2A94-47

OVERVIEW OF THE TOGIAK HERRING AND HERRING SPAWN ON KELP FISHERIES BRISTOL BAY, ALASKA, 1992-1994

REPORT TO THE ALASKA
BOARD OF FISHERIES

by
Thomas E. Brookover
and
James B. Browning

Regional Informational Report[1] No. 2A94-47

Alaska Department of Fish and Game
Division of Commercial Fisheries, Central Region
333 Raspberry Road
Anchorage, Alaska 99518

December, 1994

[1] The Regional Information Report Series was established in 1987 to provide an information access system for all unpublished divisional reports. These reports frequently serve diverse ad hoc informational purposes or archive basic uninterpreted data. To accommodate timely reporting of recently collected information, reports in this series undergo only limited internal review and may contain preliminary data; this information may be subsequently finalized and published in the formal literature. Consequently, these reports should not be cited without prior approval of the authors or the Division of Commercial Fisheries.

AUTHORS

Thomas E. Brookover is the Area Management Biologist for the Department of Fish and Game, Commercial Fisheries and Management Division, P.O. Box 230, Dillingham, Alaska 99576.

James B. Browning is the Assistant Area Management Biologist for the Department of Fish and Game, Commercial Fisheries and Management Division, P.O. Box 230, Dillingham, Alaska 99576.

ACKNOWLEDGEMENTS

Dennis Haanpaa reviewed and edited this manuscript. Kathy Rowell is gratefully acknowledged for compiling harvest statistics and stock abundance data, for providing forecast information, and for her assistance in reviewing and editing the final manuscript.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

INTRODUCTION

Pacific herring (*Clupea harangus pallasi*) have been documented throughout Bristol Bay, but the major concentration returns to the Togiak area each spring as the focus of two commercial fisheries (Figure 1). The herring sac roe fishery began in Bristol Bay in 1967, followed by the first fishery for herring spawn on rockweed kelp (*Fucus spp.*) in 1968. Effort and harvest levels remained low for the first 10 years of the fishery. However, increased interest, favorable market conditions and additional incentives provided by the Fishery Conservation and Management Act of 1976 (the 200-mile limit) resulted in a major expansion of the Togiak herring fishery in 1977. Sac roe harvests since 1978 average over 16,000 tons, worth $7.3 million annually. Spawn-on-kelp harvests since 1984 average 396,000 lbs., worth an average $284,000.

Unlike most herring fisheries in Alaska, the Togiak sac roe fishery is not a limited entry fishery. Gillnets, purse seines and hand purse seines are legal gear. In October of 1989, the Alaska Board of Fisheries reduced the legal size of purse seines to 100 fathoms in length and 16 fathoms in depth. Gillnets were also reduced to a maximum of 100 fathoms in length per permit holder with only one compliment of gear allowed to operate from a single vessel. The amount of gillnet allowed on board a fishing vessel during an open period is limited to 100 fathoms, and the department now has emergency order authority to reduce the length of gillnet fished by a single vessel to 50 fathoms.

The spawn-on-kelp fishery became limited to holders of interim use and permanent permits in 1990. In October 1991, the Board of Fisheries limited the role of non-permit holders in the spawn-on-kelp fishery to that of assisting with transporting kelp only after the close of the period. By 1993, the majority of permits became permanent.

The commercial sac roe and spawn-on-kelp harvest in the Togiak District has been regulated by emergency order since 1981 to achieve exploitation mandates by the Alaska Board of Fisheries and to address problems with wastage. In 1984, the Bristol Bay Herring Management Plan (5 AAC 27.865.) was adopted by the board. This regulatory management plan set the policies by which these fisheries are prosecuted.

The Bristol Bay Herring Management Plan states that the maximum exploitation of the Bristol Bay herring stock is 20%. Before opening the sac roe fishery, 1,500 short tons must be set aside for the spawn-on-kelp fishery, and 7% of the remaining available harvest is allocated to the Dutch Harbor food and bait fishery. After the spawn-on-kelp and the Dutch Harbor food and bait harvests have been subtracted, the remaining harvestable surplus is allocated to the Togiak sac roe fishery: 25% to the gillnet fleet, and 75% to the purse seine fleet.

This report summarizes the Togiak herring stock assessment program conducted from 1992 through 1994, reviews the herring fisheries that occurred in the Togiak District from 1992 through 1994, and presents projections and management strategies for the 1995 herring season.

STOCK ASSESSMENT

Methods

Aerial surveys were conducted throughout the herring spawning season to determine relative abundance, timing and distribution of Pacific herring in the Togiak District. Location and extent of milt, number of fishing vessels, and visibility factors affecting survey quality are also recorded.

Data collection methods were similar to those used since 1978. Standard conversion factors of 1.52 tons (water depths of 16 ft or less), 2.58 tons (water depths between 16 and 26 ft) and 2.83 tons (water depths greater than 26 ft) per 538 ft^2 of surface area were used to convert observed herring school surface areas to biomass (Lebida and Whitmore 1985).

Herring from test commercial fishery harvests were sampled to determine age, size and sexual maturity of herring in the spawning biomass and catch. Volunteer fishermen, in cooperation with the department, provided test fish catch samples to industry roe technicians for roe quality evaluation. Test fish data was used in post-season analysis to estimate total spawning biomass.

Spawning Population

The spawning biomass of herring in the Togiak District averages (1978 - 1991) 124,000 tons each year (Table 1). However, annual estimates range from 69,000 tons observed in 1980 to 239,000 tons documented in 1979. Abundance appeared to be high in the late 1970's, declined in the mid 1980's and remained relatively low and stable through 1991. Biomass levels from 1992 through 1994 increased substantially to levels between 150,000 and 200,000 tons; the 1993 biomass estimate was the second largest in the history of the fishery.

Cool weather conditions likely contributed to a late run and rapid progression of spawning activity observed in 1992 (Table 2). Twenty seven aerial surveys were flown between April 20 and May 27, most under good to excellent survey conditions. The first significant showing of herring was not observed until May 17 and the peak biomass estimate of 129,256 tons was observed on May 19. By May 23, over 20,000 tons were observed in the eastern- and-western-most sections of the district, apparently exiting the spawning grounds. A survey from Togiak Bay east documented only 9,700 tons remaining by May 26. Spawning activity was first observed May 19 and peaked May 21, over one week later than average.

