

SECOND PROGRESS REPORT

ASSESSMENT OF SPAWNING HERRING AND CAPELIN STOCKS  
AT SELECTED COASTAL AREAS IN THE EASTERN BERING SEA  
CONTRACT 78-5, entered into between the:

North Pacific Fishery Management Council

and

Alaska Department of Fish and Game  
Division of Commercial Fisheries  
Support Building  
Juneau, Alaska 99801

I. INTRODUCTION 1/

- A. The basic objectives of this contract are to survey and assess the status of spawning herring and capelin stocks at selected coastal areas in the eastern Bering Sea. More specifically, this study is to describe and monitor separate stocks of herring and capelin. A secondary objective will be to simultaneously evaluate existing survey methodology for possible procedural modifications.
- B. This second progress report is filed by contractual agreement as prescribed in Article II, "Project Schedules and Deliverables", of the N.P.F.C. contract #78-5. This contract was entered into between the North Pacific Fishery Management Council and the Alaska Department of Fish and Game in March of this year.
- C. This second progress report is to accomplish the following objectives as prescribed in the above article of contract 78-5: "This report must encompass summaries of all data collected for Task 3, 4, and 5. In addition, this report must detail in outline form the preliminary results from the methodology tasks as specifically stated in Tasks 7 and 8".

1/ All data in this report are preliminary and subject to revision for the third progress report, due 1/15/79. Nothing contained herein can be used in any publication or presentation without the written permission of the contractor.

II. BIBLIOGRAPHY (Originally scheduled for delivery on 5/24/78 but extended to 9/18/78 by mutual agreement between the Council and the Contractor).

A. Results of bibliographical efforts may be seen in Appendix I. All works are on hand at Alaska Department of Fish and Game office, Division of Commercial Fisheries, Kodiak, Alaska.

III. TASK 3. <sup>1/</sup>

A. The objectives for this task are described in contract 78-5, section C, page 4. They are: "Establish a data base by monitoring the spatial and temporal distribution of spawning herring/forage fish stocks in the six sampling areas of the eastern Bering Sea and monitoring the relative year class composition, abundance, growth rate and stock vigor of herring/forage fish stocks at the same six selected sites."

B. Four aerial tracklines were selected where surveys (at least four) would be conducted in the spring and summer of 1978 for the purpose of assessing the temporal and spatial distribution of spawning herring/capelin stocks. They are as follows: <sup>2/</sup>

Trackline #1 = Togiak District, west and northwest around Cape Newenham, north to Jacksmith Bay.

Trackline #2 = Herendeen Bay, north coast of Alaska Peninsula.

Trackline #3 = Cape Vancouver/Nelson Island.

Trackline #4 = Norton Sound/Cape Denbigh.

C. Table listing of census areas are included as Appendix II.

<sup>1/</sup> All methods and operational plans for this contract are included in the first progress report, received and approved at NPFC offices, May 24, 1978.

<sup>2/</sup> School sizes are: s(small)=surface area 1-500 ft.<sup>2</sup>  
(as estimated from air) m1(medium 1)=surface area 501-2750 ft.<sup>2</sup>  
m2(medium 2)=surface area 2751-5000 ft.<sup>2</sup>  
Lg(large)=5001 + ft.<sup>2</sup>

- D. A summary of trackline results and data may be seen in Tables 1 through 4.
- E. Summary of schools spotted per km flown by trackline are shown in Tables 5 through 8.
- F. Kilometers flown (overall) by trackline, Table 9.
- G. Herring and capelin age, length, weight data was collected at six selected ground sites between April and July, 1978.
  - 1) Metervik Bay (Togiak District)
  - 2) Hagemeister Straits (Togiak District)
  - 3) Security Cove (Cape Newenham)
  - 4) Cape Vancouver/Nelson Island
  - 5) Cape Denbigh (Norton Sound)
  - 6) Port Clarence (Bering Strait)
- H. Total herring and capelin collected during 1978 field activities for this contract were: (See Table 10).
- I. A summary of mean length at age by site may be seen in Table 11.
- J. All capelin sampled for this contract as yet unprocessed due to time constraints. 901 collected specimens are on hand.

