GROUNDFISH
GULF OF ALASKA
1980 CUMULATIVE DOMESTIC CATCHES

Reporting Period: Nov. 1979 - Oct. 1980
Landings Thru August 31, 1980

Species	DAH	Landings Metric Tons	Landings Pounds	
Pollock	(21,310 mt)	2,101.3	4,631,000	
Flounder	(3,180 mt)	485.2	1,069,000	
Cod	(10,000 mt)	862.8	1,902,000	
Pacific Ocean Perch Rockfish	(3,815 mt)	489.3	1,078,000	
Sablefish	(6,480 mt)	1,125.4	2,480,000	(1)
Rattail	(1,332 mt)	0	0	
Atka Mackerel	(1,440 mt)	1.7	4,000	
Squid	(150 mt)	0	0	
Idiot Rockfish	(6 mt)	0	0	
Other	(1,560 mt)	105.3	232,000	
Unspecified		468.0	1,031,000	
TOTAL		5,639.0	12,428,000	

(1) Dressed Weight

Alaska Department of Fish and Game
Division of Commercial Fisheries
Juneau, Alaska 99801
19 September 1980

GROUNDFISH
BERING SEA/ALEUTIAN ISLANDS
1980 CUMULATIVE DOMESTIC CATCHES

Reporting Period: Jan. 1980 - Dec. 1980
Landings Thru August 31, 1980

Species	Landings	
	Pounds	Metric Tons
Pacific Cod	17,682,000	8,022.5
Yellowfin Sole	20,481,000	9,292.7
Other Flounders	385,000	174.9
Pollock	27,751,000	12,591.2
Pacific Ocean Perch	63,000	28.7
Other Rockfish	20,000	8.9
Sablefish	119,000	54.2
Atka Mackerel	462,000	209.6
Other	389,000	176.5
Unspecified	30,000	13.8
Total	67,383,000	30,573.0

Alaska Department of Fish and Game
Division of Commercial Fisheries
Juneau, Alaska 99801
19 September 1980

Alaska Department of Fish and Game
19 September 1980

GULF OF ALASKA GROUNDFISH - ALL AREAS
DOMESTIC CATCHES - NOV. 1979 thru OCT. 1980
Metric Tons

	Nov	Dec	Jan	Feb	Mar	Apr [1]	May	June	Jul	Aug	Sep	Oct	Catch To Date
Pollock DAH= 21,310	10.4	3.2	123.3	338.5	367.2	866.8	320.9	34.9	0	36.1			2,101.3
Cod DAH= 10,000	7.7	3.1	87.7	64.4	231.1	341.4	107.3	9.4	4.0	6.7			862.8
Flounder DAH= 3,180	47.3	54.4	54.3	16.6	16.2	150.6	140.9	2.0	0.3	2.6			485.2
Pacific Ocean Perch DAH= 2,915													
Other Rockfish DAH= 900	6.5	2.8	1.3	10.2	10.6	23.3	39.3	36.6	333.9	24.8			489.3
Sablefish [2] DAH= 6,480	26.5	7.3	19.4	56.6	40.6	130.8	154.9	167.0	325.2	197.1			1,125.4
Atka Mackerel DAH= 1,440	0	0	0	0	0	1.7	0	0	0	0			1.7
Squid DAH= 150	0	0	0	0	0	0	0	0	0	0			0
Rattails DAH= 1,332	0	0	0	0	0	0	0	0	0	0			0
Idiot Rockfish DAH= 6	0	0	0	0	0	0	0	0	0	0			0
Other DAH= 1,560	5.3	11.0	3.7	4.3	6.3	33.4	10.2	3.5	13.1	14.5			105.3
Unspecified	26.1	30.9	107.7	179.7	108.7	8.4	0.4	1.9	4.2	0			468.0
Total	129.8	112.7	397.4	670.3	780.7	1,556.4	773.9	255.3	680.7	281.8			5,639.0

1/ Domestic catches not landed in Alaska for November 1979 through April 1980 are included in the catch for April 1980

2/ Dressed weight

GULF OF ALASKA GROUNDFISH - EASTERN
DOMESTIC CATCHES - Nov. 1978 thru OCT. 1980
METRIC TONS

	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Catch To Date
Pollock DAH= 2,215	0	0	1.6	249.6	172.6	0	0	0	0	0			423.8
Cod DAH= 2,070	1.6	0.6	T	6.6	32.7	7.1	16.0	3.4	3.7	1.5			73.2
Flounder DAH= 1,360	44.8	49.3	50.6	0.1	0.3	0	0	0	0	0			145.1
Pacific Ocean Perch DAH= 1,315													
Other Rockfish DAH= 575	6.5	2.8	1.3	7.3	10.6	5.5	32.6	31.1	333.4	15.6			446.7
Sablefish 1/ DAH= 4,990	26.5	7.1	19.1	49.5	34.3	118.5	151.5	152.9	321.8	194.6			1,075.8
Atka Mackerel DAH=70	0	0	0	0	0	0	0	0	0	0			0
Squid DAH= 60	0	0	0	0	0	0	0	0	0	0			0
Rattails DAH= 1,266	0	0	0	0	0	0	0	0	0	0			0
Other DAH= 540	0.4	0.5	0.4	2.2	3.4	0.2	3.2	2.8	6.1	4.5			23.7
Unspecified	25.4	30.9	4.9	51.2	37.8	0	0.2	1.9	0.9	0			153.2
Total	105.2	91.2	77.9	366.5	291.7	131.3	203.5	192.1	665.9	216.2			2,351.5

