	0	2,795
1978	16	40	25	8	92	100	0	7,734
79	33	350	175	40	60	92	8	11,558
80	27	363	140	16	84	85	15	18,886
81	28	106	83	18	82	99	1	12,542
82	33	200	135	31	69	93	7	21,489
1983	23	250	150	19	81	97	3	26,287
84	25	300	196	25	75	98	2	19,300
85	23	302	155	17	83	99	1	25,616
86	23	209	209	21	79	99	1	16,260
87	18	148	111	17	83	98	2	15,204
18 Year Average	15	138	77	21	79	96	4	9,897
1968-77 Average	3	26	2	17	83	100	0	409
1978-87 Average	25	227	138	21	79	96	4	17,488

1/ Average Percent Catch is weighted by each year's Total Catch.
2/ Prior to 1979 number of units derived from fish tickets, 1979-1987 estimated by aerial survey.
3/ Catch prior to 1973 reflects sorted females only.
4/ Fishery not conducted.

Table 4. Commercial harvest of herring spawn on kelp, in pounds, by period and area, Togiak District, Bristol Bay, 1987.

Period	Date	Time	Hours	K-9 Harvest	K-10 Harvest	Total Daily	Total Accum.
1	4/29 Wed.	1930-0130	6.0	-	97,363	97,363	97,363
2	4/30 Tue.	2000-0200	6.0	-	70,617	70,617	167,980
3	5/01 Thu.	2100-0300	6.0	106,590	3,545	110.135	278,115
4	5/02 Fri.	2100-0100	4.0	16,204	-	16,204	294,319
5	5/04 Sun.	0300-0700	4.0	12,988	-	12,988	307,307
	Total		26.0	135,782	171,525	307,307 =	153.7 Short Tons

Table 6. Exvessel value of the commercial herring and spawn on kelp harvest, in thousands of dollars, Togiak District, Bristol Bay, 1968-87. 1/

Year	Herring		Spawn on Kelp	Total
	Sac Roe	Food/Bait		
1968	7	0	8	15
69	4	0	1	5
70	2	0	6	8
71	- 2/	- 2/	8	8
72	4	0	9	13
1973	2	0	2	4
74	24	0	19	43
75	9	0	22	31
76	- 2/	- 2/	127	127
77	447	0	116	563
1978	2,635	0	120	2,755
79	6,561	180	249	6,990
80	3,055	150	95	3,300
81	3,988	1	250	4,239
82	6,070	105	176	6,351
1983	10,450	67	284	10,801
84	7,178	33	203	7,414
85	13,696	41	- 2/	13,737
86	8,648	12	187	8,847
87	8,614	49	166	8,829
20 Year Average 3/	3,966	35	108	4,109
1968-77 Average	62	0	32	94
1978-87 Average	7,090	64	192	7,346

1/ Exvessel value is the value paid to the fishermen derived from price per pound times commercial harvest.
2/ Fishery not conducted.
3/ Based on number of years each fishery actually conducted.

APPENDIX B

APPENDIX B

CHAPTER 27.
HERRING FISHERY

Authority: AS 16.05.251

ARTICLE 2.
GENERAL SPECIFICATIONS

5 AAC 27.060 is added to Article 2 to read:

5 AAC 27.060. BERING SEA HERRING FISHERY MANAGEMENT PLAN. (a) The department shall follow the directives of the Bering Sea Herring Management Plan, as well as the regulations that govern the individual herring fisheries when managing the commmercial herring fisheries that take place in the Bering Sea.

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

percent of the biomass of those stocks.

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

District	Threshold(s.t.)
Port Moller	1,000
Togiak	35,000
Security Cove	1,200
Goodnews Bay	1,200
Cape Avinof	500
Nelson Island	2,500
Nunivak Island	1,500
Cape Romanzof	1,500
Norton Sound	7,000

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

(e) If the herring sac-roe harvest in the Togiak District exceeds its allocation by more than 20 percent, the department shall deduct the amount of herring that exceeds the Togiak District herring sac roe allocation from the Dutch Harbor fishery allocation for that season as determined in (d) of this section.

(f) If the Togiak District herring sac-roe fisheries do not take their available harvest, the unharvested amount of herring will be added to the Dutch Harbor fishery allocation as determined in (d) of this section. When making this re-allocation, the department shall consider the conditions that lead to the under harvest, the amount of herring to be re-allocated, and the status of the herring stock. When an increase of the Dutch Harbor fishery allocation is made under this section, the total allocated harvest may not exceed 3,100 s. tons.

(g) When the Togiak District is below its threshold, the Dutch Harbor fishery will be closed for that season. (Eff. __/__/88, Register __)

Authority: AS 16.05.060
AS 16.05.251

ARTICLE 10.
STATISTICAL AREA M-

5 AAC 27.865 is amended to read:

5 AAC 27.865. BRISTOL BAY HERRING MANAGEMENT PLAN. (a) When managing the Bristol Bay commercial herring fishery, the primary objectives of the department will be to prosecute an orderly and manageable fishery, while striving for the highest level of product quality with a minimum of waste.

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

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

(2) Whenever possible, openings for both gear types must start at or near low tide.

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

(4) If an adequate biomass is not available for a gear type to achieve its allocation in its assigned sections, the movement of that gear group into the sections assigned to the

other gear type may be accomplished by emergency order. This movement may be initiated at any time during the fishery at discretion of the department.

(5) When opening an area for the secondary gear type the department shall consider

(A) avalability of herring;

(B) roe quality; and

(C) whether one of the gear types has taken its quota.

(6) When both gear types are allowed to fish in the same section, the department shall manage the fishery so that

(A) only one gear type fishes at a time; and

(B) the secondary gear type may not be allowed to fish until the primary gear type has taken at least 75 percent of its quota.

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

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

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

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

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

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

(C) a major improvement in the roe maturity of fish sampled over a broad area, indicating the arrival of a quantity of new herring. (In effect before 1982; am 4/14/82, Register 82; am 4/28/84, Register 90; am __/__/88, Register __)

Authority AS 16.05.060
AS 16.05.251

APPENDIX C

EASTERN BERING SEA HERRING BYCATCH CONCERNS

Alaska Department of Fish and Game
Office of the Chief Fisheries Scientist
Issue Paper Series

December 2, 1987

INTRODUCTION

Concern for the bycatch of herring in trawl fisheries is increasing as eastern Bering Sea herring stocks continue to decline and trawl fishing effort is shifting into areas of known herring migratory concentrations. Coordinated state-federal action is needed to address the problem of herring bycatch in trawl fisheries. Herring migrations occur in coastal areas, but often transcend the 3 mile boundary. Trawl fisheries which could intercept migrating herring stocks also transcend the 3 mile boundary. Differing state and federal regulations would cause confusion among the industry and create substantial enforcement problems.

Eastern Bering Sea herring stocks have declined to low levels (Fig.1). No significant recruitment has occurred since the 1977 and 1978 year classes. Most of the remaining biomass is due to the 1977-78 year classes which will be aged 10 and 11 in 1988 (Fig. 2). Herring natural mortality increases with age and the remaining biomass of these year classes is likely to be rapidly depleted. The 1988 herring harvest levels in target fisheries will be about one-half of the levels of the early 1980's. The 1989 directed harvests will be sharply reduced or possibly eliminated if no recruitment is observed in 1988. In this case, continued incidental harvests in 1989 will create critical concerns for the conservation of the eastern Bering Sea herring resource.

Herring begin to enter Eastern Bering Sea coastal areas during late April and spawn in these areas from late April through mid June. After spawning, herring follow the Bristol Bay coastline, moving in a clockwise direction, and occur along the north Alaska Peninsula from June through August while enroute to overwintering areas along the central Bering Sea shelf edge. In the Togiak area, herring approach the spawning grounds from the south and west, between Hagemeister Island and the Nushagak Peninsula, and first appear in the spawning area between late April and early May. Alaska Department of Fish and Game herring aerial surveys have documented the migration routes used by Togiak stocks after leaving the Togiak spawning grounds. The majority of the herring schools exiting the Togiak grounds stream along the Nushugak Peninsula, heading southeastward after rounding Cape Constantine (Fig. 3). Aerial surveys have followed Togiak herring schools around eastern Bristol Bay, as far as the Kvichak River. Most Togiak herring stocks have usually exited the spawning ground area by mid- June, although the late-spawning stocks from spawning grounds to the north continue to pass through the area until mid-July. Scale pattern analysis of herring collected in the Dutch Harbor herring food/bait fishery have shown that Togiak stocks are moving through the eastern Aleutian area in July and August (Rogers and Schnepf 1985, Rogers et al 1984, Walker and Schnepf 1982). Overwintering grounds for eastern Bering Sea spawning stocks

were identified in the central Bering Sea by Soviet scientists (Dudnik and Usol'tsev 1964, Shaboneev 1965) aboard commercial and scientific vessels following herring concentrations in the early 1960's (Fig. 4).