#### IV. TASK 4.

- A. The objectives for this task are described in contract 78-5, section C, page 5. They are:  
"Determine the feasibility of utilizing year-class strength and abundance of spawning stocks in conjunction with existing data base to interpret stock strengths and to what extent their strengths are affected by commercial harvests."

- B. Comparative year class strength was determined for herring caught at six different land sites described in III of this report. Relative year class strength for each site can be seen in Figures 1 through 3 <sup>1/</sup>.
- C. The extent of commercial harvest affects upon stock strength cannot be ascertained at this time. Further analysis to be completed for the third progress report.
- D. Herring samples were successfully collected at five land sites, frozen and shipped to NMFS in Seattle for stock separation analysis. The five land sites were Pt. Clarence, Cape Denbigh, Cape Romanzof, Security Cove and Kulukuk Bay.

V. TASK 5.

- A. The objectives for this task are described in contract 78-5, section C, page 5. They are:  
"Measure physical requirements of spawning substrate at each selected spawning area." (Component II).
- B. Results of substrate transects may be seen in Table 12.
- C. In addition to results of Table 12, two subtidal stations were sampled with SCUBA equipment, (6/4/78).
  - 1) One dive 1 kilometer 90°T from Metervik Bay camp produced 10 kilograms of large (greater than 1 meter in length) Laminaria sp. with no spawn detected. Depth 6 M.
  - 2) Second dive .3 kilometers off Metervik Bay camp (90°T) produced very small quantities of Laminaria sp. with no spawn. Depth 3 meters.

<sup>1/</sup> Cape Romanzof sampling activities funded and operated outside of this contract by ADF&G. Results are included for comparative purposes.

- 3) No substrate work completed at any other site.

## VI. TASKS 7 & 8. (Preliminary Results).

### A. Task 7.

- 1) The objectives for this task are described in contract 78-5, section C, page 5 and 6 as follows:

"The contractor will evaluate the following parameters for inclusion into standard methodology to be used at the onshore forage fish sites.

- (a) Salinity and temperature at depth throughout herring areas and adjacent waters.
  - (b) Substrate at primary tidal and subtidal spawning locations.
  - (c) Quantitative determination of spawn deposition".
- 2) Salinity and temperature was taken at least bi-weekly at Metervik throughout the spawning period (Table 13). This section of the contract was not satisfied, as it is in conflict with approved project plan where s.t.d. work was downgraded to that of secondary importance because of a pre-season visit to Nanaimo, British Columbia sponsored by the NPFC for purposes of this study.
  - 3) Impoundment results in regards to spawn deposition and viability are presented in Table 14.
    - (a) Portions of 7b (above) are satisfied by work accomplished and presented in this progress report for Task 5.

### B. Task 8.

- 1) The objectives for this task are described in contract 78-5, section C, page 6 as:

"The contractor will determine how closely gill net catches from the test fishing effort represents the commercial catches by purse seines in the same area. This determination must be statistically valid and must compare length-frequency distribution, size and sex composition".

- 2) Preliminary results may be seen in Figure 4 for specimens caught for the gear selectivity study.<sup>1/</sup>
- 3) Statistical tests have not yet been applied to results. Further morphometric analysis to be completed.

<sup>1/</sup> Specimens taken within the same time frame for each gear type, (from 5/21 to 6/3).

Table 1 - Summary of aerial observations seen during NPFC Bering Sea Herring surveys, 1978.