1/ Dressed weight

Alaska Department of Fish and Game
19 September 1980

GULF OF ALASKA GROUNDFISH - CENTRAL
DOMESTIC CATCHES - NOV. 1979 thru OCT. 1980
METRIC TONS

	Nov	Dec	Jan	Feb	Mar	Apr 1/	May	Jun	Jul	Aug	Sep	Oct	Catch To Date
Pollock DAH= 13,320	10.4	3.2	121.7	88.9	194.6	789.9	320.4	34.9	0	0.8			1,564.8
Cod DAH= 6,050	6.1	2.5	87.7	57.8	198.4	325.8	91.3	6.0	0.3	1.0			776.9
Flounder DAH= 1,120	2.5	5.1	3.7	16.5	15.9	142.3	140.9	2.0	0.3	0.5			329.7
Pacific Ocean Perch DAH= 1,225													
Other Rockfish DAH= 250	0	0	0	2.9	0	17.8	6.7	5.5	0.5	7.8			41.2
Sablefish 2/ DAH= 1,220	0	0.2	0.3	7.1	6.3	12.3	3.4	14.1	3.4	2.5			49.6
Atka Mackerel DAH= 1,080	0	0	0	0	0	1.7	0	0	0	0			1.7
Squid DAH= 60	0	0	0	0	0	0	0	0	0	0			0
Rattails DAH= 33	0	0	0	0	0	0	0	0	0	0			0
Other DAH= 620	4.9	10.5	3.3	2.1	2.9	33.2	7.0	0.7	7.0	10.0			81.6
Unspecified	0.7	0	102.8	128.5	70.9	8.4	0.2	0	3.3	0			314.8
Total	24.6	21.5	319.5	303.8	489.0	1,331.4	569.9	63.2	14.8	22.6			3,160.3

1/ Domestic catches not landed in Alaska for November 1979 through April 1980 are included in the catch for April 1980.

2/ Dressed weight

Alaska Department of Fish and Game
19 September 1980

GULF OF ALASKA GROUNDFISH - WESTERN
DOMESTIC CATCHES - NOV 1979 thru OCT. 1980
METRIC TONS

	Nov	Dec	Jan	Feb	Mar	Apr 1/	May	Jun	Jul	Aug	Sep	Oct	Catch To Date
Pollock DAH= 5,775	0	0	0	0	0	76.9	0.5	0	0	35.3			112.7
Cod DAH= 1,880	0	0	0	0	0	8.5	0	0	0	4.2			12.7
Flounder DAH= 700	0	0	0	0	0	8.3	0	0	0	2.1			10.4
Pacific Ocean Perch DAH= 345	0	0	0	0	0	0	0	0	0	1.4			1.4
Other Rockfish DAH= 75	0	0	0	0	0	0	0	0	0	0			0
Sablefish DAH= 270	0	0	0	0	0	0	0	0	0	0			0
Atka Mackerel DAH= 290	0	0	0	0	0	0	0	0	0	0			0
Squid DAH= 30	0	0	0	0	0	0	0	0	0	0			0
Rattails DAH= 33	0	0	0	0	0	0	0	0	0	0			0
Other DAH= 400	0	0	0	0	0	0	0	0	0	0			0
Unspecified	0	0	0	0	0	0	0	0	0	0			0
Total	0	0	0	0	0	93.7	0.5	0	0	43.0			137.2

1/ Domestic catches not landed in Alaska for November 1979 through April 1980 are included in the catch for April 1980.

2/ Dressed weight.

Alaska Department of Fish and Game
19 September 1980

INSHORE ABUNDANCE OF PACIFIC HERRING IN THE BERING SEA DURING THE 1980 SPAWNING SEASON

By

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September 1980

Inshore Abundance of Pacific Herring in the Bering Sea During the 1980 Spawning Season

INTRODUCTION

This report describes methods used for assessment of the abundance of herring in the Bering Sea during the 1980 domestic inshore roe fishery and the methods and results of post-season analysis. This report updates two previous reports to the North Pacific Fishery Management Council concerning the status of Bering Sea herring stocks and fisheries. Barton and Steinhoff (1980) described the stock assessment technique and results for 1978 and 1979 and other important biological characteristics. The "Preliminary Report on the 1980 Western Alaska Herring Fishery" (ADF&G, 1980) presented to the Council July 24, 1980, summarized in-season and preliminary post-season assessments of Bering Sea Herring stocks.

The basic methods of data collection used in 1980 were identical to those used in 1978 and 1979 (Barton and Steinhoff, op cit). Repeated aerial surveys were conducted over the spawning grounds to determine number, size, and location of fish schools. Occurrence and extent of spawn or milt were also noted, as well as fishing effort and visibility factors affecting the quality of the survey. Test fishing with variable mesh gillnets was conducted on the Togiak, Security Cove, Cape Romanzof and Cape Denbigh fishing grounds (Figure 1) to collect herring samples for age, weight, sex and maturity analysis and also to determine relative abundance of other schooling fishes (capelin, smelt, sand lance and cod) which might be mistaken for herring by aerial observers. In

the Togiak District, commercial purse seine vessels and crews were contracted to set on herring schools of known surface area to enlarge an existing data base on surface area-biomass conversion factors. Finally, additional information pertinent to stock assessment was obtained through monitoring magnitude, timing, location and composition of commercial harvests of both herring and herring spawn-on-kelp. The Department of Fish and Game maintained field camps or large support vessels during the Togiak, Security Cove, Cape Romanzof and Norton Sound herring fisheries, and monitored remaining fisheries by aerial and ground surveys.