Post season analysis calculated the 1992 spawning biomass at 156,955 tons, the largest biomass documented since 1981. The 1992 biomass nearly tripled the pre-season forecast of 60,214 tons. Fifty-seven percent (by weight) was comprised of age 9-16 herring, and an additional 34% were age 7 and 8. Ninety-seven linear miles of spawn were documented throughout the season; the most spawn observed since the aerial survey program began.

In contrast to the 1992 herring run, the run in 1993 was extremely early (Table 3). The first survey of the 1993 season was conducted on April 24 in response to a reported herring observation; department observers documented over 74,000 tons of herring at that time. Thirteen aerial surveys were conducted through May 7, and the peak biomass of 164,135 tons was observed on April 26. Spawning activity was first observed April 25, and the peak spawn observation totaled over 21 miles of spawn on April 27. Spawning activity peaked approximately two weeks earlier than average and nearly four weeks earlier than the peak observed in 1992.

The post-season estimate of spawning biomass totaled 193,847 tons, the second largest biomass documented in Togiak District. The estimated biomass increased substantially for the second consecutive year and was 30% greater than the pre-season forecast of 148,786 tons. Herring age 7 and older comprised 59% of the biomass, while 37% were ages 5 and 6. Over 53 miles of spawn was observed throughout the season.

Run timing in 1994 was more typical than progression observed in 1992 and 1993 (Table 4). Aerial surveys in 1994 began April 18 and continued through May 16. The first herring were observed on May 8, with the peak biomass of 148,716 tons observed May 12. Total spawning biomass was estimated post-season at 185,454 tons, 30% over the preseason forecast of 142,497 tons and the fourth largest biomass documented. Age 6 and 7 herring comprised about 40% of the biomass, while an additional 55% were age 9 or older. A total of 71.8 miles of spawn were observed during the course of the season.

SAC ROE HERRING FISHERY

Sac roe harvests from 1978 through 1991 average approximately 16,000 tons annually, and range from 7,700 to 26,300 tons (Table 5). Industry participation in the fishery peaked between 1979 and 1982, when up to 33 processors registered to purchase herring in Togiak District. The number of companies declined in the mid-1980's and stabilized at an average (1978-91) of 18 companies.

Fishing time and area is regulated in an effort to divide the harvestable surplus using a 75%-25% allocation ratio for purse seine and gillnet vessels. The gillnet fleet is usually larger than the purse seine fleet, averaging (1978-91) 238 and 168 vessels, respectively. Purse seine vessels have generally accounted for 78% of the total harvest each year, with gillnet harvests comprising the remaining 22%. Harvest roe recoveries average approximately 9.2% for both gear types combined. Historically, purse seine harvests average 9.7% mature roe, while gillnet harvests average 8.3% mature roe (Table 1).

1992 Season Summary

The 1992 sac roe harvest totaled 25,808 tons (Table 6). The 1992 harvest was the second

largest since the fishery began, exceeded only in 1983 (26,287 tons). The harvest more than doubled the pre-season forecast, and was the largest sac roe harvest reported in Alaska during 1992. The sac roe harvest for both gear types averaged 9.2% mature roe, identical to historical recoveries.

The entire purse seine harvest (20,778 tons) was taken during one 20-minute opening on May 20, in spite of attempts to limit the duration and opening tide stage to achieve a smaller harvest. The 1992 purse seine harvest was the largest single-period harvest in the history of the fishery. The large available surplus, excellent spotting conditions and large fishing effort all contributed to the magnitude of the purse seine harvest. Purse seine fishing effort totaled 301 vessels, the second largest purse seine fleet in the history of the fishery. The purse seine harvest comprised 81% of the total sac roe harvest. Purse seine roe recovery averaged 9.2%, or slightly less than average (1978-91) roe recoveries.

Seven fishing periods were held for herring gillnets between May 20 and May 27, for a total of 25.5 hours of fishing time. The gillnet harvest totaled 5,030 tons, and averaged 8.8% mature roe. The fishing effort of 274 gillnet vessels was 15% above the 1978-91 average. The majority of gillnet fishing occurred east of Right Hand Point, after initial harvests in other areas contained poor quality roe.

The May 20 harvests, landed primarily by purse seine vessels, exceeded the available processing capacity on the grounds. Companies reported processing herring that had been held for up to seven days, and over 1,300 tons of waste was documented as a result of herring killed in purse seines. As a result of the 1992 fishery, purse seine harvest quality and management control of individual period harvest levels became leading issues in the 1993 and 1994 fisheries.

The commercial value of the 1992 sac roe fishery was the highest experienced since 1988 (Table 10). Fishermen received approximately $400/ton at 10%, adjusted at $40 per point for sac roe herring. The value of the 1992 sac roe harvest to fishermen was estimated at $8.8 million. Average price for food/bait herring was $50/ton, and the overall value of the food/bait product was $26,000. Approximately 2% of the sac roe harvest was sold as food/bait. Eighteen companies purchased sac roe herring in the 1992 Togiak herring fisheries.

1993 Season Summary

A large preseason forecasted biomass (148,786 tons), coupled with the occurrence of waste and reduced product quality in 1992, resulted in concern for product quality in the 1993 season. Results from an industry poll prior to the season indicated that available processing capacity would be reduced in 1993. Therefore, the department intended to control time and area in the purse seine and gillnet fisheries to limit individual harvests to a size that could be processed with little loss in quality. Prior to 1993, area had not been restricted in the purse seine fishery.

Warm spring weather conditions in the eastern Bering Sea contributed to an early arrival of herring into the Togiak District. The district opened by emergency order on April 27, shortly

after the first fishing vessels and tenders arrived on the grounds (Table 7). A total of 17 purse seine and 12 gillnet openings occurred between April 27 and May 9, for total fishing times of 33.8 hours for purse seines and 144.5 hours for gillnets. The harvest for both gear types combined totaled 17,925 tons.