HERRING BYCATCH IN THE TOGIAK AREA YELLOWFIN SOLE JOINT VENTURE FISHERY

Problem Definition

A major shift in fishing effort occurred in the yellowfin sole joint venture (JV) fishery in 1987. After the April closure of eastern Bering Sea area 511 (Fig. 5) when the tanner crab (C. bairdi) prohibited species catch (PSC) limit was reached, large numbers of vessels moved northward into the area immediately adjacent to the Togiak herring grounds. Approximately 60 catcher vessels and 30 processing vessels representing Soviet, Korean, Japanese, and Chinese JV operations were reported to be operating in the Togiak area. Additional nearshore JV effort was reported to the southeast near Egegik and north of Cape Newenham. Vessels were frequently observed within 3 miles of shore. The trawl fleet is reported to have encountered high concentrations of yellowfin sole with valuable high roe content and will likely return to the area in 1988. Heavy predation on herring eggs by yellowfin sole has been documented, which may account for the close proximity of yellowfin sole stocks to the herring spawning grounds immediately after the herring spawning period. Because of the close proximity of the yellowfin sole stocks to the herring grounds, there is substantial concern for the magnitude of herring bycatches in this fishery. Intense trawl effort was observed in the central area of the Togiak herring grounds, through which dense schools of herring approach the Togiak spawning grounds, and off of the eastern end of the grounds which is the normal route by which herring schools exit the Togiak spawning grounds.

The observed herring bycatch in the 1987 area 514 YFS fishery was 314 tons with a total harvest of 150,000 tons of groundfish for a bycatch rate of 0.25% (Table 1).

The current depressed levels of Togiak area stocks are described by Skrade (1987). Because of the concern for bycatch of Togiak herring stocks and the movement of herring stocks inside and outside the 3 mile boundary, coordinated state-federal regulatory action is needed. The time frame required to develop federal regulations will likely preclude action by the North Pacific Fishery Management Council for the 1988 fishing season. Since directed harvests of eastern Bering Sea herring stocks will be allowed in 1988, the NPFMC is not likely to determine that a conservation crisis exists and therefore is not likely to consider emergency regulatory actions for the 1988 fishing season.

1. Develop coordinated state/federal regulatory action for 1989.

   The NPFMC is currently considering a proposed amendment to the Bering Sea/Aleutian Fishery Management Plan submitted by the Bristol Bay Herring Marketing Co-Op which addresses the problem of herring bycatch in Bristol Bay. Appropriate alternative actions under this amendment proposal may involve closure of specific portions of area 514 adjacent

to and east of the Togiak herring spawning grounds to trawling from April 15 to June 30, or other alternative actions.

The Alaska Board of Fisheries is currently reviewing proposal # 236 which would close the Togiak area to trawling between Cape Newenham and Cape Constantine (Fig. 3). The Board's jurisiction extends only 3 miles from shore. Although some of the trawl effort during 1987 occurred within 3 miles of shore, closure of only the 0-3 mile zone would not provide an effective solution to the problem. Because of the configuration of the 3 mile boundary line in this area, enforcement of a state waters closure would be difficult.

Effective solutions to Togiak area herring bycatch problems, particularly if time/area closures are involved, will require coordinated Board/Council action. Staff from the Alaska Department of Fish and Game, the North Pacific Fishery Management Council and the National Marine Fisheries Service will need to work together to develop alternative proposed actions. The NPFMC would normally be reviewing proposed 1988 plan amendments during its spring 1988 meetings. The Board of Fisheries would have opportunities to review proposed actions during its fall 1988 finfish meeting, or possibly during the March 1988 shellfish meeting. The proposed coordinated regulatory actions should be formally presented to each body during 1988 as a cooperative management plan.

2. Provide directives to agencies with inseason management authority regarding time/area closures or other actions to be taken if critical bycatch problems develop during the 1988 season.

Bycatch problems could develop rapidly in the Togiak area yellowfin sole joint venture fishery in 1988, before it will be possible to implement coordinated state/federal action. The Board and Council may wish to provide guidance to the Alaska Department of Fish and Game and National Marine Fisheries Service as to specific time/area closures or other actions to implement if bycatch problems develop. Rapid response would be imperative in such a situation since herring are densely schooled in this area and bycatches could quickly accumulate to high levels. Prior guidance from the regulatory bodies would increase the response time of the inseason management agencies.

Effective inseason management responses would depend on rapid processing of observer data. Providing adequate observer coverage in potential herring bycatch areas is essential.

3. Condition joint venture permits for 1988 such that JV processors be restricted from entering the Togiak area between April 15 and June 30.

Attaching restrictive conditions to joint venture permits may be an effective method of reducing harvests in the Togiak area in 1988. While domestic catcher vessels cannot be restricted directly in this manner, it is usually not economical for catcher vessels to fish more than a few miles from JV processing vessels during cod-end transfer

operations. An appropriate processing area restriction might include the waters between Cape Newenham and Cape Constantine north of 58 degrees north latitude.

OTHER HERRING BYCATCH CONCERNS

Central Bering Sea Interational Zone Foreign Pollock Trawl Fisheries

Pollock harvests in the "doughnut area" International Zone of the Bering Sea (Fig. 5) could be well in excess of 1 million metric tons. If these harvests occur during the fall or winter months when herring are on their wintering grounds, herring bycatch rates could be substantial. Data on the monthly distribution of pollock catches in the International Zone are urgently needed.

Central Bering Sea Winter Pollock Trawl Fisheries

Herring bycatch rates in pollock joint venture trawl fisheries declined in 1987 because harvest quotas were reached in June. In earlier years when pollock harvests extended into the fall months when herring were moving into the central Bering Sea overwintering grounds, bycatches were considerably higher (Table 2). Herring bycatches could rise again if the Council should choose to take action to spread out the pollock harvest into the fall months.

Dutch Harbor Shore-Based DAP Pollock Fishery During June-August.

A shore-based DAP fishery has developed in the Dutch Harbor area to supply pollock to local processing plants for the surimi and fillet markets. The fishery takes place in nearshore waters where eastern Bering Sea herring occur in late summer during their migration from spawning grounds to central Bering Sea wintering grounds. Samples from the Dutch Harbor food/bait herring seine fishery in July and August have been shown to consist primarily of Togiak stocks (Rogers and Schnepf 1985, Rogers et al 1984, Walker and Schnepf 1982).

This pollock trawl fishery operates year-round, but product quality for surimi production is poor during the spring spawning season, resulting in high effort for surimi product during the summer months. Trawl vessels make up to 2 day trips from Dutch Harbor, using refrigerated seawater systems to maintain the high quality product needed for surimi production. Vessels have been expending up to 8 hours in travel time, allowing fishing to occur as far away as Unimak Pass.

Large bycatches of herring were occasionally reported from the fishery during the summer of 1987. One observer was placed aboard one of the vessels for a short time period, but no significant bycatches of herring were recorded during this time. The potential for large incidental harvests of herring in the DAP trawl fishery in this area exists.

The steep bathymetric contours of the area may result in some separation of herring and pollock schools. After DAP fishermen have acquired additional experience they may be able to selectively avoid herring schools. 1987 was the

first year of substantial shore-based pollock effort in the Dutch Harbor surimi fishery.

Port Moller Area Domestic Pacific Cod Trawl Fishery During June-August.

Domestic factory trawlers conducted a Pacific cod fishery in the Port Moller area in 1986 after NPFMC action closed other areas of Bristol Bay to trawling. Trawlers were restricted to an area with depths of less than 25 fathoms (Fig. 5) and were required to carry NMFS approved observers aboard at their own expense. Because of the shallow nearshore areas fished and the occurrence of the fishery during the summer months, the potential for herring bycatch is high.

NEED FOR EXPANDED OBSERVER COVERAGE ALONG HERRING MIGRATION ROUTES

For trawl fisheries that occur along herring migratory routes, state and federal agencies need to ensure that adequate observer coverage is present so that problem time periods and areas can be precisely defined. Observer coverage of domestic trawl vessels is particularly poor. Because this component of the groundfish fisheries is rapidly expanding, much more intensive observer effort needs to be directed into both the shore-based and floating-processed components of the domestic trawl fishery. Domestic trawl effort along the north Alaska Peninsula and eastern Aleutian Islands during July and August are the primary focus of concern for expanded observer coverage to document herring bycatches.

Bycatches of herring and salmon in the International Zone are a particular concern. It is imperative that mechanisms be found for placing observers aboard foreign vessels fishing in this area.