TOGIAK DISTRICT (BRISTOL BAY)

Aerial Surveys

During the 1980 season survey flights in the Togiak District occurred on 22 days from April 15 through June 2. Two biologists experienced in aerial survey techniques of herring biomass assessment in the Bering Sea participated in most of these flights, frequently in the same aircraft at the same time. Suitability of survey conditions (visibility of fish schools) was rated on a 5-way scale from excellent to unacceptable for each flight and index area. Comparative visibility data for surveys during the period 1978-1980 are summarized below:

	1978	1979	1980
Excellent	4%	0%	1%
Good	19%	25%	29%
Fair	25%	25%	28%
Poor	29%	26%	28%
Unacceptable	23%	24%	14%

Water turbidity was the primary interference in 1980, occurring at least to some degree on 17 of the 22 flights. Other factors which reduced the effectiveness of aerial surveys were rough seas, rain or snow squalls, low ceilings, winds, fog, poor light and heavy spotter plane traffic. An examination of survey rating data, survey maps and notes indicated that visibility of fish schools was as good as or even somewhat better than that of the previous two years. Survey conditions were rated poor or unacceptable in all index areas on May 11 and 13 resulting from intense storm activity on May 9, 10, and 12, but conditions improved to fair in four of the five index areas flown on May 14 and fair or good in four of six areas surveyed on May 19. It is unlikely that large numbers of herring schools were present in the Togiak District but not counted.

Test Fishing

A total of 82 sets was made using variable mesh gillnets in the Nushagak, Kulukak, Nunavachak and Togiak Bay portions of the Togiak District (Figure 2). Duration of the sets varied from 10 minutes to 18 hours depending upon the time necessary to capture a sample of fish. Test fishing began May 3 and continued through May 29, nearly 3 weeks after the commercial fishery was closed. The value of this activity to collect biological data in the absence of a commercial fishery is evident.

A total of 6,447 fish were collected of which 83% were Pacific herring. However herring composed 96% of the schooling, pelagic fishes which were likely to be spotted by aerial observers. Capelin, which are also abundant at times in the Togiak District, were not caught in the test

nets until May 19 and then in very low numbers. Analysis of age, weight, sex and maturity data from herring test fishing and commercial catch sampling is incomplete and will be presented in a future report.

Relative Abundance and Timing

To enable comparison between years and between dates and areas within years, the aerial survey observations of fish school numbers and sizes in the Togiak District have been converted to relative abundance indices (RAI's) following the method of Barton and Steinhoff (1980). Each observed school was converted to an equivalent number of small fish schools of standard area (50 m^2) which then allowed summation of daily counts by index area. Comparative RAI data by index area and date for 1980, 1979 and 1978 are presented in Tables 1, 2 and 3 respectively.

No fish schools were observed at the time of the scheduled fishery opening on April 15 and the first commercial herring delivery did not occur until April 25. Fish schools were observed in the Nushagak, Kulukak and Nunavachak index areas on April 28 and on all subsequent flights except those on May 11 and 13. The test net and commercial catches support the assumption that the vast majority of fish schools observed were composed of herring.

Herring reached peak abundance in 1980 during the period May 3-6. However on May 8, with good to excellent visibility, only about 40% of the peak abundance was observed. Further, spawn deposition at that time, based on aerial and ground surveys and spawn-on-kelp harvest monitoring, was light and limited in extent. These factors contributed

to the closure of the herring fishery on May 10. As described earlier, the storm of May 9, 10, and 12 reduced survey effectiveness from May 9-13. However, later surveys under improved conditions indicated a nearly constant, low level of herring abundance.

Compared to the 1978 and 1979 runs, the herring run in 1980 initially developed more rapidly, but relative abundance at the peak fell far below either of those years in nearly all index areas (Figure 3). The highest combined RAI for any single date in 1980 was about 10% of that in 1979 and about 30% of that in 1978. The 1980 run was largely over by May 10 which was the date of peak abundance in 1979 and the very beginning of the run in 1978.

Herring spawn deposition in the Togiak area was estimated during aerial observations during 1978, 1979, and 1980 (Table 4). Aerial observers mapped areas of milt (i.e. number of spawnings) and then calculated the corresponding length of shoreline covered by the milt (i.e. miles of spawn).

Due to the difficulties encountered in quantitatively assessing herring spawn deposition from aerial observations, these results can serve as a comparison only in a general way. Some of the potential sources of error in these aerial observations include multiple counts of the same herring spawn, multiple spawns within the same area, undocumented offshore spawnings, and variable survey conditions. Also, and probably most crucial, very little ground work was conducted to measure extent or quality (number of layers) of deposited spawn.

The 41.2 miles of spawn in 1978 and 21.9 miles of spawn in 1979 represented medium to heavy spawn depositions. Spawn deposition was studied at five locations in Metervik Bay in 1978 and ranged from 1 to 8 egg layers. Ground surveys in 1979 were conducted from Kulukak Bay to Right Hand Point and spawn deposition was generally classified as medium density (range from 1 to 6 egg layers). Commercially harvested herring spawn-on-kelp in 1979 was generally classified as fair to good (3 to 5 egg layers).

The 23.1 miles of spawn in 1980 was considered to represent very light spawn deposition. Ground surveys conducted in Togiak Bay on 6 May documented very light spawn deposition (1 to 2 egg layers) primarily on rockweed kelp. These findings were further substantiated by the processors evaluations of commercial spawn-on-kelp quality (fair to poor product; 1 to 3 egg layers). It was also likely that the May 9 to 12 storm destroyed a substantial amount of existing herring spawn (9.3 miles or 40% of total).

Biomass Estimation

Contracted purse seiners provided tonnage data on 6 additional schools of estimated surface area in the Togiak District in 1980. Thus, there are 9 data pairs from the 1978-80 period (Table 5). Barton and Steinhoff assumed that density of herring schools as perceived from the air would increase with water depth i.e. a school of 50 m^2 surface area in 20 meters of water might have a biomass twice as great as the same sized school in 10 meters of water. They attempted to analyze biomass in the various index areas from Bristol Bay to Norton Sound on the basis of

estimated depths. However, the school density estimates to date don't support nor refute their assumption and bathymetry information is incomplete. Therefore a simple arithmetic average of the 9 data points of 3.4 MT/RAI was chosen for estimation of herring biomass in 1980. Relative abundance indices from aerial surveys on May 6, 19 and 20 were used as the basis of calculations. Herring present on May 6 were about 93% 6, 7 and 8 year old fish, whereas those present on May 19 and 20 were about 60% 3 and 4 year old fish. It was necessary to utilize RAI's from both May 19 and May 20 to obtain good surveys of all index areas. Of the two survey biologists, the observations of the one which mapped the maximum number of schools were used (Table 6).