Purse seine vessels landed 14,361 tons (80%) of herring and gillnet vessels accounted for 3,564 tons (20%). Area restrictions implemented in the purse seine fishery helped control single period harvests and wastage; the largest period harvest totaled 5,300 tons. Waste was estimated at approximately 50 tons and attributed to purse seine vessels holding fish for extended durations while waiting for tenders.

The roe quality of the 1993 gillnet harvest was the highest in the history of the fishery, surpassing the highest gillnet roe quality on record (1990) by a full percentage point, and exceeding roe quality of the purse seine harvest for the first time ever. Purse seine roe recovery averaged 9.6%, while gillnet recoveries averaged over 10%. The overall roe recovery in the sac roe harvest was estimated at 9.7%.

The early run and limited market availability resulted in low effort in the purse seine and gillnet fleets. Purse seine effort increased as the season progressed but reached only 140 vessels, which was less than 50% of the peak effort observed in 1989 (310 vessels). Seventy five gillnet vessels participated, accounting for less than one-third of the average (1978-91) gillnet effort level. Guideline harvest levels were not met for either gear type, due largely to low fishing effort on the grounds.

Fishermen received approximately $300/ton at 10%, adjusted at $30 per point for sac roe herring. The value of the 1993 sac roe harvest to fishermen was estimated at $5.2 million. Two companies purchased a small amount of herring as food/bait. Twelve companies purchased and/or processed sac roe herring in 1993.

1994 Season Summary

A strong preseason forecast and limited processing capacity contributed to the issue of harvest quality in 1994. Prior to the season, companies reported that the number of fishing vessels, most notably gillnet, with a confirmed market would be smaller in 1994. For the second consecutive year, the department intended to control time and area in the purse seine and gillnet fisheries to limit individual harvests to a size that could be processed with little loss in quality

The 1994 sac roe harvest (both gear types combined) was the largest ever in Togiak District, reaching 30,300 tons (Table 8). Five purse seine and six gillnet openings occurred, totalling 4.6 and 76 hours of fishing time for each gear type. Although the initial purse seine opening on May 11 was restricted to 15 minutes and a portion of the district's area, the resulting harvest from that period totaled 15,700 tons. As a result, most companies processed herring from the May 11 harvests for up to five days; some loss in quality was reported. Waste was estimated at 350 and 50 tons for purse seine and gillnet fisheries, and included in the total harvest

estimate.

Purse seine vessels landed a total of 22,837 tons with 9.5% mature roe, and the gillnet fleet landed 7,463 tons averaging 12.1% mature roe. The roe quality of the gillnet harvest was the highest in the history of the fishery for the second consecutive year, and again exceeded roe quality in the purse seine fishery. Both purse seine and gillnet harvest guidelines were met.

Purse seine effort was 240 vessels, 43% above the 1978-91 average; while a reduced gillnet fleet of 146 vessels (39% below average) participated in the fishery.

The commercial value of the 1994 sac roe fishery was the highest since 1988, exceeding the value of the 1992 fishery. The value of the 1994 sac roe harvest to fishermen was estimated at $9.1 million. Fishermen received approximately $300/ton at 10%, adjusted at $30 per point for sac roe herring. Sixteen companies registered to buy or process herring in the Togiak District.

SPAWN ON KELP FISHERY

The spawn-on-kelp fishery is managed under the direction of the Togiak District Herring Spawn on Kelp Management Plan (5 AAC 27.834). The plan essentially provides for an allocation of 350,000 lbs. of product, equivalent to 1,500 tons of herring, to this fishery. The plan also directs the department to rotate harvest areas on a two- to three-year basis and to ensure product quality (Figure 2).

Two openings (3.25 hrs.) for kelp harvesting were held in 1992 (Table 9). Both occurred in Area K-9 on May 23. The resulting harvest of 363,600 lbs of herring spawn-on-kelp product slightly exceeded the allowable harvest of 350,000 specified in the Togiak District Herring Spawn On Kelp Management Plan (Table 3). Harvest occurred during daylight hours, with holdover tides, and fair weather conditions with 386 permit holders participating. Using the formula adopted by the Board of Fisheries in 1984, the spawn-on-kelp harvest was converted to a herring equivalent of 1,482 st, which was included in the overall exploitation.

Two periods with one extension (7.0 hrs total) were permitted for the spawn-on-kelp fishery in 1993. Area K-8 was opened May 1 and 2, resulting in a harvest of 383,000 lbs of product by 173 permit holders. The 1993 harvest was similar to the recent 10-year average, and 9% above the allowable harvest defined by the management plan. Only two companies were registered to buy spawn-on-kelp product when the unusually early fishery took place.

The 1994 spawn-on-kelp fishery occurred over two periods with one extension (7.5 hrs.). Area K-5 was opened on May 13 and 14. Two hundred and four permit holders harvested 308,400 lbs of product, which was 88% of the allowable harvest and 19% below the recent 10-year average. The harvest level was somewhat reduced this season due to heavy on shore winds just prior to the second period, causing silt to render the product unacceptable. The purchase of kelp

product was halted by the two companies participating.

Value of the spawn-on-kelp fishery from 1992 to 1994 was similar to the 1978-91 average-ex-vessel value ($251,000). Spawn-on-kelp product sold for $.70/lb in each of the three years.

LITERATURE CITED

Lebida, R.C. and D.C. Whitmore. 1985. Bering Sea Herring Aerial Survey Manual. Alaska Department of Fish and Game, CFMD, Bristol Bay Data Report 85-2, Anchorage.

Table 1. Estimated total run biomass and inshore commercial harvest (tons), Togiak District, Bristol Bay, Alaska, 1978–94.