Trackline #	1	# of Surveys	Km Flown	Pacific Herring				Capelin				Unknown			
				Sm	Med 1	Med 2	Lg	Sm	Med 1	Med 2	Lg	Sm	Med 1	Med 2	Lg
8		8	1080									9	154		79
9		13	585	39	273		141								
10		19	1425	51	115		38	13	5		2	380	506		378
15		9	1125									331	640		163
16		1	107									14			
18 a,b,c		7	262	1	3		7	6	2		7	46	16		9
19		7	161		1		2	11	1		2	10	11		
20 a,b		7	508	73	3		9	6	1		2	13	4		5
21		6	1011				1	1			2	3	4		2
11		1	10			6									
TOTALS			6274	164	395	6	198	37	9	0	15	806	1335	0	636

Table 2 - Summary of aerial observations seen during NPFC Bering Sea Herring surveys, 1978.

Trackline # <u>2</u>		Pacific Herring				Capelin				Unknown				
Census Area	# of Surveys	Km Flown	Sm	Med 1	Med 2	Lg	Sm	Med 1	Med 2	Lg	Sm	Med 1	Med 2	Lg
3 c	8	968									3			
TOTALS		968	0	0	0	0	0	0	0	0	3	0	0	0



Table 3 - Summary of aerial observations seen during NPFC Bering Sea Herring surveys, 1978.

Trackline # <u>3</u>		Pacific Herring				Capelin				Unknown				
Census Area	# of Surveys	Km Flown	Sm	Med 1	Med 2	Lg	Sm	Med 1	Med 2	Lg	Sm	Med 1	Med 2	Lg
23 A + B	5	384	8	1		42			5	10	7	7		
24	5	220	6											
25 a,b,c,d,e	1	466	8	1							54	1		
22	2	352												
TOTALS		1422	22	2	0	42	0	0	5	10	61	8	0	0

Table 4 - Summary of aerial observations seen during NPFC Bering Sea Herring surveys, 1978.

Trackline # <u>4</u>	# of Surveys	Km Flown	Pacific Herring				Capelin				Unknown			
			Sm	Med 1	Med 2	Lg	Sm	Med 1	Med 2	Lg	Sm	Med 1	Med 2	Lg
34 a,b,c,d	2	101	2											
35	2	50	1											
36 a,b,c,	3	68												
37 a,b,c,d	3	195	40	7	2	2								
38 a,b,c,	4	311	116	28	7	5								
39 a,d	4	227	57	18	4	1								
40 b,c,d	3	141	91	31	1									
41	2	180	14	8										
42 a,b,c	3	174	32	1		2					124	29	15	5
43 a,b,c,d	3	342	6	2							77	13	5	1
44	1	200												
TOTALS		1989	359	95	14	10	0	0	0	0	201	42	20	6

Table 5. Summary of schools spotted per Km flown per fishing week during NPFC Bering Sea herring aerial surveys, 1978.

Trackline # <u>1</u>	4/23- 4/29	4/30- 5/6	5/7- 5/13	5/14- 5/20	5/21- 5/27	5/28- 6/3	6/4- 6/10	6/11- 6/17	6/18- 6/24	6/25- 7/1	7/2- 7/8
Fishing Week	1	2	3	4	5	6	7	8	9	10	11
Km Flown		360	1523.25	1407.2	1282.8	1411.67	291.12				
<u>Pacific Herring</u>											
small		24	77	40	5						
med. 1		14	205	132	38	36					
med. 2					6						
large		5	65	88	5	7					
<u>Capelin</u>											
small				1		45					
med. 1					4	5					
med. 2											
large					2	13					
<u>Unknown</u>											
small			198	60	204	334					
med.1			806	238	165	132					
med.2..											
large			251	257	82	46					
TOTALS Σ/Km	0	.43 .119	1602 1.05	816 .58	511 .39	618 .43	0	0	0	0	0

Table 6. Summary of Schools spotted per Km Flown per fishing week during NPFC Bering Sea herring aerial surveys, 1978.