In 1980, the combined RAI for the three dates for all index areas in the Togiak District was 15,249. Applying the 3.4 MT/RAI conversion factor yields an estimated biomass of pelagic schooling fishes of 51,846 MT. Of those 4% or 2,074 MT were species other than herring based on the results of test fishing, which leads to an estimated herring biomass of 49,772 MT. The commercial fishery removals (12,508 MT) 1/ prior to the May 6 peak aerial survey must be added which yields an estimated herring biomass for the Togiak District in 1980 of 62,280 MT or about 62,300 MT.

The above estimate may be regarded as minimal in that multiple waves of spawning herring even of the same age could arrive and depart with only a portion present during the two peak aerial survey periods. However if only the 1980 surface area - biomass conversion data were applied (from

1/ Includes preliminary commercial catch plus prorated wastage prior to May 6.

Table 5), the estimated biomass would be reduced by 50%. It should be noted that a preliminary biomass estimate employing the surface area-biomass conversion factors used by Barton and Steinhoff (1980) produced a biomass estimate for Togiak District herring in 1980 of 69,250 to 146,052 metric tons. A biomass of the higher magnitude would still be 19% below the lowest estimate of 172,600 MT for 1978 and 35% below the low range for 1979 of 216,800 MT.

DISTRICTS NORTH OF BRISTOL BAY

Estimation of herring biomass in Districts north of Bristol Bay was more difficult due to fewer surveys flown during the season and the higher frequency of poor weather and turbid water conditions. Also the surface area - biomass conversion factors were derived from observations in the Togiak District and thus may not be representative of these northern stocks. For these reasons biomass estimates can be regarded as less accurate than for Togiak herring. However comparative RAI data presented in Table 10 is believed to fairly accurately depict the relative abundance of these northern stocks from year to year.

Unacceptable survey conditions precluded assessment of herring abundance in Goodnews Bay, Nelson Island and Cape Romanzof areas during 1980. Biomass estimates were based largely on 1978-79 data. Biomass estimates were made for Security Cove and Norton Sound in 1980 using similar techniques previously described for Togiak.

Several attempts were made to survey herring stocks north of Norton Sound. There is growing evidence from test fishing and subsistence

catches during fall, winter and early spring that these stocks remain in inshore waters year-round and do not join other Bering Sea herring stocks wintering north of the Pribilof Islands.

Security Cove

Aerial surveys were flown in this District on 13 days from May 2 through June 7 during the 1980 season, about triple the effort of the previous year. Twelve of the surveys were made under fair to excellent conditions. Fish schools were observed on all of the flights, however the peak relative abundance (RAI) of 407 of May 22 was only 14% of the peak abundance of the previous year (Table 7). Only one light cloud of milt was seen in Security Cove proper on May 13, although additional spawning was noted west of Security Cove on June 7.

Test fishing with variable mesh gillnets was conducted from May 12 through June 3. A total of 33 sets captured 5303 pelagic schooling fishes of which only 23% were herring. It appears that the limited area in which test fishing occurred may have been favored by capelin which contributed the majority of the schooling fish. Therefore in the estimation of herring biomass, 75% of the total fish school area and biomass was assumed to have been herring. The same proportion was used in 1978.

In the estimation of 1980 herring biomass for Security Cove, abundance indices (RAI's) for May 18 and 26 were summed. Herring from test fish samples prior to May 18 were about 85% age 6 or older while herring taken after May 25 were about 77% age 3 or 4. Applying the surface area - biomass conversion of 3.4 MT/RAI described previously to the RAI of 435 resulted in a fish biomass of 1479 MT. Assuming that 75% of that

biomass was herring and adding commercial fishery removals prior to May 18 of 34 MT, the estimated biomass of herring in Security Cove in 1980 was 1143 MT or about 1100 MT.

Goodnews Bay

As described in the July 24, 1980 report on Bering Sea herring fisheries to the Council, aerial surveys in this District in 1980 were severely restricted by weather and turbidity. One survey on May 8 under fair to poor conditions resulted in a relative abundance index of 240. A second survey on May 16 under excellent conditions indicated no fish schools present. Those two surveys generate a minimum biomass estimate of schooling fishes of 816 MT. However, it was assumed that herring populations in Goodnews Bay fluctuated in a similar manner to those of adjacent Security Cove, which experienced ar 85% decrease from 1979 to 1980. Following that assumption, 15% of the mid point of the 1979 biomass range (7,550 MT) is 1,132 MT or about 1,100 MT.

Nelson Island

Aerial survey conditions were unacceptable for this area during 1980. Subsistence catch data indicate that herring abundance was similar to or slightly greater than than of 1979. The best estimate of 1980 herring biomass is then about 7,200 MT which is the mid point of the range of estimated biomass for 1979 (5,421 - 8,900 MT).

Cape Romanzof

In this District, as in the Goodnews Bay District, aerial survey data are inadequate for biomass estimation. The mid point (3,600 MT) of the

biomass range of 2,700 to 4,400 MT indicated by Barton and Steinhoff for 1978 and 1979 is probably about the correct order of magnitude for the Cape Romanzof stocks.

Norton Sound

Aerial Surveys of at least portions of this extended coastline on 12 different days from May 8 to June 26, 1980. Although fish schools were observed on all of the surveys, visibility was reduced very frequently due to weather and turbid seas. Visibility ratings during surveys in Norton Sound showed the following frequency distribution in comparison with 1978 and 1979:

	1978	1979	1980
Excellent	35%	24%	19%
Good	25%	40%	11%
Fair	25%	16%	22%
Poor	15%	16%	14%
Unacceptable	0%	4%	33%

Test fishing with variable mesh gillnets was conducted near Cape Denbigh from May 23 through June 9. Twenty-eight sets captured 4,275 pelagic schooling fishes, of which 99% were herring.