Year	Total Run Biomass[1]	Inshore Harvest	Roe Recovery			Percent Exploitation[1]
			Gillnet	Purse Seine	Mean	
1978	190,292	7,734			8.2%	4
79	239,022	11,558			8.6%	5
1980	68,686	18,886			9.2%	35
81	158,650	12,542	6.7%	10.1%	9.1%	8
82	97,902	21,489	7.4%	9.5%	8.8%	22
83	141,782	26,287	6.9%	9.3%	8.9%	19
84	114,880	19,300	8.4%	10.2%	9.8%	18
1985	131,400	25,616	7.4%	10.0%	9.6%	20
86	94,700	16,260	8.8%	9.9%	9.7%	19
87	88,400	15,204	8.6%	8.9%	8.8%	19
88	134,717	14,382	8.3%	10.9%	10.3%	13
89	98,965	12,258	8.0%	8.6%	8.4%	18
1990	88,105	12,253	9.1%	9.7%	9.6%	17
91	83,329	15,070	8.8%	10.1%	9.9% [a]	21
Mean (1978–91)	123,631	16,346	8.0%	9.7%	9.2%	17
1992	156,955	25,808	8.8%	9.2%	9.2%	19
1993	193,847	17,925	10.1%	9.6%	9.7%	12
1994	185,410	30,300	12.1%	9.5%	10.2%	19

[1] Estimated as a result of post–season analysis.
[2] Includes final harvest estimates in the Togiak sac roe and Dutch Harbor food and bait fisheries, all documented waste and the equivalent herring harvest of the spawn on kelp removal.
[a] Includes only herring sold as sac roe. Bait % not included.

Table 2. Daily observed biomass estimates (short tons) of herring during the 1992 season by index area, Togiak District, Bristol Bay, Alaska.[a]

Date	Time Surveyed	Survey Conditions	Miles of Spawn	Estimated Biomass by Index Area.[b] NUS	KUK	MET	NUK	UGL	TOG	TNG	MTG	HAG	OSK	PYR	CN	WAL	Daily Total (tons)
4/20	pm	Fair	0.0		0	0	0	0	0								0
4/29	pm	Exc	0.0		0	0	0	0	0	0	0[c]						0
5/01	pm	Good	0.0		0	0	0	0	0	0[c]	0[c]	0					0
5/02	am	Exc	0.0		0	0	0	0	0	0[c]	0[c]	0					0
5/05	pm	Good	0.0		0	0	0	0	0	0	0[c]	12					12
5/06	pm	Fair-Poor	0.0							0	0	0					0
5/07	pm	Fair	0.0			0	0	0	0	0[c]	0	0					0
5/09	pm	Fair	0.0					0	0	0[c]	0	0					0
5/10	pm	Good	0.0					0	0	0[c]		0					0
5/13	am	Fair-Poor	0.0			0	0	0	0	0		0					0
5/15	am	Fair-Unsat	0.0				0	0	0		0						0
5/16	am	Good-Poor	0.0		0	0	0	0	0	0	0	62	0				62
5/17	am	Good-Poor	0.0		0	0	136	0	0[c]	0	0	0					136
5/17	pm	Good-Fair	0.0			72	323	826								109	1,330
5/18	pm	Good	0.0		114	0	81	632	0[c]	0	0	13,379	0	1,882		86,281	102,369
5/19	am	Good	1.5	29,701	7,336	62	2,553	1,187	46,810	13,713	10,932	15,006	52			1,904	129,256
5/19	pm	Exc	7.0					13,137	47,270	21,209	20,408	7,950					109,974
5/20	am	Good	4.8		8,923	4,104	0	5,157	17,246	967	15,980		0	9,347			61,724
5/20[d]	pm	Good	19.4														
5/21[d]	pm	Good	34.3														
5/22	am		8.5		4,082	537	4,960	1,611									11,190
5/23	pm	Good	14.9	9,440	38,260	9,085	9,104[e]	13,204	21,102[e]	5,569[e]	3,676	452	2,022	10,633	0	340	122,887
5/24	pm	Fair	8.8		283	1,296	522										2,101
5/25	pm	Good	2.5		2,186	3,937	3,767[e]										9,890
5/26	am	Good	1.3		2,016	3,668	1,556	1,961	539								9,740
5/26	am	Good	1.2			2,811											2,811
5/27	am	Fair	0.3		57	223	1,322	169[e]									1,771
Total			96.9														

[a] The revised total run biomass for Togiak District Pacific herring was estimated at 156,955 short tons for the 1992 season. The revised biomass estimate is the summation of:
1) 122,887 tons observed during the aerial survey conducted 23 May,
2) the commercial catch of 24,328 tons harvested up to the 23 May survey date, and
3) 9,740 tons observed during the aerial survey conducted 26 May.

[b] Index Areas: NUS- Nushagak Peninsula; KUK-Kulukak; MET-Metervik; NUK-Nunavachak; UGL-Ungalikthluk; Togiak; TOG-Togiak; TNG-Tongue Point; MTG-Matogak; HAG;Hagemeister; OSK-Osviak; PYT-Pyrite Point; CN-Cape Newenham; WAL-Walrus Islands.

[c] Smelt schools observed.

[d] Spawn and fishing effort survey.

[e] Includes estimates of observed dead loss.

Table 3. Daily observed biomass estimates (short tons) of herring during the 1993 season by index area, Togiak District, Bristol Bay, Alaska.*

Date	Time Surveyed	Survey[c] Conditions	Miles of Spawn	Biomass by Index Area[b] NUS	KUK	MET	NUK	UGL	TOG	TNG	MTG	HAG	OSK	PYR	CN	WAL	Daily Total (Tons)
4/24	pm	Fair-Poor	0.0		5,704	73	101	1,170	48,376	8,983	7,077	566	2,398			67	74,514
4/25	pm	Fair-Poor	0.3		10,664	0	514	2,793	73,765	5,893	26,228	251	6,316			0	126,424
4/26	pm	Good	5.1	0	24,983	976	827	6,363	83,779	9,268	30,077	837	4,127	2,898			164,135
4/27	pm	Poor	21.3			0	6,357	904									7,261
4/28	pm	Fair-Poor	13.0			133	452	2,925	2,366	21	1,530	159	160	372			8,118
4/29	pm	Fair	6.0			930	501	1,293	1,897	429	623	287	436	1,504	319		8,218
4/30	pm	Fair	4.0		312	712	761	631	7,557	122	349		15	737			11,196
5/01	pm	Fair	2.2			298	1,194	1,186	39,438		81		54				42,250
5/03	pm	Fair	1.5		422	209	144	194	23,613	2,004	85	30	38	42	95		26,875
5/04	pm	Fair	0.0		52	1,689	571	205	25,561	1,629	0	11					29,718
5/05	pm	Fair	0.0		2,174	3,740	5,225	27									11,165
5/06	pm	Fair-Poor	0.0	74	2,219	2,137	2,567	550	15,395	3,339	39	0	243				26,562
5/07	pm	Fair	0.0	0	1,199	3,128	614	64									5,005
		Total	53.3														

* The final 1993 Togiak District Pacific herring biomass was estimated at 193,847 short tons which is a summation of:
1) Peak estimate of 164,130 tons observed 26 April, and
2) the biomass observed 4 May of 29,718 tons.