Trackline #	2	4/23-	4/30-	5/7-	5/14-	5/21-	5/28-	6/4-	6/11-	6/18-	6/25-	7/2-
Fishing Week		4/29 1	5/6 2	5/13 3	5/20 4	5/27 5	6/3 6	6/10 7	6/17 8	6/24 9	7/1 10	7/8 11
Km Flown			121	121	121	242	363					
<u>Pacific Herring</u>												
small												
med. 1												
med. 2												
large												
<u>Capelin</u>												
small												
med. 1												
med. 2												
large.												
<u>Unknown</u>												
small					3							
med. 1												
med. 2												
large												
TOTALS		0	0	0	3	0	0	0	0	0	0	0
$\Sigma$ /Km					.024							

Table 7. Summary of schools spotted per Km flown per fishing week during NPFC Bering Sea herring aerial surveys, 1978.

Trackline # <u>3</u>	4/23- 4/29	4/30- 5/6	5/7- 5/13	5/14- 5/20	5/21- 5/27	5/28- 6/3	6/4- 6/10	6/11- 6/17	6/18- 6/24	6/25- 7/1	7/2- 7/8
Fishing Week	1	2	3	4	5	6	7	8	9	10	11
Km Flown			120.8	417.8	586.8		296.8				
<u>Pacific Herring</u>											
small				6	16						
med. 1					2						
med. 2											
large				38	4						
<u>Capelin</u>											
small											
med. 1											
med. 2					5						
large					10						
<u>Unknown</u>											
small				7	54		3				
med. 1				7	1						
med. 2											
large							1				
TOTALS	0	0	0	58	82	0	4	0	0	0	0
Σ/Km				.139	.14		.013				

Table 8. Summary of schools spotted per Km flown per fishing week during NPFC Bering Sea herring aerial surveys, 1978.

Trackline #	4	4/23- 4/29	4/30- 5/6	5/7- 5/13	5/14- 5/20	5/21- 5/27	5/28- 6/3	6/4- 6/10	6/11- 6/17	6/18- 6/24	6/25- 7/1	7/2- 7/8
Fishing Week		1	2	3	4	5	6	7	8	9	10	11
Km Flown					695.95	587.67	74.73	556.75	76		100	
<u>Pacific Herring</u>												
small						57	163	34	105			
med. 1						10	43	6	35			
med. 2						1	10	2	1			
large						4	4	2				
<u>Capelin</u>												
small												
med. 1												
med. 2												
large												
<u>Unknown</u>												
small						7	191				3	
med. 1						1	59					
med. 2							20					
large						1	5					
TOTALS		0	0	0	0	81	495	44	141	0	3	0
$\Sigma$ /Km						.138	6.624	.079	1.855		.03	

Table 9. Summary of kilometers flown by trackline during NPFC Bering Sea herring aerial surveys, 1978.

Time Period	4/23- 4/29	4/30- 5/6	5/7- 5/13	5/14- 5/20	5/21- 5/27	5/28- 6/3	6/4- 6/10	6/11- 6/17	6/18- 6/24	6/25- 7/1	7/1- 7/8
Fishing Week	1	2	3	4	5	6	7	8	9	10	11
Track# 1		360	1523.25	1407.2	1282.8	1411.67	291.12				
2		121	121	121	242	363					
3			120.8	417.6	586.8		296.8				
4					695.95	587.67	74.73	556.75	76	100	

Table 10. Herring<sup>1/</sup> and Capelin caught for NPFC Contract 78-5, at six sites, Bering Sea 1978.

	Metervik	Hagemeister Straits	Security Cove	Nelson Island	Cape Denbigh	Port Clarence
Herring	3666	2536	2069	1362	1843	72
Capelin	129	219	943	278	0	0

<sup>1/</sup> All herring and capelin catches subsampled by previously submitted sampling plan.



Table 11. Mean length-at-age of Bering Sea herring captured at selected coastal sites, spring 1978.