In 1980, the peak abundance of fish schools in Norton Sound appears to have been reached at the end of May or early June in most index areas (Table 8) and in most index areas those peak indices equalled or exceeded those of 1979 (Table 9). The total of those peak index area counts was about 20% higher than the corresponding total for 1979.

The 1980 herring biomass estimate for Norton Sound was calculated as the product of the combined index area RAI of 2,242 and the surface area-biomass conversion factor of 3.4 MT/RAI. That product is 7,623 MT or about 7,600 MT. Based on test fishing data, the biomass of other pelagic schooling fishes can be ignored.

SUMMARY

The abundance of Pacific Herring declined significantly in the inshore waters of the Bering Sea south of the Yukon river (Togiak and Security Cove Districts) in 1980 as compared to abundance observed in 1978 and 1979 (Table 10). Spawn deposition in the Togiak Distrfict was likewise reduced. Spawning herring abundance in Norton Sound appears to have increased, but not so much as to offset the reduction of populations further south.

Spawning herring abundance data from Goodnews Bay, Nelson Island and Cape Romanzof is incomplete but appears to be of the same order of magnitude as was observed in 1978 and 1979. The 1980 estimates of spawning herring biomass in the inshore waters of the eastern Bering Sea total 82,900 MT (Table 11).

1. Relative abundance of fish schools in the ...iak District of Bristol Bay in 1980 based on aerial survey data. Numbers represent counts of schools standardized by surface area.

	Nushagak	Kulukak	Nunavachak	Ungalikthluk	Togiak	Matogak	Total
4/15	0	0	0	0	0		
/////							
4/28	259	101	7	0	0		367
29							
30	122	2,105	0	0	40		2,267
5/01							
2	60	142	6	71	45		324
3	336	2,915	43	318	8,873		12,485
4							
5	0	0	0	913	149		1,062
6	1,175	4,599	19	346	4,730	166	11,147
7							
8	788	1,238	0	310	2,332	389	4,668
9							
10							
11		0	0	0	0		0
12							
13	0	0	0	0	0		0
14	0	30	59	12	0		101
15	23	0	487	864	+		1,374
16	0	175	96	7	0	0	278
17							
18							
19	0	20	203	147	1,387	0	1,757
20	512	835	178	1	0		1,526
21							
22	0	633	27	277	5	0	942
23							
24							
25							
26							
27	0	429	472	106	0		1,007
28							
29	25	182	553	75	0		835
30							
31	236	123	32				391
6/01							
2							
/////							
7	0	378	218	36	0	534	1,203

Table 2. Relative abundance of fish schools in the Togiak District of Bristol Bay in 1979 based on aerial survey data. Numbers represent counts of schools standardized by surface area.

Date	Nushagak	Kulukak	Nunavachak	Ungalikthluk	Togiak	Matogak	Total
4/30		0	42	752			794
5/01							
02	0	0	900	1,004	71		1,975
03	61	0	5	317			383
04	17,355	563	71	280	1,460		19,729
05	18,724	29,918	326	159	486		49,613
06							
07	981	24,389	91	58	65,602	932	92,053
08							
09	0	0	46	743			789
10	76,783	12,312	21	+	46,956		136,072
11							
12	0	0	79	+	13,066	+	13,145
13							
14	340	+	31	29	2,522	699	3,621
15							
16	0	0	6	0	474		480
17	337	2	62	0	+	0	401
18							
19							
20							
21	0	0	0	0			
22							
23							
24	0	6	10	56	2,768	0	2,840
25							
26	0	0	34	7	2,767		2,808

Table 3. Relative abundance of fish schools in the Togiak District of Bristol Bay in 1978 based on aerial survey data. Numbers represent counts of schools standardized by surface area.

Date	Nushagak	Kulukak	Nunavachak	Ungalikthluk	Togiak	Matogak	Total
4/30							
5/01		805	0	0			805
02							
03	0	87	0	0			87
04							
05	0	2,957	0	0	0	0	2,957
06							
07							
08	0	923	0	10			933
09	0	0					
10							
11	410+	3,571	141	25	4,515	785	9,447
12	0	41	19	63	5,976		6,099
13	6,323	15,130	14,404	893	3,499	2,801	43,050
14	0	2,218	1,231	981			4,430
15							
16							
17	+	+	+	88			88
18	5,453	14,935	2,736	111	41,436	145	64,816
19		6,631	5,089	17			11,719
20							
21	+	198	42	91	0		331
22	0	150					150
23							
24	+	0	+	0			
25	161	45	509	87	116	+	918
26	0	421	377	+	44	375	1,217
27							
28	0	+					
29							
30	0	55	52	159	+	544	810
31							
6/01							
02	0	18	6	0	0	0	24

Table 4. Aerial observations of herring spawnings in the Togiak area of Bristol Bay, 1978-1980. 1/

Date	1978		1979		1980	
	No. 2/	Miles 3/	No. 2/	Miles 3/	No. 2/	Miles 3/
4/15					0	0
4/28					0	0
4/29						
4/30			2	2.5	0	0
5/01	1	0.4				
5/02			21	8.3	11	4.0
5/03	1	0.4	14	5.0	8	3.0
5/04			8	3.1		
5/05			1	1.3	0	0
5/06					3	0.9
5/07			3	0.6	3	1.2
5/08	2	1.8			1	0.2
5/09			2	0.4		
5/10			0	0		
5/11	9	7.7			0	0
5/12	3	1.5	0	0	0	0
5/13	12	8.6			0	0
5/14	11	5.6	0	0	2	2.3
5/15					6	4.0
5/16			0	0	4	1.2
5/17			0	0		
5/18	11	4.2				
5/19	3	2.5			1	0.3
5/20					4	0.9
5/21			0	0		
5/22					2	0.5
5/23						
5/24						
5/25	8	4.2				
5/26	2	2.2	1	0.7		
5/27					3	0.3
5/28	0	0				
5/29					8	1.6
5/30	6	1.6				
5/31					2	0.8
6/01						
6/02	1	0.5				
6/03						
6/04						
6/05						
6/06						
6/07					6	3.1
Total	70	41.2	52	21.9	64	23.1

1/ Survey area covers Nushagak Peninsula to Togiak Bay.
2/ Number of individual herring spawnings.
3/ Linear miles of spawn.