[b] Index Areas: NUS- Nushagak Peninsula; KUK-Kulukak; MET-Metervik; NUK-Nunavachak; UGL-Ungalikthluk/Togiak; TOG-Togiak; TNG-Tongue Point; MTG-Matogak; HAG;Hagemeister; OSK-Osviak; PYT-Pyrite Point; CN-Cape Newenham; WAL-Walrus Islands Area.

[c] Survey condition rating: 1= Excellent, 2=Good, 3=Fair, 4=Poor, 5=Unacceptable.

Table 4. Daily observed estimates (short tons) of herring during the 1994 season by index area, Togiak District, Bristol Bay, Alaska.[a]

Date	Time Surveyed	Survey Conditions	Miles of Spawn	Estimated Biomass by Index Area[b,c] NUS	KUK	MET	NUK	UGL	TOG	TNG	MTG	HAG	OSK	PYR	CN	WAL	Daily Total (tons)
4/18	pm	Fair	0.0	0	0	0	0	0	0	0	0	0					0
4/21	pm	Fair-Good	0.0	0	0	0	0	0	0								0
4/25	am	Good-Excel.	0.0	0	0	0	0	0	0	0		0					0
4/30	pm	Good	0.0	0	0	0	0	0	0	0	0	0				0	0
5/02	pm	Poor	0.0	0	0	0	0	0	0	0	0	0	0				0
5/03	pm	Fair	0.0		0	0	0	0	0	0	0						0
5/05	pm	Fair	0.0		0	0	0	0	0	0	0	0	0			0	0
5/06	pm	Fair	0.0						0	0	0	0				0	0
5/08	am	Fair	0.0	0	0	0	0	0	0	0	0		0	0			0
5/08	pm	Fair	0.0									2,110				3,351	5,461
5/09	am	Fair	0.0	3,574	6,499	259	2,428	379	1,030	12,580	0	716				6,805	34,270
5/09	pm	Fair	0.0	6,178	3,849	928	750	4,304	16,338	5,696	268	13,474					51,784
5/10	pm[d]	Fair	3.8	10,306	9,358	1,905	303	9,002	13,981	7,397	10,541	9,676	3,172	126			75,767
5/11	am[d]		21.0														
5/12	am	Fair	23.0	43,235	16,191	12,909	6,943	2,988	12,383	8,746	2,112	21,001	8,842	9,484	274	3,609	148,716
5/13	am[d]		18.8														
5/14	am	Fair	5.3	22,015	5,922	4,593	5,427	5,120	14,862	4,562	5,128	23,280	6,405	472			97,786
5/16	am	Fair	0.0		2,809	1,153	445	3,890	6,784	602	2,962	94	175	83			18,998
		Total	71.9														

[a] Togiak District Pacific herring biomass was estimated at 185,454 short tons.
[b] Index Areas: NUS- Nushagak Peninsula; KUK-Kulukak; MET-Metervik; NUK-Nunavachak; UGL-Ungalikthluk/Togiak; TOG-Togiak; TNG-Tongue Point; MTG-Matogak; HAG;Hagemeister; OSK-Osviak; PYT-Pyrite Point; CN-Cape Newenham.
[c] Smelt schools observed Tog 4/23, 4/25, 4/30; Ugl 5/05; Tng 5/05, 5/06; MTG 5/02; Hag4/30, 5/05; Osk 5/02.
[d] Spawn survey.

Table 5. Commercial harvest of herring by gear type and product, Togiak District, Bristol Bay, Alaska, 1978–94.

Year	Number of Processors	Effort: Units of Gear[1] Gillnet	Effort: Units of Gear[1] Purse Seine	Harvest: Percent by Gear Gillnet	Harvest: Percent by Gear Purse seine	Harvest: Product Sac Roe	Harvest: Product Food/ Bait	Inshore Total[2] (tons)
1978	16	40	25	8	92	100	0	7,734
79	33	350	175	40	60	92	8	11,558
1980	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
83	23	250	150	19	81	97	3	26,287
84	25	300	196	25	75	98	2	19,300
1985	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
88	22	300	239	26	74	99	1	14,382
89	19	320	310	24	76	97	3	12,258
1990	16	277	221	25	75	99	1	12,253
91	16	170	200	21	79	97	3	15,070
Mean (1978–91)	23	238	168	22	78	97	3	16,346
1992	18	274	301	19	81	98	2	25,808
1993	12	75	140	20	80	100	0	17,925
1994	16	146	240	25	75	100	0	30,300

[1] Derived from fish tickets in years prior to 1979. From 1979 to present, includes peak aerial survey count.
[2] Data for some years includes ADF&G harvests and waste.
[a] Fishery not conducted.

Table 6. Commercial inshore herring harvest (tons) by fishing section and gear type, Togiak District, Bristol Bay, 1992. Weighted roe percentage is listed in parentheses.