REFERENCES

Dudnik, Y.I. and E.A. Usol'tsev. 1964. The herring of the eastern part of the Bering Sea. In: P.A. Moiseev (ed.), Soviet fisheries investigations in the northeastern Pacific, Part II: 225-229. (In Russian, Transl. 1968. Israel Program Sci. Transl., avail. U.S. Dept. of Commerce Natl. Tech. Inf. Ser., Springfield, VA.)

Rogers, D.E., K.N. Schnepf, and P.R. Russell. 1984. Feasibility of using scale analysis methods to identify Bering Sea herring stocks. Univ. Washington, Fish. Res. Inst. Final Rep. FRI-UW-8219. 21 pp.

Rogers, D.E., and K.N. Schnepf. 1985. Feasibility of using scale analysis methods to identify Bering Sea herring stocks. Univ. Washington, Fish. Res. Inst. Annual Rep. FRI-UW-8501. 48 pp.

Shaboneev, I.E. 1965. Biology and fishing of herring in the eastern part of the Bering Sea. Pages 130-154 in: P.A. Moiseev (ed.), Soviet fisheries investigations in the northeastern Pacific, Part IV. (In Russian, Transl. 1968. Israel Program Sci. Transl., avail. U.S. Dept. of Commerce Natl. Tech. Inf. Ser., Springfield, VA as TT67-51206)

Skrade, J.R. 1987. Preliminary review of the 1987 Togiak herring fishery: Annual herring management report to the Board of Fisheries. Bristol Bay Area Data Report No. 87-4, Alaska Department of Fish and Game, Dillingham, Alaska, 22 pp.

Walker, R.V. and K.N. Schnepf. 1982. Scale pattern analysis to estimate the origin of herring in the Dutch Harbor fishery. Univ. Washington, Fish. Res. Inst. Final Rep. FRI-UW-8219. 21 pp.

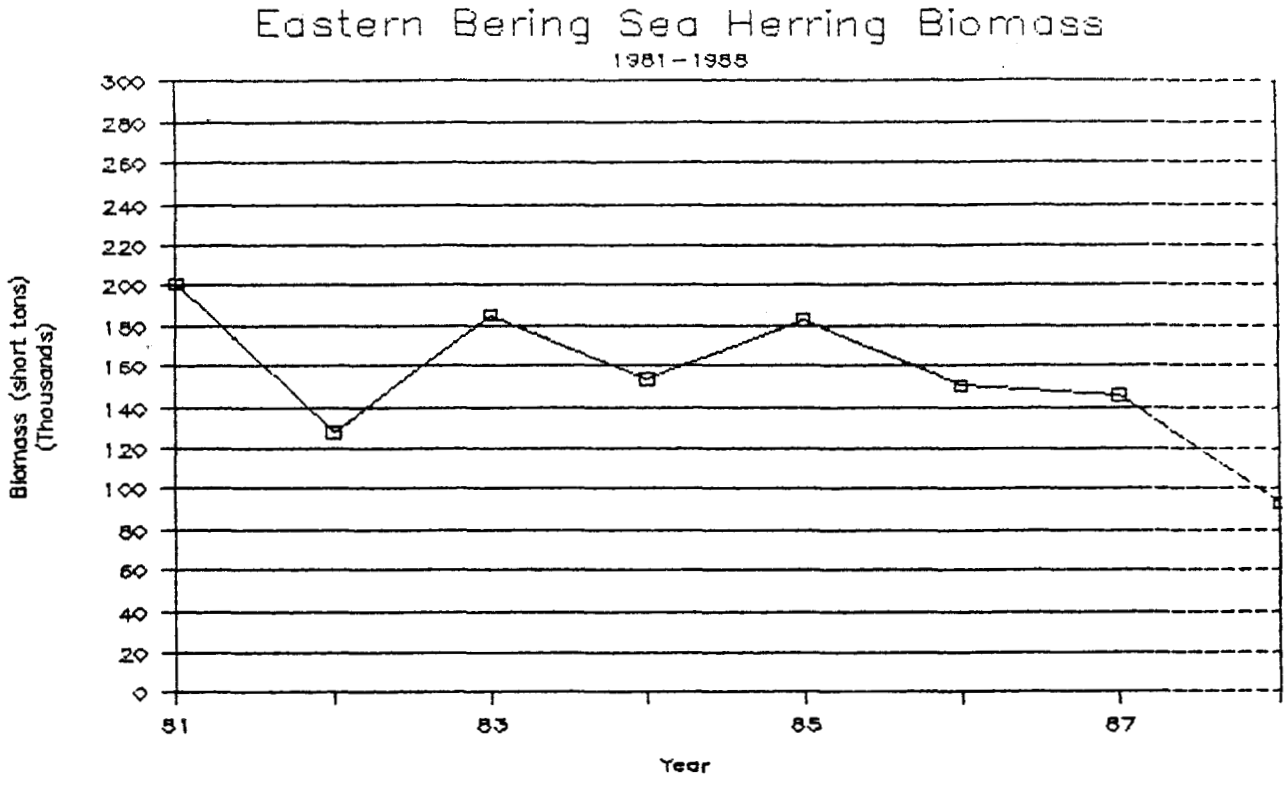
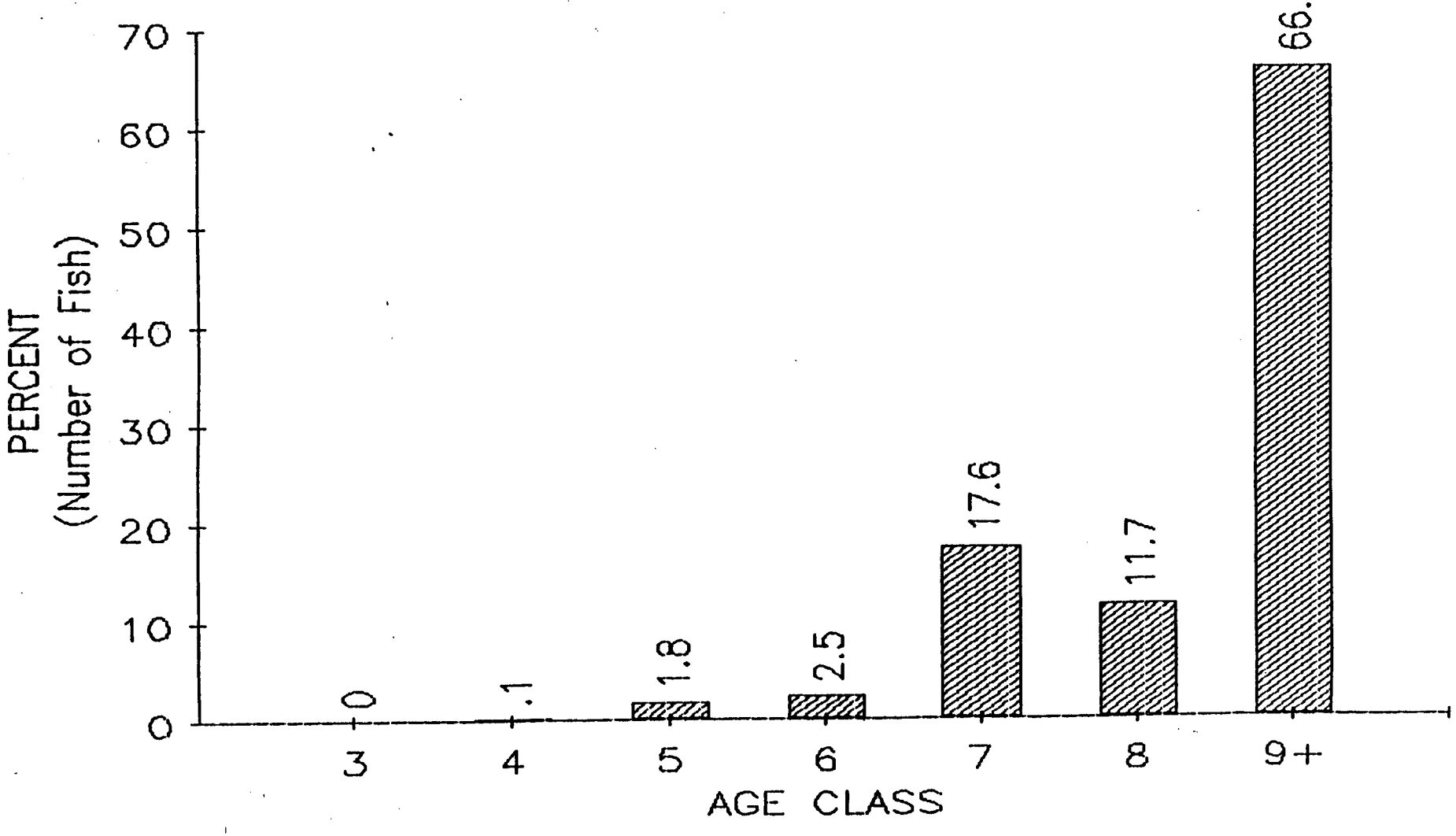

Eastern Bering Sea Herring Biomass
1981-1988
Biomass (short tons)
(Thousands)
300
280
260
240
220
200
180
160
140
120
100
80
60
40
20
0
81
83
85
87
Year

Figure 1.