	Age In Years											
	1	2	3	4	5	6	7	8	9	10	11	12
Pt. Clarence n = 63			164	187	173	189	227	232	230	207	232	214
Cape Denbigh n = 756		159	177	207	226	236	242	257	264	271	267	
Nelson Island n = 738			197	215	239	245	247	280	287			
Security Cove n = 1,095	120	178	200	217	242	248	250	288	283	293	295	
Metervik Bay n = 1,280	113	183	208	228	239	243	262	274	279	323		
Hagemeister Straits n = 944	112	190	207	221	241	248	269	282	289	283	295	

Table 12. Scuba<sup>3/</sup> transects completed to ascertain substrate type and herring spawning activity in regards to habitat zone, Metervik Bay (Togiak area) 6/3/78.

Transect#	Distance (in meters from 0' tiday <sup>1/</sup> level, and <sup>1/</sup> substrate type found there									
	10	20	30	40	50	60	70	80	90	100
9	<i>Fucus</i> / spawn	only <i>Laminaria</i> no spawn	(same as 20)	(same as 20)	uniden- tified kelp no eggs	<i>Laminaria</i> light spawn	(same as 60)	<i>Laminaria</i> no eggs	black mud, some <i>Laminaria</i> no spawn	mud, no vegetation
1	<i>Fucus</i> no spawn	<i>Fucus</i> light spawn	rock aggregate	hard mud some <i>Laminaria</i> no spawn eel grass	hard rock silted eel grass dominant	(same as 50)	patchy eel grass no spawn sparse <i>Laminaria</i>	(same as 70)	(same as 70)	rock <sup>2/</sup> bare
7	<i>Fucus</i> with spawn Trace of <i>Laminaria</i>	<i>Fucus</i> with spawn	<i>Laminaria</i> abundant, with some spawn on stipe	(same as 30)	(same as 30)	(same as 30)	<i>Laminaria</i> but very few eggs	(same as 70)	(same as 70)	(same as 70)

1/ Transects laid out directly offshore from 0' tide level with compass, and marked with twine, which in turn was "flagged" every 10 meters with surveyor's ribbon. From 70 meters on out, transects can be considered subtidal.

2/ Numerous yellow fin sole in area.

3/ Diver, Guy C. Powell, ADF&G, Kodiak.

Table 13. Temperature/salinity readings taken at Metervik Bay (Togiak area) during spring and early summer, 1978.

Date	Location	Salinity (parts per thou.)	Method	Temp. C <sup>0</sup> (H <sub>2</sub> O)	Comments
4/27	Metervik Bay	25%	Yellow Springs S & T Meter	6 <sup>0</sup> H <sub>2</sub> O	Starting day
4/28	Nearshore Zone	25%	"	6 <sup>0</sup>	Taken at 1530
4/30	"	25%	"	6 <sup>0</sup>	Taken at 0930
5/1	"	25%	"	6 <sup>0</sup>	Taken at 1000
5/2	"	25%	"	6 <sup>0</sup>	" " 1000
5/3	"	27%	"	6 <sup>0</sup>	" " 1700
5/5	"	27%	"	7 <sup>0</sup>	" " 1200
5/9	"	25%	"	6 <sup>0</sup>	1400
5/15	"	24%	"	8-5 <sup>0</sup>	1930
5/18	"	25%	"	8-8 <sup>0</sup>	1200
5/20	"	29%	"	7 <sup>0</sup>	2300
5/24	"	24%	"	8 <sup>0</sup>	1200
5/26	"	24%	"	11 <sup>0</sup>	1145
5/28	"	26%	"	7 <sup>0</sup>	1740
5/30	"	23%	"	11 <sup>0</sup>	1800
6/2	← Meter Malfunctioned →				
6/7	"	-	hand held thermometer	8 <sup>0</sup>	-
6/19	"	28%	meter	7 <sup>0</sup>	-
6/24	"	29%	"	7 <sup>0</sup>	-
6/28	"	30.5%	"	7 <sup>0</sup>	-