Table 5. Conversion estimates; metric tons of fish per 50^2 meters of surface area, Togiak herring grounds, 1978-1980.

Date	Observer	Est. of tons /50^2m	School size in feet	Weight of catch in tons	Actual or est. weight of catch	Fish condition	Location of set	Water depth in feet
5/13/78	Nelson	6.7	1/	1/	Estimated	1/	Nunavachak Bay	1/
5/18/78	Nelson	11.0	80 x 60	110	Estimated	2/	Nunavachak Bay	1/
5/04/79	Randall	2.4	40 dia.	5.6	Actual	Ripe	Ungalithluk Bay	20
5/15/80	Barton/Nelson	1.22	60 x 40	6	Actual	Ripe	Ungalithluk Bay	10
5/15/80	Barton/Nelson	1.63	40 x 30	4	Estimated	Spawn-outs	Ungalithluk Bay	25
5/16/80	Barton/Nelson	1.14 2/	220 x 50	21	Actual	Spawn-outs	Nunavachak Bay	15
5/16/80	Barton/Nelson	1.17	65 x 20	3	Estimated	Fish lost	1 Mile West Ungalithluk Pt.	16
5/20/80	Barton/Nelson	2.99	70 x 70	30	Estimated	Ripe	East of Eagle Bay	20
5/20/80	Barton/Nelson	2.60	150 x 75	60	Estimated	Fish lost	Eagle Bay	20

1/ Incomplete data.
2/ Average of 2 observers estimates.

Table 6. Relative abundance of fish in the Togiak District used to calculate 1980 herring biomass.

Date	Nushagak	Kulukak	Nunavachak	Ungalikthluk	Togiak	Matogak	Total
May 26	4,321 1/	1,845 1/	61 1/	674 1/	4,730	505 1/	12,136
May 19	-	-	-	147	1,387	0	1,534
May 20	512	835	232 1/	-	-	-	1,579
	4,833	2,680	293	821	6,117	505	15,249

1/ Based on observations of Louis Barton; the remainder based on observations of Mike Nelson.

Table 7. Relative abundance of fish schools in the Security Cove District in 1978. 1979 and 1980 based on aerial survey data. Numbers represent counts of schools standardized by surface area.

DATE	1978	1979	1980
5/01			
5/02			2
5/03			
5/04			
5/05	0		23
5/06			
5/07			198
5/08		270	175
5/09			
5/10			
5/11			
5/12			
5/13	48		81
5/14		2,912	186
5/15			
5/16			1
5/17	0	135	
5/18			353
5/19			288
5/20	120		
5/21			
5/22			407
5/23			
5/24		288	1
5/25			
5/26			82
5/27			
5/28			
5/29	107		
5/30	246		
5/31			
6/01			
6/02			
6/03	28		
6/04			
6/05			
6/06			
6/07	0		47

Table 8. Relative abundance of fish schools in the Norton Sound District in 1980 based on aerial survey data. Numbers represent counts of schools standardized by surface area.

Date	Klikitarik	Unalakleet	Cape Denbigh	Norton Bay	Golovin	Bluff	Total
5/05							
5/06							
5/07							
5/08	12	35					47
5/09							
5/10							
5/11							
5/12							
5/13							
5/14							
5/15							
5/16							
5/17	55	0					55
5/18							
5/19		304	29				333
5/20							
5/21							
5/22							
5/23							
5/24							
5/25							
5/26							
5/27	232	6	7				245
5/28							
5/29	1,033	0	507				1,540
5/30							
5/31							
6/01							
6/02	83	0	0				83
6/03							
6/04	212						212
6/05							
6/06	20	0	441	242	43	0	746
6/07		0	0	288	2	0	290
6/15						0	0
6/26		0	0	8	17	67	92

Table 9. Relative abundance of fish schools in the Norton Sound District in 1979 based on aerial survey data. Numbers represent counts of schools standardized by surface area.

Date	Klikitarik	Unalakleet	Cape Denbigh	Norton Bay	Golovin	Bluff	Total
5/15	85	9					94
5/16							
5/17							
5/18							
5/19							
5/20							
5/21	797	6	146				949
5/22							
5/23		6					6
5/24			48				48
5/25							
5/26							
5/27							
5/28		67	627	2	0	26	825
5/29							
5/30		92	212				304
5/31							
6/01							
6/02			7	62	34	103	234
6/03							
6/04							
6/05							
6/06							
6/07							
6/08							
6/09			10	49	27	248	334
6/10							

Table 10. Relative abundance of fish schools in the inshore waters of the eastern Bering Sea, 1978-1980.

DISTRICTS	1978 RAI	1979 RAI	1980 RAI
Togiak	43,050	137,630	15,249
Security Cove	246	2,912	407
Goodnews Bay	241	3,729	N/A
Nelson Island	1,079	N/A	N/A
Cape Romanzof	539	N/A	N/A
Norton Sound	1,277	1,860	2,242

Table 11. Estimates of inshore herring biomass in the Bering Sea, 1980.