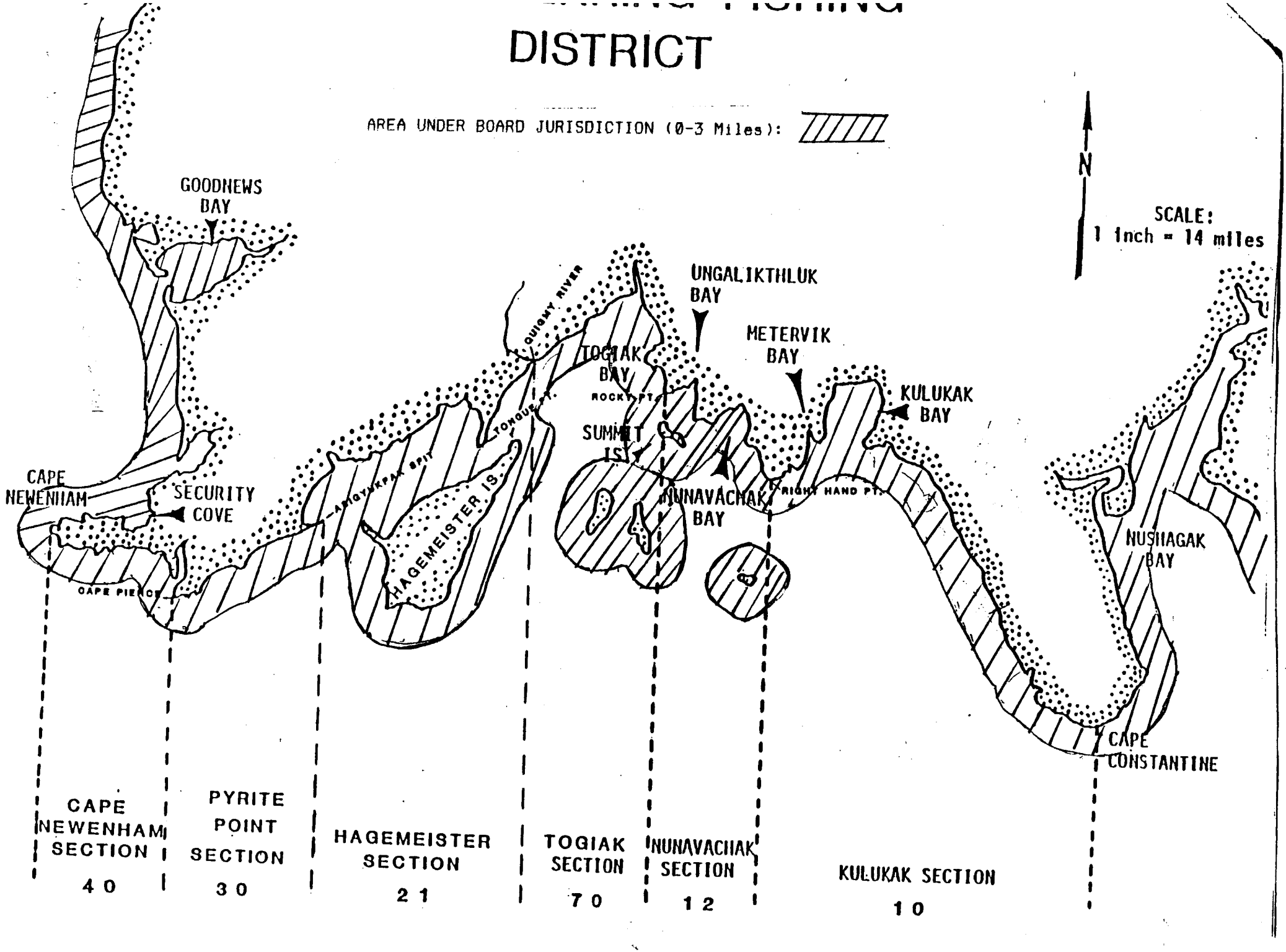
BRISTOL BAY
PACIFIC HERRING SPAWNING BIOMASS
1988 MINIMAL PROJECTION

(Biomass = 54,500 st...20% Harvest = 10,900 st)



NOTE: Use projection estimate with extreme caution.

DISTRICT


AREA UNDER BOARD JURISDICTION (0-3 Miles):
N
SCALE:
1 inch = 14 miles
GOODNEWS BAY
CAPE NEWENHAM
SECURITY COVE
CAPE PIERCE
ANGYUKPAK SPIT
HAGEMEISTER IS.
QUIGMY RIVER
TORQUE PT.
UNGALIKTHLUK BAY
METERVIK BAY
TOGIAK BAY
ROCKY PT.
SUMMIT IS.
NUNAVACHAK BAY
RIGHT HAND PT.
KULUKAK BAY
NUSHAGAK BAY
CAPE CONSTANTINE
CAPE NEWENHAM SECTION
40
PYRITE POINT SECTION
30
HAGEMEISTER SECTION
21
TOGIAK SECTION
70
NUNAVACHAK SECTION
12
KULUKAK SECTION
10

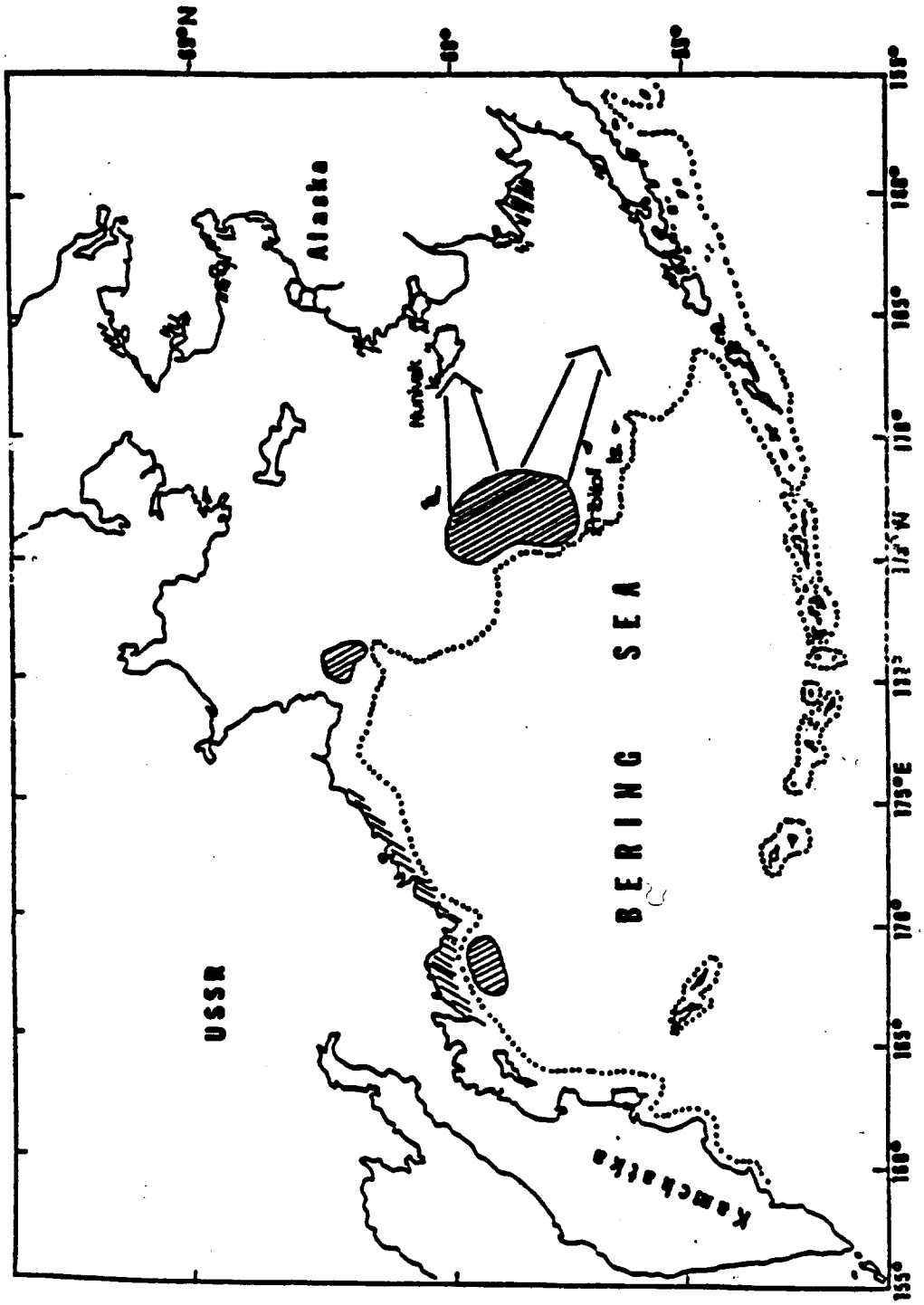


Figure 4. Location of the spawning and winter grounds (oval areas) of main eastern and eastern Bering Sea Pacific herring stocks and routes of migration of eastern stocks to spawning areas.