Date	Time (hours)	Section: Kulukak	Nunavachak	Togiak	Hagemeister	Pyrite Point	Cape Newenham	Total
				Purse Seine				
5/20	0.3	562 (9.0)	2,750 (8.4)	6,905 (9.1)	4,374 (9.4)	4,792 (9.6)	25 (11.5)	19,407 (9.2)
5/20[a]			61	1,310				1,371
Total	0.3	562 (9.0)	2,811 (8.4)	8,215 (9.1)	4,374 (9.4)	4,792 (9.6)	25 (11.5)	20,778 (9.2)
				Gillnet				
5/20	3.0	285 (8.2)	85 (7.7)	959 (7.7)				1,330 (7.8)
5/22	4.0	2,220 (9.3)						2,220 (9.3)
5/25[b]	6.0	597 (8.8)						597 (8.8)
5/26	5.0	239 (9.3)						239 (9.3)
5/27	7.5		645 (9.0)					645 (9.0)
Total	25.5	3,341 (9.1)	730 (8.8)	959 (7.7)				5,030 (8.8)
				Combined Gear				
5/20	3.3	847 (8.8)	2,896 (8.2)	9,175 (8.9)	4,374 (9.4)	4,792(9.6)	25 (11.5)	22,108 (9.1)
5/22	4.0	2,220 (9.3)						2,220 (9.3)
5/25	6.0	597 (8.8)						597 (8.8)
5/26	5.0	239 (9.3)						239 (9.3)
5/27	7.5		645 (9.0)					645 (9.0)
Total	25.8	3,902 (9.1)	3,541 (8.3)	9,175 (8.9)	4,374 (9.4)	4,792 (9.6)	25 (11.5)	25,808 (9.2)

[a] Estimated waste from purse seine dead loss.
[b] Combined harvest for two distinct fishing periods.

Table 7. Commercial inshore herring harvest (tons) by fishing section and gear type, Togiak District, Bristol Bay, 1993. Weighted roe percentage is listed in parentheses.[a]

Date	Time (hrs)	Section: Kulukak	Nunavachak	Togiak	Hagemeister	Pyrite Point	Cape Newenham	Total
				Purse Seine				
4/27	0.4		222 (8.4)	514 (9.5)				735 (9.2)
4/28	0.3		329 (9.1)	75 (8.8)	126 (10.0)			529 (9.3)
4/29	4.0	237 (9.2)	1,125 (8.8)	47 (10.7)	1,119 (10.2)	1,452 (10.4)	1,334 (11.2)	5,314 (10.2)
4/30	1.7		195 (8.9)	32 (12.3)	219 (9.9)	1,156 (9.9)	831 (10.7)	2,432 (10.1)
5/01	6.5		409 (9.0)	71 (7.9)	845 (9.3)[b]	235 (9.1)	46 (10.3)	1,606 (9.2)
5/02	7.0	602 (7.9)[b]	198 (8.6)	2 (9.8)	747 (8.8)	135 (9.5)		1,684 (8.5)
5/03	6.0	151 (7.4)[c]	102 (8.6)		311 (8.9)	25 (10.1)		589 (8.5)
5/04	6.0	167 (9.3)	124 (8.9)	24 (8.3)	501 (9.0)	151 (10.7)		968 (9.3)
5/05	2.0		87 (8.2)[b]	89 (9.0)	305 (9.6)	24 (10.0)		505 (9.3)
Total	33.8	1,157 (8.3)	2,790 (8.8)	853 (9.4)	4,172 (9.5)	3,178 (10.1)	2,211 (11.0)	14,361 (9.6)
				Gillnet				
4/29	9.0	705 (9.1)						705 (9.1)
4/30	17.8	991 (10.5)						991 (10.5)
5/02	11.3	338 (9.9)						338 (9.9)
5/03	5.0	82 (9.8)						82 (9.8)
5/04	15.0	617 (9.4)						617 (9.4)
5/06	9.8	102 (10.5)						102 (10.5)
5/07	42.8	615 (11.0)						615 (11.0)
5/09	34.0	100 (11.2)	15 (14.8)					115 (11.7)
Total	144.5	3,549 (10.1)	15 (14.8)					3,564 (10.1)

-continued-

Table 7. (page 2 of 2)

Date	Time (hrs)	Section: Kulukak	Nunavachak	Togiak	Hagemeister	Pyrite Point	Cape Newenham	Total
				Combined Gear				
4/27	0.4		222 8.4	514 (9.5)				735 (9.2)
4/28	0.3		329 9.1	75 (8.8)	126 (10.0)			529 (9.3)
4/29	13.0	942 (9.1)	1,125 8.8	47 (10.7)	1,119 (10.2)	1,452 (10.4)	1,334 (11.2)	6,019 (10.0)
4/30	19.5	991 (10.5)	195 8.9	32 (12.3)	219 (9.9)	1,156 (9.9)	831 (10.7)	3,422 (10.2)
5/01	6.5		409 9.0	71 (7.9)	845 (9.3)	235 (9.1)	46 (10.3)	1,606 (9.2)
5/02	18.3	940 (8.6)	198 8.6	2 (9.8)	747 (8.8)	135 (9.5)		2,022 (8.7)
5/03	11.0	233 (8.3)	102 8.6		311 (8.9)	25 (10.1)		671 (8.7)
5/04	21.0	784 (9.4)	124 8.9	24 (8.3)	501 (9.0)	151 (10.7)		1,584 (9.3)
5/05	2.0		87 8.2	89 (9.0)	305 (9.6)	24 (10.0)		505 (9.3)
5/06	9.8	102 (10.5)						102 (10.5)
5/07	42.8	615 (11.0)						615 (11.0)
5/09	34.0	100 (11.2)	15 14.8					115 (11.7)
Total	178.3	4,706 (9.6)	2,805 (8.8)	853 (9.4)	4,172 (9.5)	3,178 (10.1)	2,211 (11.0)	17,925 (9.7)

[a] Catches for multiple fishing periods for the same day are combined.
[b] Includes 10 tons deadloss.
[c] Includes 20 tons deadloss.