Table 14. Herring spawn deposition in respect to hatching viability in 5 different .5<sup>2</sup> meter impoundments at 0<sup>th</sup> tide level, at Metervik Bay (Togiak area) May and June, 1978.<sup>2/</sup>

Cage No.	Substrate Type	Layers <sup>1/</sup> of Spawn	Photos Available	# of devel. tests	% Hatch	Incubation period (approx.)
9	spawn on <i>Fucus</i> and bare rock	6-8	B & W prints throughout incubation period of .5 <sup>2</sup> plot	9	100%	13-15 days
1	"	1-2	"	9	100%	14-17 days
5	spawn on 95% rock	4-6	"	8	100%	12-14 days
7	spawn on <i>Fucus</i> and bare rock	4-6	"	9	100%	14-16 days
8	spawn on <i>Fucus</i> and bare rock	2-4	"	6	100%	13-15 days

<sup>1/</sup> "Layers of Spawn" counted on both sides of substrate, i.e., 6-8 overall layers of spawn would be evenly or unevenly divided on each side of kelp,

<sup>2/</sup> Precise areas of cages determined by, 1) Marking cage location on a pre-designed X/Y grid system of Metervik Bay. 2) Triangulating off 2 known points via azimuth readings.

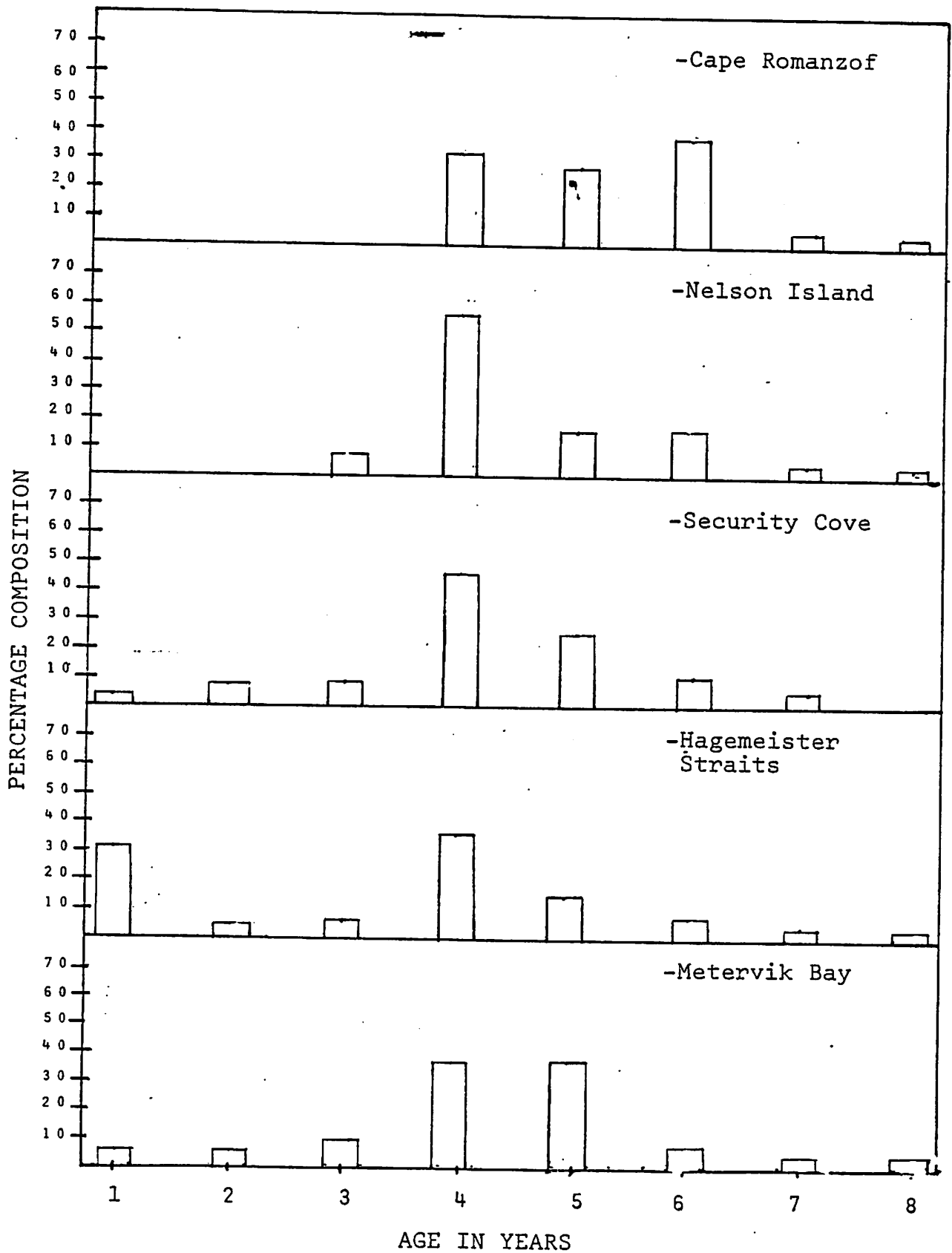


Figure 1 - Age Frequency by groundtruth site, Bering Sea Herring; (*Clupea harengus pallasii*) 1978.