(Proposed area for closure indicated by yellowed area/shaded area-
Zones 511, 512, and the eastward portion of Zone 514 extending from Cape Newhenham)

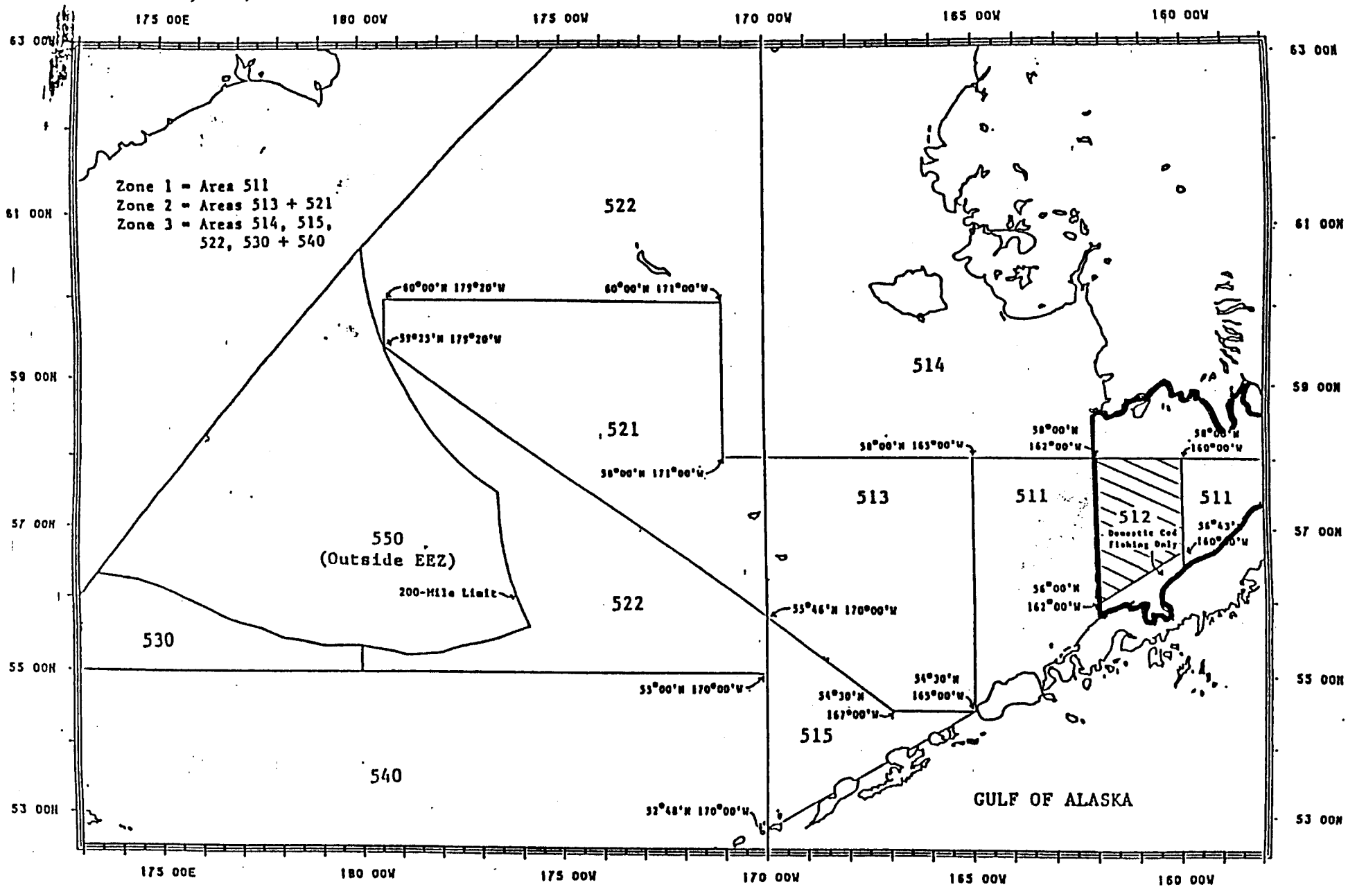


Figure 5.--Bering Sea zones by which the restrictions on the incidental catch of king and Tanner crab appl

TABLE 2/.--Estimated catches of prohibited species and associated bycatch rates in 1987 yellowfin sole/flatfish joint venture fishery in Area 514 of the Bering Sea[1/]

SPECIES	ESTIMATED CATCH	BYCATCH RATE[1/]
HERRING	374.7 T	0.25 %
HALIBUT	119,411 fish	0.865 halibut/t
	312.9 T	0.23 %
CHINOOK SALMON	93 fish	0.0006 fish/t
OTHER SALMON SPECIES	470 fish	0.003 fish/t
RED KING CRAB	10,299 crab	0.075 crab/t
BLUE KING CRAB	245 crab	0.002 crab/t
OTHER KING CRAB SPECIES	18 crab	0.0001 crab/t
C. BAIRDI TANNER CRAB	39,423 crab	0.286 crab/t
OTHER TANNER CRAB SPECIES	1.6 Million crab	11.867 crab/t

1/ The bycatch rates of herring and halibut are expressed in terms of % by weight of total groundfish catch. The bycatch rates of halibut, king crab species, salmon species, and Tanner crab species are expressed in terms of number per ton of groundfish catch.

Denby Lloyd 11/28/87

Table 8.--Estimated catches of groundfish (1,000s t) taken by the foreign and joint venture fisheries in the Bering Sea/Aleutian Islands region, 1977-86a.

Fisheries/ species group	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
	Foreign directed catches (metric tons)									
Pollock	978.4	979.4	944.0	1,006.1	986.9	959.3	891.5	933.0	820.3	352.3
Pacific cod	35.9	47.4	41.4	37.3	39.1	28.2	41.5	58.5	57.2	39.3
Sablefish	4.6	2.0	2.2	2.4	3.0	3.8	3.2	1.9	0.3	0.1
Atka mackerel	NA	24.2	23.3	20.2	18.1	7.4	1.2	0.1	<0.1	<0.1
All rockfish	10.8	7.5	7.2	8.5	7.3	4.9	2.0	0.9	0.1	<0.1
Yellowfin sole	0.3b	110.3	101.1	77.8	81.3	76.0	85.9	126.8	100.7	57.2
Turbots and other flatfish	136.4b	125.5	90.0	88.5	91.9	79.3	80.3	59.3	46.9	20.8
Pacific herring	19.3	8.4	7.5	0.8	0.3	1.9	1.4	1.3	1.5	0.3
Other fish	94.7	71.8	64.7	47.0	39.4	22.3	14.3	7.5	6.3	4.0
Squid	8.4	9.4	7.0	6.4	5.9	5.0	4.0	3.1	1.6	0.8
Snails	0.4	2.2	0.5	0.1	0.2	0.2	0.3	0.2	0.1	0.5
TOTAL	1,289.1	1,385.5	1,288.9	1,295.1	1,273.4	1,188.4	1125.5	1,192.7	1,035.0	475.9
	Joint venture catches (metric tons)									
Pollock				10.7	42.1	54.6	149.0	237.0	377.5	835.1
Pacific cod				8.5	9.2	13.6	14.4	30.8	41.3	63.9
Sablefish				<0.1	0.2	0.1	0.1	0.3	0.1	0.4
Atka mackerel				0.3	1.6	12.5	10.5	35.9	37.9	32.0
All rockfish				0.1	<0.1	<0.1	0.1	0.6	0.5	0.5
Yellowfin sole				9.6	16.0	17.4	22.5	32.8	126.4	151.4
Turbots and other flatfish				2.8	6.0	9.2	11.8	17.4	46.3	65.5
Pacific herring				0.0	0.0	<0.1	1.1	1.8	3.1	3.8
Other fish				0.7	3.4	1.1	1.6	2.6	6.3	7.6
Squid				0.0	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Snails				0.0	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL				32.6	78.5	108.6	211.2	359.3	639.4	1,160.2

a Statistics for 1977-85 from Berger et al., 1987.

b Japan reported yellowfin sole combined with other flounders.