Table 8. Commercial inshore herring harvest (tons) by fishing section and gear type, Togiak District, Bristol Bay, 1994. Weighted roe percentage is listed in parentheses.[a]

Date	Time (hours)	Fishing Section: Kulukak	Nunavachak	Togiak	Hagemeister	Pyrite Point	Cape Newenham	Total
				Purse Seine				
5/11	0.25	1,518 (9.2)	10,278 (9.4)[b]	3,864 (9.2)[c]				15,660 (9.5)
5/15	0.50		193 (10.3)	309 (10.1)				502 (10.2)
5/16	3.50				5,268 (10.1)		25 (11.5)	5,293 (10.1)
5/18	0.33				1,376 (10.3)			1,376 (9.8)
5/27[d]				6 (10.2)				6 (10.2)
Total	4.58	1,518 (9.2)	10,471 (9.4)	4,178 (9.3)	6,645 (10.1)		25 (11.5)	22,837 (9.5)
				Gill Net				
5/11	8.00	2,080 (11.2)[e]						2,080 (11.2)
5/15	14.00	1,846 (12.2)						1,846 (12.2)
5/16	9.00	1,148 (12.6)						1,148 (12.6)
5/18	33.00	2,106 (12.6)						2,106 (12.6)
5/20	12.00	283 (12.2)						283 (12.2)
Total	76.00	7,463 (12.1)						7,463 (12.1)
				Combined Gear				
5/11	8.25	3,598 (10.4)	10,278 (9.4)	3,864 (9.2)	5,268 (10.1)			17,740 (9.6)
5/15	14.50	1,846 (12.2)	193 (10.3)	309 (10.1)				2,348 (11.6)
5/16	12.50	1,148 (12.6)					25 (11.5)	6,441 (11.2)
5/18	33.33	2,106 (12.6)			1,376 (10.3)			3,483 (11.7)
5/20	12.00	282.5 (12.2)						283 (12.2)
5/27				6 (10.2)				6 (10.2)
Total	80.58	8,980 (11.6)	10,471 (9.4)	4,178 (9.2)	6,645 (10.1)	0	25 (11.5)	30,300 (10.2)

[a] Catches for multiple fishing periods for the same day are combined.
[b] Includes 350 tons deadloss.
[c] Includes 205 tons ground into fish meal.
[d] ADF&G test fish harvest.
[e] Includes 50 tons deadloss.

Table 9. Commercial harvest of herring spawn–on–kelp, Togiak District, Bristol Bay, Alaska, 1974–94.

Year	Processors	Permit Holders[1]	Deliveries	Harvest (lbs)
1974	3	26	49	125,646
1975	2	44	98	111,087
76	5	49	118	295,780
77	5	75	266	275,774
78	11	160	349	329,858
79	16	100	228	414,727
1980	21	78	186	189,662
81	7	108	277	378,207
82	8	214	167	234,924
83	4	125	257	270,866
84	6	330	412	406,587
1985 [a]				
86	3	204	351	374,142
87	5	187	334	307,307
88	10	259	330	489,320
89	11	487	330	559,780
1990	7	481 [b]	286	413,844
91	7	532 [b]	248	348,357
20–Year Ave.	7	183	228	294,823
1972–81 Ave.	7	62	149	202,033
1982–91 Ave.	7	313	302	378,347
1992	5	386	267	363,600
1993	2	173	313	383,000
1994	3	204	212	308,400

[1] Based on fish tickets, unless specified otherwise.
[a] Fishery not conducted.
[b] Estimated via aerial survey during the harvest; includes both limited entry interim use permit holders and crew members.

Table 10. Exvessel value of the commercial herring and spawn–on–kelp harvest, in thousands of dollars, Togiak District, Bristol Bay, Alaska, 1978–94.[a]

Year	Sac Roe	Food/Bait	Spawn–on–Kelp	Total
1978	2,635	0	120	2,755
79	6,561	180	249	6,990
1980	3,055	150	95	3,300
81	3,988	1	250	4,239
82	6,070	105	176	6,351
83	10,450	67	284	10,801
84	7,178	33	203	7,414
1985	13,696	41	[b]	13,737
86	8,648	12	187	8,847
87	8,614	49	166	8,829
88	14,103	3	346	14,452
89	4,983	19	448	5,450
1990	6,494	9	360	6,863
91	6,173	21	383	6,577
Mean (1978–91)	7,332	49	251	7,615
1992	8,818	26	254	9,098
1993	5,218	3	268	5,539
1994	9,090	0	212	9,302

[a] Exvessel value (value paid to the fisherman) is derived by multiplying price/lb by the commercial harvest.
[b] Fishery not conducted.