Togiak District	62,300 MT
Security Cove	1,100 MT
Goodnews Bay	1,100 MT
Nelson Island	7,200 MT
Cape Romanzof	3,600 MT
Norton Sound	7,600 MT
	82,900 MT

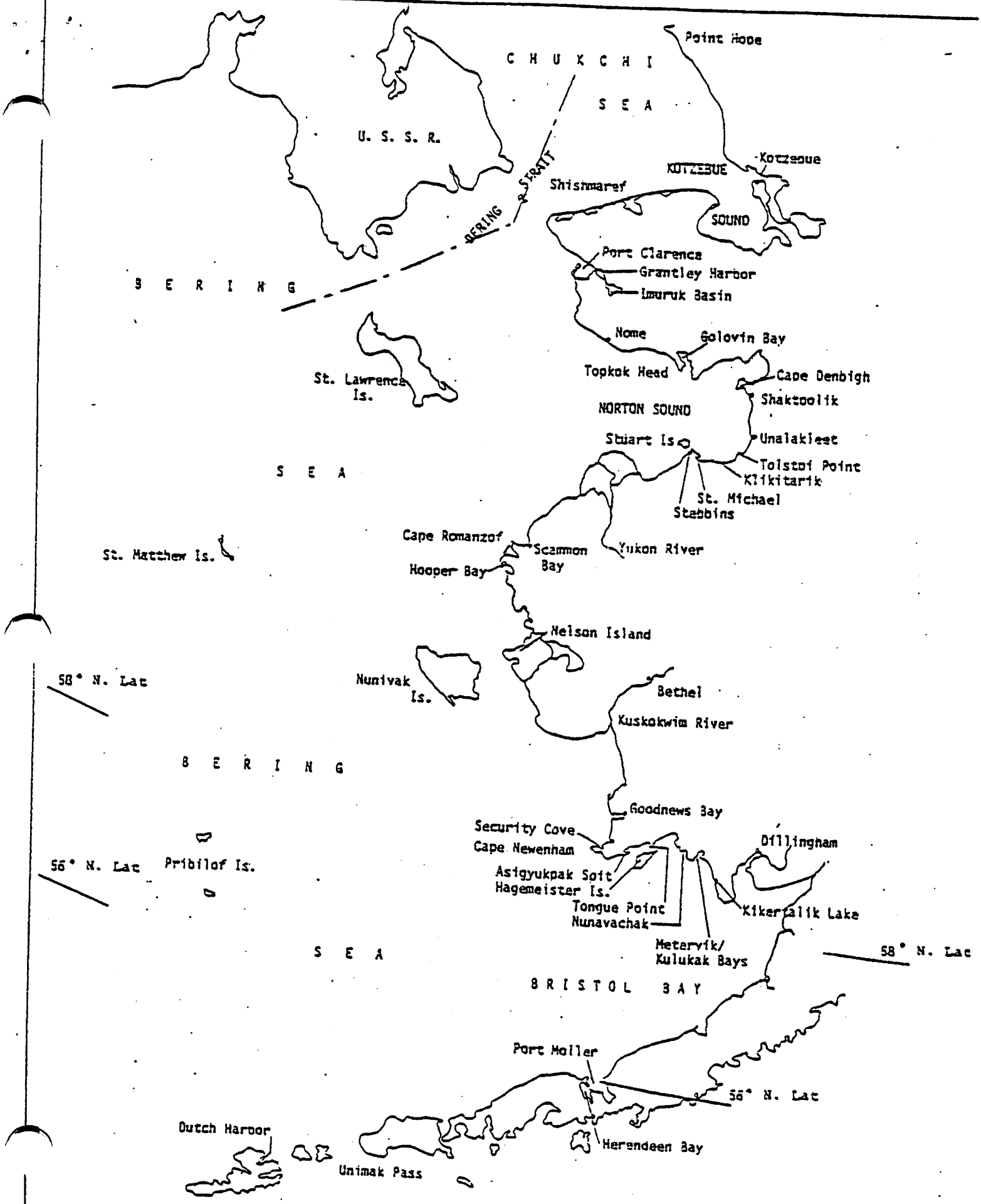

Figure 1. Eastern Bering Sea study area.