Denby Lloyd 11/28/87

APPENDIX D

STATE OF ALASKA

DEPARTMENT OF FISH AND GAME

DIVISION OF BOARDS

STEVE COWPER, GOVERNOR

P.O. BOX 3-2000
JUNEAU, ALASKA 99802-2000
PHONE: (907) 465-4110

December 10, 1987

Mr. James O. Campbell, Chairman
North Pacific Fishery Management Council
P. O. Box 10316
Anchorage, AK 99510

Dear Mr. Campbell:

The Alaska Board of Fisheries wishes to express its concern for the incidental harvest of herring in domestic, joint venture, and international zone foreign trawl fisheries in the Bering Sea. The severity of this problem is rapidly increasing as trawl fleets are shifting effort into herring spawning and migration areas while eastern Bering Sea herring stocks continue to decline. Togiak, Security Cove, Goodnews Bay, Nelson Island, and Nunivak Island herring stocks are depressed and harvests will be substantially reduced in 1988 compared to recent levels. If no recruitment is observed in 1988, directed or incidental harvests of these stocks in 1989 will constitute a critical conservation problem.

Yellowfin sole joint venture effort in the Togiak area herring spawning grounds may be of a particular concern. The Board of Fisheries currently has a proposal before it to close waters of Alaska to trawling in the Togiak area. Following Board action on this proposal, we will notify you of our decision.

The Board recognizes that coordinated state and federal actions will be needed to provide management and conservation of herring. To address the Togiak area and other herring bycatch concerns, the Board of Fisheries recommends that the Council place a high priority on proposals to amend the Bering Sea/Aleutians Fishery Management Plan during the 1988 Plan amendment cycle that will allow the Council to address herring bycatch issues; provide for adequate observer coverage in 1988 in domestic and joint venture trawl fisheries which occur along known herring migration routes; and investigate mechanisms for placing observers aboard vessels in the Bering Sea International Zone and improving catch reporting from this area.

We also suggest that the Bering Sea/Aleutians Plan Team work with Alaska Department of Fish and Game staff to develop a coordinated state/federal management plan to address herring issues.

Thank you for your attention to this matter.

Sincerely,

Gary Slaven, Chairman
Alaska Board of Fisheries

APPENDIX E

STATE OF ALASKA

STEVE COWPER, GOVERNOR

DEPARTMENT OF FISH AND GAME

DIVISION OF COMMERCIAL FISHERIES

P.O. BOX 3-2000
JUNEAU, ALASKA 99802-2000
PHONE: (907) 465-4210

January 27, 1988

Dear Joint Venture Operator:

The Alaska Department of Fish and Game is concerned about potential herring bycatches in yellowfin sole trawl fisheries which may occur near the Togiak herring spawning grounds. Togiak herring stocks are currently at low levels because recruitment has been poor for the past seven years, and the remaining age classes in the population are rapidly declining. Substantial unplanned-for incidental harvests of Togiak herring stocks could further depress the resource. While herring trawl bycatches were not high in 1987 in this area, it would be possible for herring bycatches to accumulate very rapidly if trawl effort were to occur in areas through which dense concentrations of herring were migrating.

Herring migratory routes in the Togiak area are indicated on the attached map. The majority of the herring spawning activity in the Togiak area lasts for a duration of about three weeks. Spawning activity can begin as early as April 15 and last until June 30, depending on migratory timing during any specific year. We will be providing more precise information on the timing of the 1988 herring spawning migration to you during April. The department requests your cooperation in attempting to minimize herring bycatches by avoiding these areas to the extent possible during the time of the Togiak herring spawning migration. Your help in this effort can minimize the potential need for future regulatory restrictions.

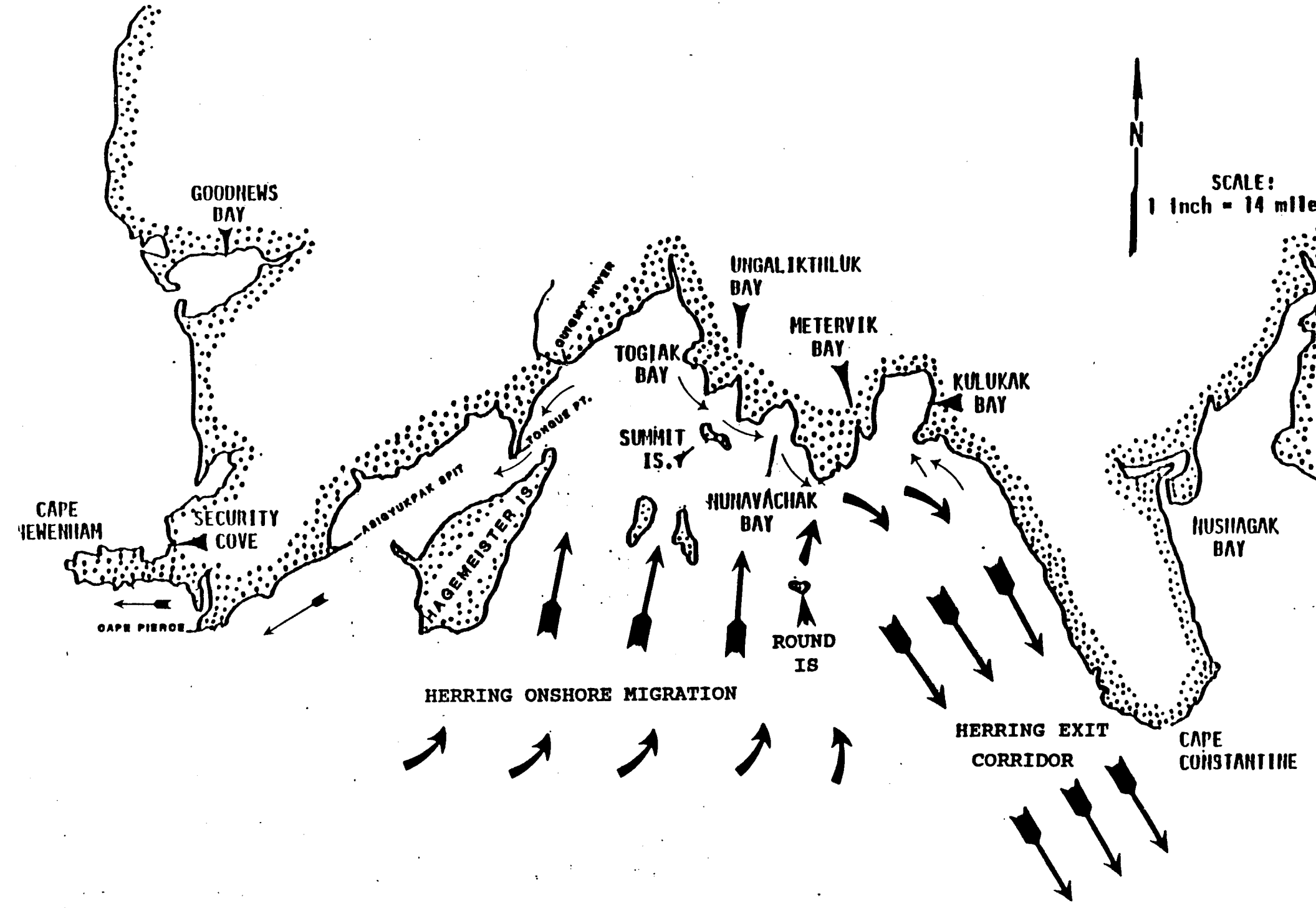
Sincerely,

Ken Parker, Director
Division of Commercial Fisheries

cc: Jim Branson, NPFMC
Bob McVey, NMFS/AKR

11-K5LH

TOGIAK HERRING SPAWNING MIGRATION



ProFish International, Inc.

PROFISH INTERNATIONAL

January 29, 1988

Ken Parker - Director
Division of Commercial Fisheries
Alaska Dept. of Fish & Game
P.O. Box 3-2000
Juneau, AK 99802-2000

Dear Director Porter:

Thank you for your letter and information sheet on herring migratory patterns with reference to the issue of by catch in the joint venture yellowfin sole fishery.

Let me assure you that we are aware of the concerns and sensitive to our responsibility to conduct the cleanest possible fishery. We will look forward to further timely information regarding your staffs opinions on the timing and orientation of this years spawning herring migration. We will stand ready to forward any relevant information to our fleets on a daily basis.

Our hopes and efforts will be to continue to conduct this JV fishery "by-catch free". Thank you for your assistance.