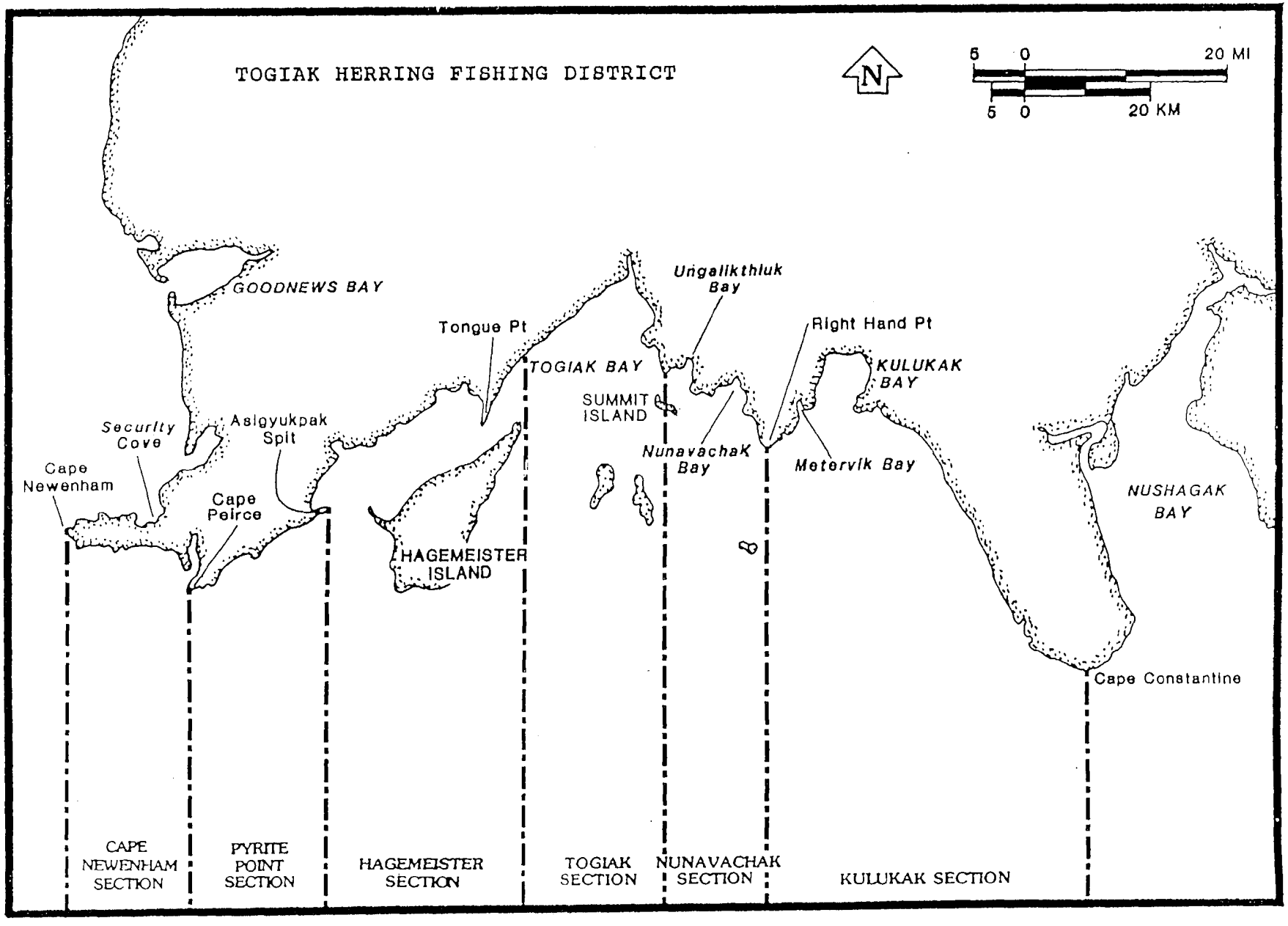

Figure 1. Togiak Herring Fishing District.

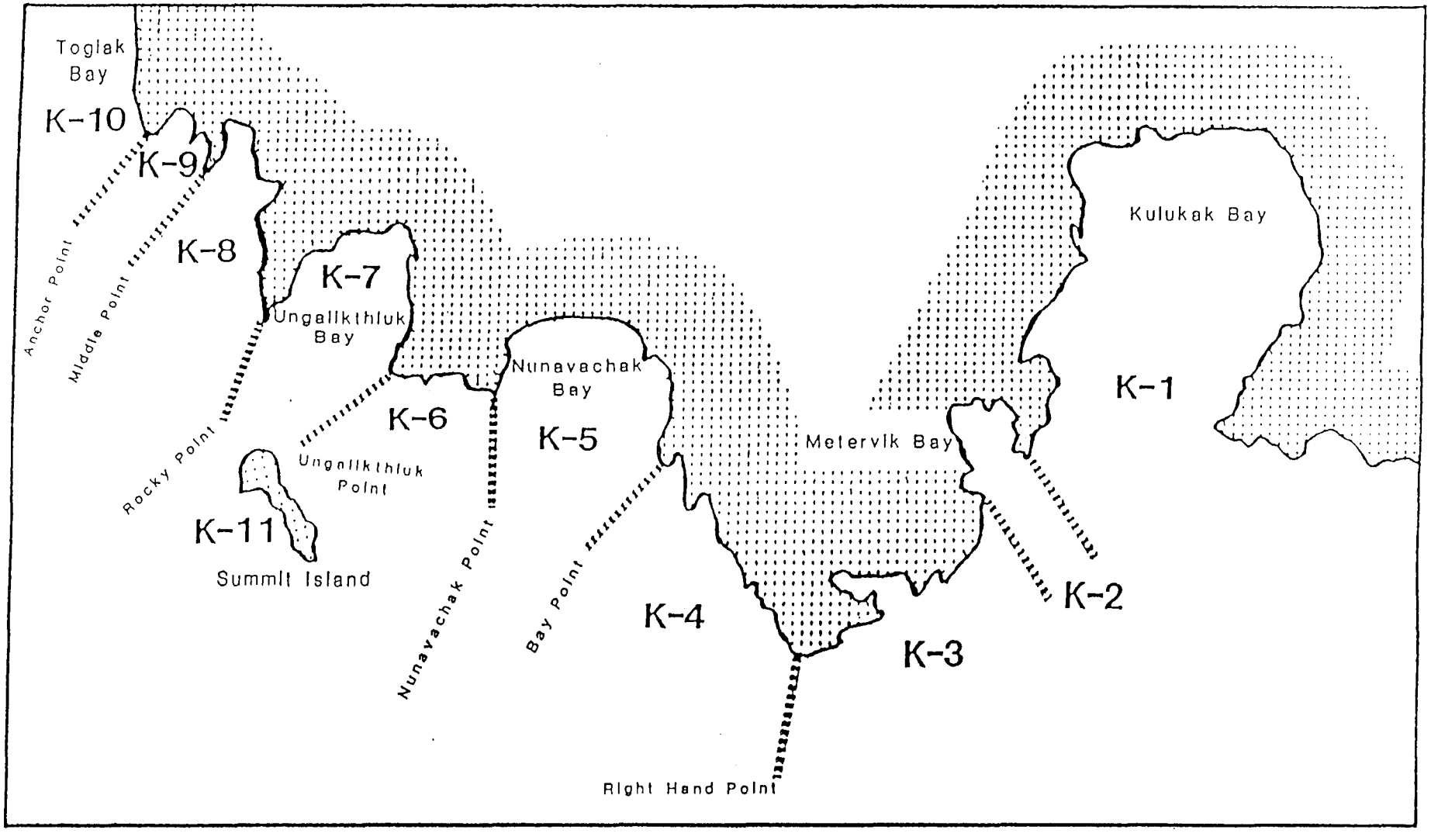

Figure 2. Togiak District Spawn-on-Kelp Management Areas, Bristol Bay, (K-1 through K-11).