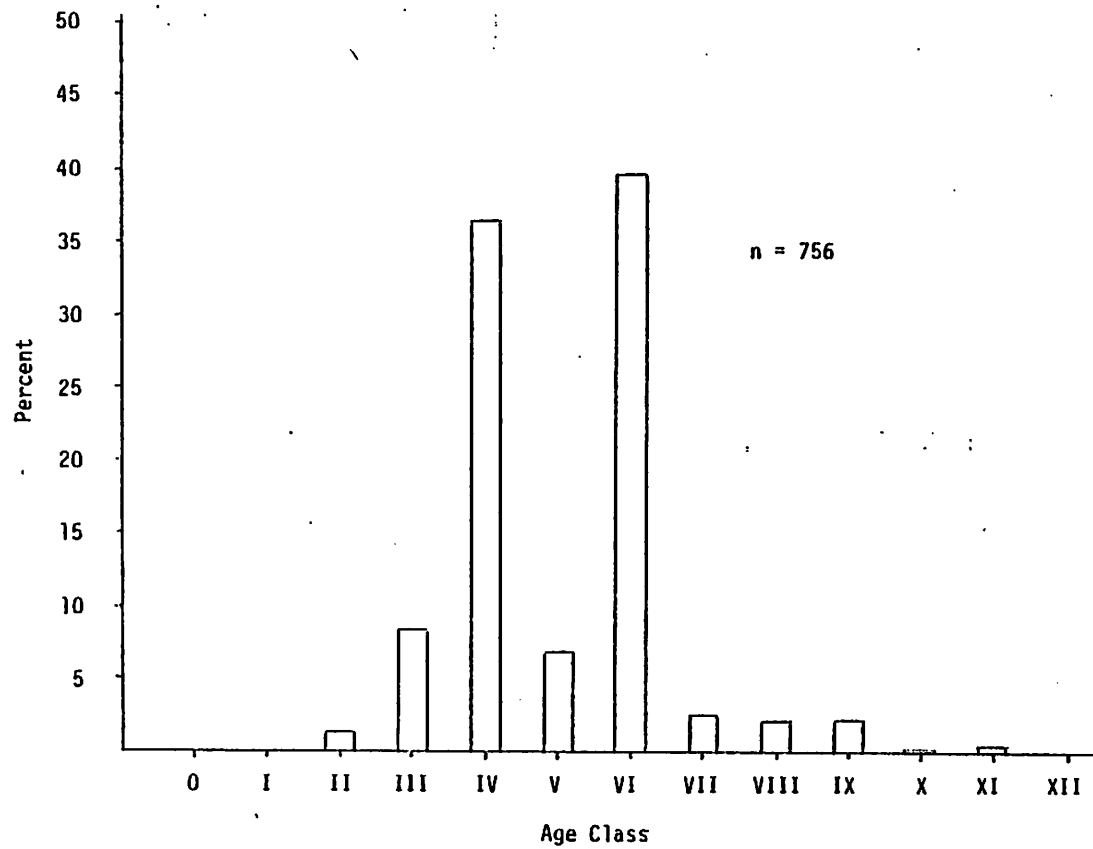


Figure 2. Percent age composition of herring captured at Cape Denbigh from May 30 - June 13, 1978.