Sincerely,

Michael G. Stevens

659 North 34th Street, Seattle, WA 98103 USA, 206-547-6800, Telex: 320355 PROFSH

KODIAK & WESTERN TRAWLER GROUP

David Harville

F/V Margaret Lyn
Little Bear
Hickory Wind
Adgee
Joey Lee II

P.O. Box 1578
Kodiak, AK 99615
Telephone:
(907) 486-6460 Office
(907) 486-4628 Home
Telex:
AK DAGRS KODK 26429

February 1, 1988

Ken Parker, Director
Division of Commercial Fisheries
Department of Fish & Game
P.O. Box 3-2000
Juneau AK 99802-2000

Dear Ken:

I am in receipt of your letter dated January 27, 1988. I too am very concerned about the JV fishery in the Togiak area, and its relationship to the Togiak herring fishery. Last year, this fishery proved to be a very substantial portion of our years harvest and I would hate to see it lost. I also realize that significant impact on the herring fishery is not to be tolerated.

I know that the Board of Fish is looking at this situation possibly even considering blanket closures. This could be devastating to the JV fleet. It is also a fact that the North Pacific Management Council is showing a great deal of interest in this area.

Last year, when the concern of the Togiak people was raised, I personally telephoned the radio station in Dillingham and offered to take anyone, especially the very vocal radio announcer, aboard any of my catcher vessels to personally monitor the situation. I had no takers.

In light of the above, Ken, I hereby make this offer to ADF & G, to the North Pacific Council, to interested fishermen or anyone else concerned with the Togiak herring fishery:

> I will make any of my vessels available to these parties during the time we are in the Togiak area. These interested parties may put one observer aboard with the only condition that they are responsible for any additional insurance premiums incurred. This should be no more than $500.00. I will provide bunks and food and any other help that I can in order that we can together get a good handle on the situation.

Ken, please keep me informed as to the situation and as to anything I can do to facilitate peaceful coexistence within the Bristol Bay fisheries. Please forward a copy of this letter to the Board of Fish and to the ADF & G office in Dillingham.

Sincerely,

David P. Harville

DPH/nad

cc: North Pacific Fisheries Management Council
Bob McVey, NMFS/Juneau

STATE OF ALASKA **MEMORANDUM**

To: Distribution

Date: February 24, 1988

From: Fritz Funk
Marine Finfish Biometrician
Division of Commercial Fisheries

Phone: 465-4210

Re: Bristol Bay Stock Status

Attached is the final version of the Bristol Bay Stock Status RIR that I put together to respond to Senator Zharoff's request.

Distribution: Doug Eggers
Ken Florey
Chuck Meacham
Dennis Haanpaa
Jeff Skrade
Linda Brannian
Gene Sandone
Kathy Rowell
Bob Wilbur ✓

February 18, 1988

The Honorable Fred Zharoff
Alaska State Legislature
P.O. Box V
Juneau, AK 99811

Dear Senator Zharoff:

In response to the concerns you expressed to Mr. Parker during your January 28 meeting, my staff has prepared the attached summary and analysis of the declining abundance of Bristol Bay herring spawning stocks.

The declining herring biomass results from the low levels of recruitment over the past six years. Herring recruitment is strongly driven by environmental fluctuation, and is not heavily affected by the magnitude of the spawning biomass, within limits. Given the past 25 years of recruitment history of these stocks, the present six year recruitment lapse is not unusual. Also attached is an article from the May 1987 National Fisherman, which discussed the problem of lack of recruitment in the Togiak fishery.

Although we do not believe that trawl bycatch is related to the low recruitment levels, trawl bycatch could become particularly serious now that Bristol Bay herring stocks are declining to lower levels. We have taken steps to ensure that the Board of Fisheries and the North Pacific Fisheries Management Council will be addressing herring trawl bycatch issues. As you are aware, the immediate need in addressing all trawl bycatch problems is expanded observer coverage. Because it does not appear that regulatory measures to address herring bycatch issues will be in place for the 1988 fishing season, our staff is attempting to work with the joint venture and domestic trawl fleets to secure their voluntary cooperation. We are providing the trawl fleets with information regarding herring migration routes and timing, and will be updating the fleets on the specific timing of the 1988 spawning migration. Thus far we have received a positive response from the trawl fleets that wish to avoid another incidental catch problem if at all possible.

Please let us know if we can provide further information about Bristol Bay herring stocks.

Sincerely,

Don W. Collinsworth
Commissioner

Enclosures

bcc: Ken Parker

Ken Florey

Roland Shanks

DWC/FF/jln

STATUS OF BRISTOL BAY HERRING STOCKS IN 1988

EXECUTIVE SUMMARY

Although Bristol Bay herring stocks have provided the largest sac-roe herring fishery in Alaska in recent years, stock biomass is declining rapidly because no significant recruitment to the fishery has been observed for six years. This lapse in recruitment is not unusual for Bristol Bay stocks, for which long periods of very low recruitment, followed by one or two years of excellent recruitment, are typical. For the 25 year classes resulting from the 1959-1983 spawning events for which recruitment strength indices are available, strong year classes have been produced only once every five years on the average.

Herring recruitment success is strongly controlled by environmental factors and only very generally related to spawning biomass. No relationship between spawning biomass and recruit production is evident for the 1959-1983 year classes, although for very low spawning biomass levels, some relationship must exist. Spawning biomass during this period has consistently remained well above the 35,000 ton threshold set for the Bristol Bay area, although recruitment has shown extreme variation.

The large Soviet and Japanese trawl fisheries for herring in the Bering Sea in the 1960's were exploiting the very strong 1957 year class and the strong 1962 year class. The peak foreign harvest of over 150,000 metric tons in 1968 resulted in sharp declines in herring biomass and subsequent foreign trawl harvests. Foreign trawl harvests ended in 1978 under provisions of the FCMA. Maximum biomass of all eastern Bering Sea stocks may have exceeded 1-2 million metric tons during the 1960's when the very strong 1957 year class was present. Biomass levels observed in aerial surveys of the Bristol Bay area since the inception of roe fisheries have ranged between 100,000 and 200,000 short tons. The strong 1972-1974 year classes supported the early development of the roe fishery, while the 1977 and 1978 year classes have supported by roe fishery during the mid 1980's. Harvests of herring during the roe fishery have ranged between 12,000 and 26,000 short tons.

The 1988 projected biomass of 54,500 tons is expected to decline rapidly in the future because the population is mostly comprised of 10 and 11 year old fish (the 1977 and 1978 year classes) for which natural mortality rates are high. Herring fisheries will be sharply curtailed or eliminated in the future if no recruitment is observed.

The Board of Fisheries has adopted a management plan for the Bristol Bay herring fishery which specifies that that exploitation rates up to 20% are allowed if the biomass is above the 35,000 ton threshold. An exploitation rate of up to 20% is considered to be appropriate for herring by other west coast fishery management agencies. Exploitation rates are kept at this relatively low level to ensure that sufficient reproductive potential is preserved for the relatively infrequent occurrence of favorable environmental conditions for larval survival.

Because recruitment has been extremely low while adult survival has remained high, the incidental harvest of Bristol Bay herring stocks in groundfish trawl fisheries has clearly not been the cause of the declining biomass. However, if Bristol Bay herring stock levels continue to decline so that target herring fisheries are reduced or closed, substantial trawl bycatches could constitute a critical conservation concern in the future. Expanded observer coverage, particularly on domestic vessels, is critically needed in order to estimate the magnitude of the incidental harvests.

While the available indices of Bristol Bay herring stock abundance clearly indicate a declining trend, the precision of these estimates is relatively low. The precision and reliability of aerial survey estimates is a particular problem. A biomass estimate is now also derived from cohort analysis techniques which rely on the time series of age distributions from ADF&G age-weight-length sampling programs and are relatively independent of aerial surveys. However, only aerial surveys can provide inseason estimates of abundance. New technology needs to be incorporated into aerial survey estimates to increase their reliability and precision. Computerized pattern recognition techniques can be used to precisely estimate the surface area and density of herring schools, removing a highly subjective element of the present aerial survey estimates. Side-scanning sonar can be used during aerial survey calibrations to determine how the underwater profiles of herring schools vary with depth. A sonic tagging project could provide estimates of the residence time of herring schools on the spawning grounds, so that the overlap between biomasses observed on successive aerial surveys can be determined.

Increasing the precision of abundance estimates will become critically important as stocks decline to low levels. Relatively small shifts in abundance indices could determine whether or not any fishery will be allowed, or whether overharvest might occur.

A so-called beach party assembles on the shore at Togiak to await the opening of the sac roe herring fishery. At the start-up signal, the boats and spotter planes will be whipped into action. The scenario at Togiak is mild compared to the frenzied openings elsewhere in Alaska.