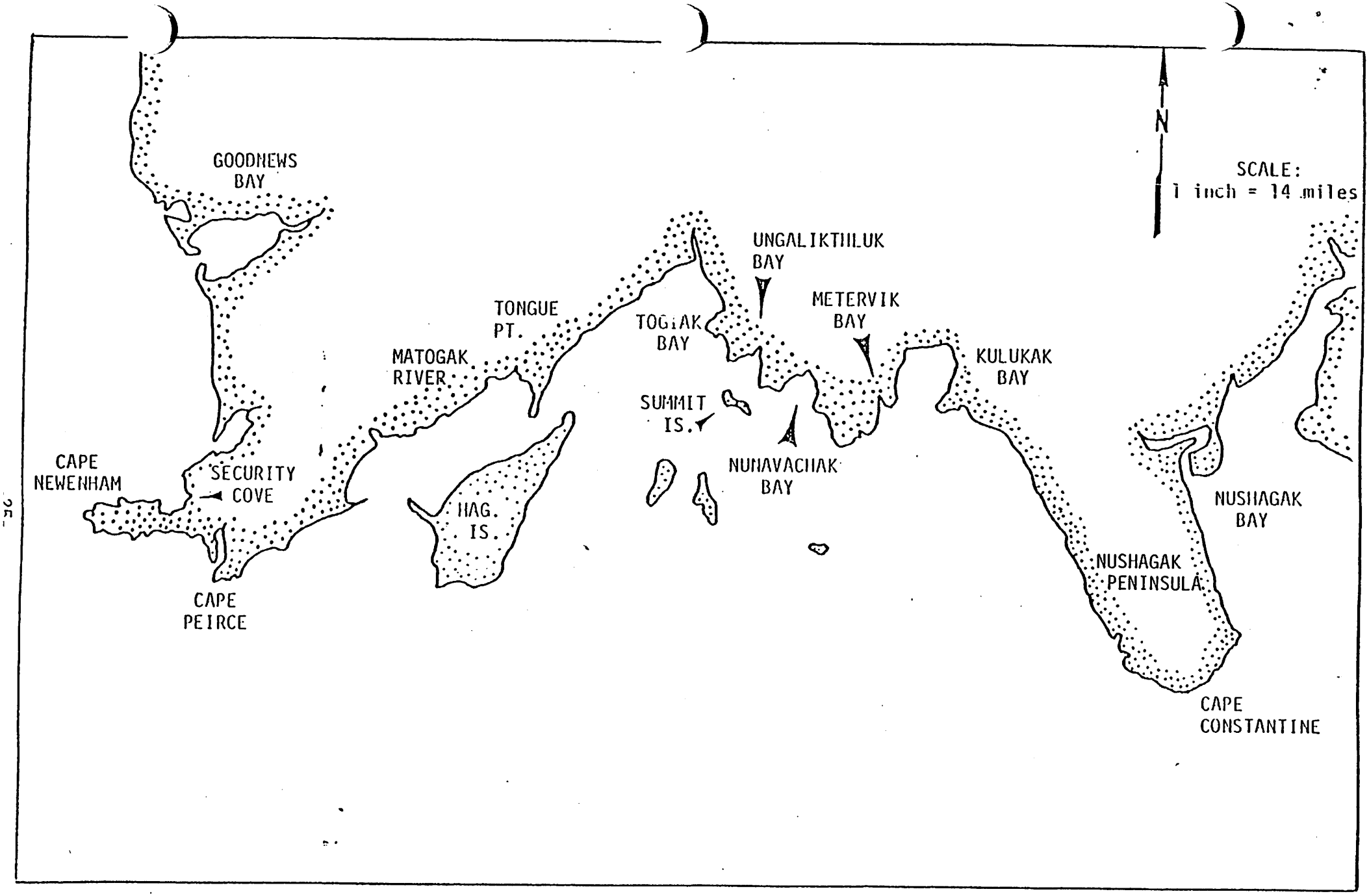

Figure 2. Map of the Togiak District of Bristol Bay showing aerial survey index areas.

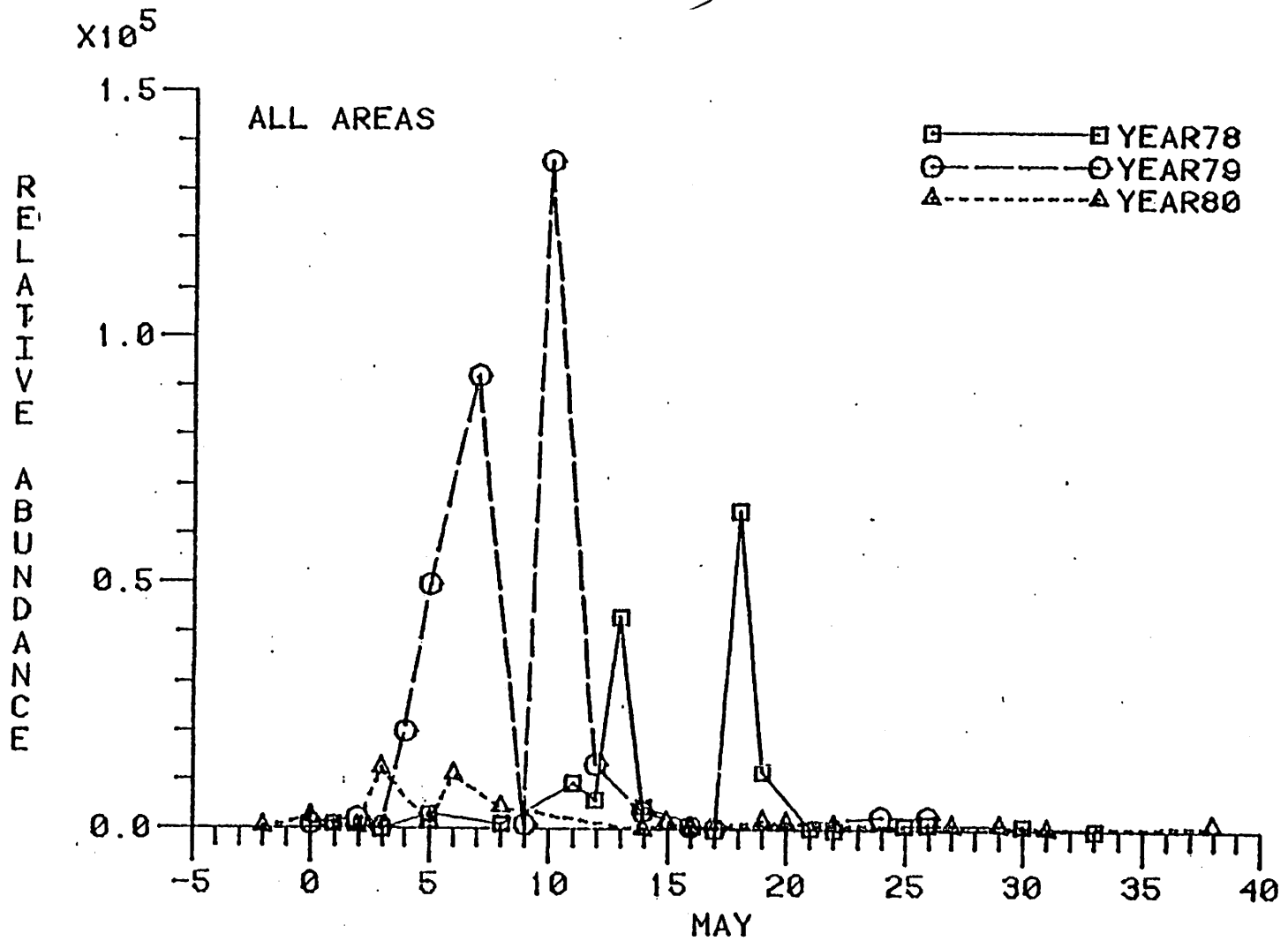

Figure 3. Relative abundance of fish schools in the Togiak District of Bristol Bay in 1978-80 based on aerial survey data.