— Bart Eaton photos

Togiak's roe herring 'crapshoot' is becoming an even greater gamble

By Joel Gay

Alaska's sac roe herring fisheries have a reputation for being fast, furious and lucrative, but the granddaddy of them all — the one in Togiak, located on the north shore of Bristol Bay — is showing signs of aging, and that isn't a pretty sight for fishermen.

Not that Togiak is all that old. It was just ' -s ago that three seiners made the ' rip from Homer to find those grounds, full of fish and devoid of competition. Nor will the fishery this May be a waste of time: If herring prices remain at last year's level, the 1987 ex-vessel value will top $6 million for three or four hours of fishing time.

But Togiak is in danger of death by attrition. For the past several years, the fishery has relied almost solely on a huge age class of fish spawned in 1977-'78. Unless a big batch of young fish appears on the grounds this year, the 1988 season will be a bare-bones operation that could drop the seine fishery to the lowest level since its inception. And if that scenario were to repeat itself the next year, as it has for the past six or seven, Togiak will be heading for the rest home.

The 1987 catch is forecast at 12,200 tons, according to Jeff Skrade of the Alaska Department of Fish and Game in Dillingham. Take out 1,500 tons for a spawn-on-kelp fishery, and that leaves just 10,700 for seiners and gillnetters to split. If the projection is borne out on the grounds, it would be the lowest harvest since 1978's.

Even at 12,000 tons, Togiak will still be the biggest herring fishery in the state, with a harvest three times higher than those of Prince William Sound, Sitka Sound or Cook Inlet. Nonetheless, it doesn't compare to landings of just two seasons ago, when fishermen hauled nearly 26,000 tons out of Togiak Bay, nor to the 1983 catch, which hit almost 27,000 tons, nor to 1980's 24,500 tons.

Herring are prized not for their meat but for their precious payload of eggs. The Japanese, in particular, are fond of herring roe after it's undergone a complex pickling process. Called "kazunoko," the pickled roe is a holiday delicacy that more and more Japanese have found affordable.

Following the simplest of economic laws, as demand increased, the price paid to fishermen skyrocketed. During the 1970s, the price of herring roe jumped several thousand percent, thus attracting an unparalleled following among Alaskan fishermen.

In the Beginning

Homer seiner Beaver Nelson is one of the pioneers of the sac roe fishery. He and a handful of others from the Homer area started fishing for Whitney-Fidalgo around Kodiak Island in 1969. "They furnished the gear and paid $30 a ton," Nelson recalls. Thus was the sac roe industry born.

To pass time before the summer salmon seasons began, Nelson and his cohorts began exploring other areas. Cook Inlet initially yielded little.

"I remembered seeing schools of herring over in Seward when I was a kid, so just on a lark, we went over," Nelson says. As it turned out, the Seward run was good, so a few more boats trickled over. The price of roe was nudged higher.

Over the next several years, the Homer fleet investigated other areas of Prince William Sound and parts of lower Cook Inlet. But the biggest discovery was made by a Japanese fish buyer named Shigeyoshi Kitano — better known as "Capt. K." He had done some investigating on his own around Bristol Bay, and in 1977, Nelson and Kenny Moore were directed to a little bay on the north shore called Togiak. It was herring heaven — thousands of tons of fish and no other fishermen in sight. The isolation was short-lived, however.

"It went from zero to 'maxed-out' in three years," Nelson recalls. Within 10 days, the two-boat fleet had swelled to seven and by the next year, to 25. In 1979, over 100 vessels split a total catch of 11,500 tons worth $6.7 million.

No Guarantees

Togiak has been good to many Alaska fishermen and heartless to others. A big set might be worth as much as $250,000 to some lucky seiner, while another might round up a batch of "green" fish after waiting on the grounds for a month. And more than one spotter pilot has died in the air over Togiak.

Yet Togiak is mild compared to other sac roe fisheries. In Prince William Sound a few years back, the entire 5,000-ton catch was taken in one hour. Some boats had waited nearly a month for the opening and then, anticipating that a flare would signal the fishery's start, battled for position with 100 others. Spotter planes circled overhead

like gulls around a dumpster, searching for [illegible] codends to their boats and trying to avoid mid-air collisions. It was snowing when the flare went off.

With only an hour, a skipper doesn't want to make a wrong move. "You don't have any time to make a mistake," says Nelson, "because there's no time to correct it. It could take 20 minutes to haul your net back in, and by the time you're done, the season might be over."

Fishermen are given 24 hours' notice of imminent opening; then six, and then one. By that time, the entire fleet is on the grounds, with schools of herring appearing and disappearing by the minute.

"Some times the fish are swimming right under you, and if the flare were to go off right then, you'd have a huge set," Nelson notes. "But that position may be good for 10 seconds, and then they're gone and in front of somebody else."

"It's the most unpredictable game I've ever seen," adds Homer seiner Ken Jones, whose good fortune in the herring fishery boosted him from deckhand to skipper in a few short years.

Added Pressure Expected

The pressure on Alaska's sac roe herring fisheries may increase in 1987. The statewide harvest is projected to drop from 1986's levels. Prince William Sound's fishery should yield less than half last year's harvest, at about 4,000 tons, and Sitka Sound is expected to fall slightly, to 3,600 tons. One of the brighter spots is Cook Inlet, which has been closed for most of the past decade but has rebounded to an estimated 1987 catch of 3,900 tons.

More than 75% of the Togiak catch will come from fish aged eight years or older, and therein lies a dilemma, according to herring biologist Jeff Skrade.

"We've been exploiting fish of this same age class every year, and nature is not replacing them," he explains. Biologists haven't seen any big group of younger fish waiting to take that group's place.

The harvest every year can be determined by removing 20% of the total biomass. "We feel pretty confident that 20% is a conservative number," Skrade says. Nature is what has taken the toll on Togiak's herring stocks, he believes. "These things are a very sought-after prey, from the initiation of spawning through their entire life history. Virtually everything that swims or flies out there is after herring."

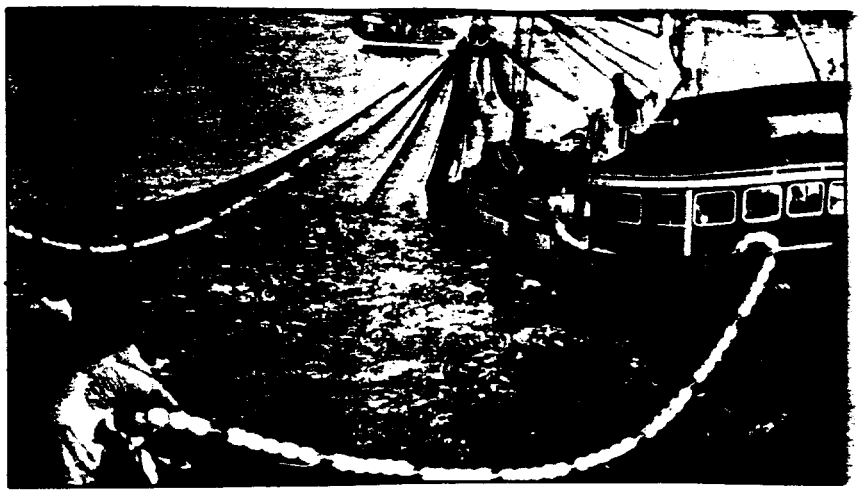
Climatic forces haven't been kind, either, Skrade adds. Togiak is frequently hit by big storms in the spring. "We get spawning on the beaches, and then these big southerly storms bring in an influx of cold water with high salinity. I suspect that's the driving force behind low survival rates in recent years," Skrade notes.

Herring fishing is a high-stakes gamble anywhere in Alaska, and this year Togiak will be no different. Anyone who shows up on the grounds can participate, which is not the case with the limited-entry fisheries in most areas of the state.

There's a possibility that an enormous class of three-year-old fish will show up in Togiak this year, and though it wouldn't contribute significantly to the catch, it could boost the harvest higher than projected. On the other hand, Skrade says, there might have been greater mortality than thought, which would result in a lower catch than expected. Then too, biologists may have gotten a bad estimate of the biomass last year, in which case all bets are off on how big the 1987 harvest will be.

Some fishermen don't particularly like the thoughts of an unpleasant surprise after a long run — four days from Homer in good weather, perhaps two or three weeks if the winds pick up along the Alaska Peninsula. Fishermen who combine that prospect with the knowledge of improved stocks in Cook Inlet are not likely to make the Togiak run this year.

Others will continue to take the chance as long as the fishery is open. "It's a real crapshoot kind of thing," explains one Togiak veteran. "You can make your whole season if there's an opening." □



A large measure of luck comes into play during the roe herring openings at Togiak. One lucky seiner might make a set worth as much as $250,000, while another can end up with a batch of empty fish after spending a month on the grounds awaiting the openi Fortunes are made and hea are broken simultaneously i this fishery.