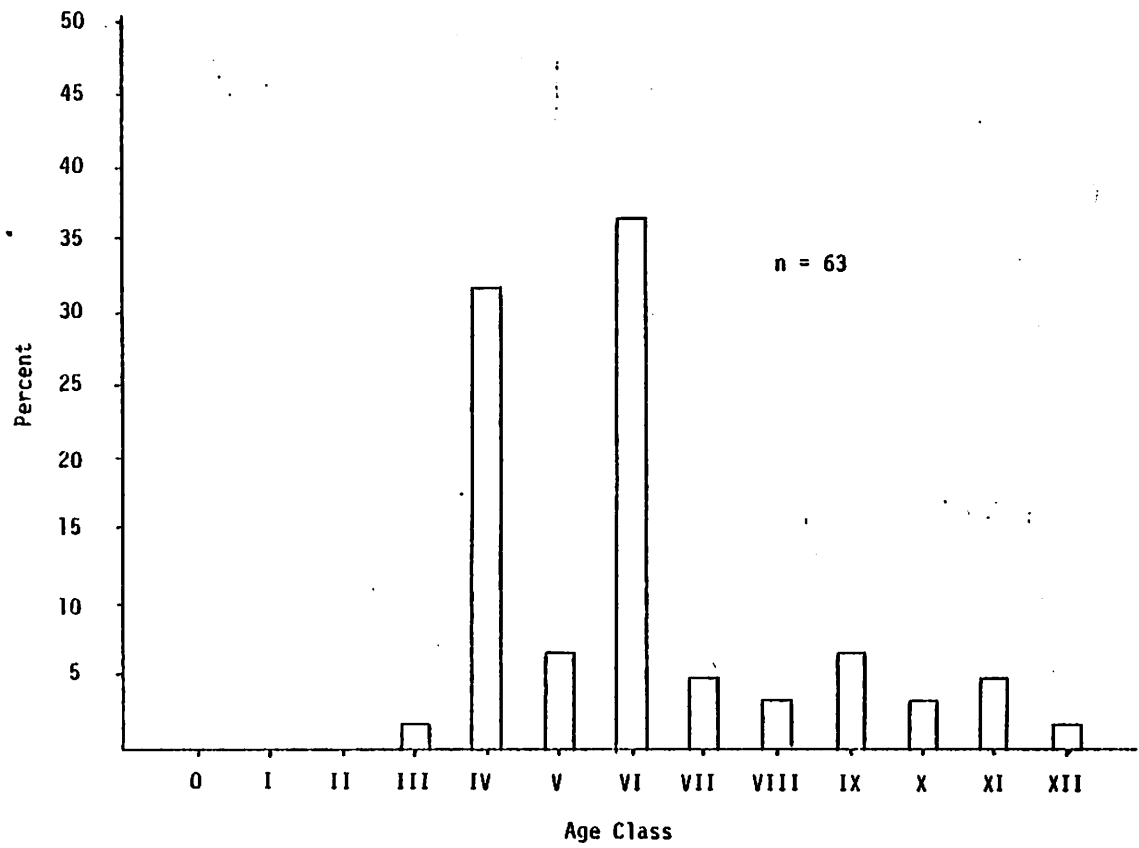


Figure 3. Percent age composition of herring captured in the Port Clarence area from June 21-22, 1978.

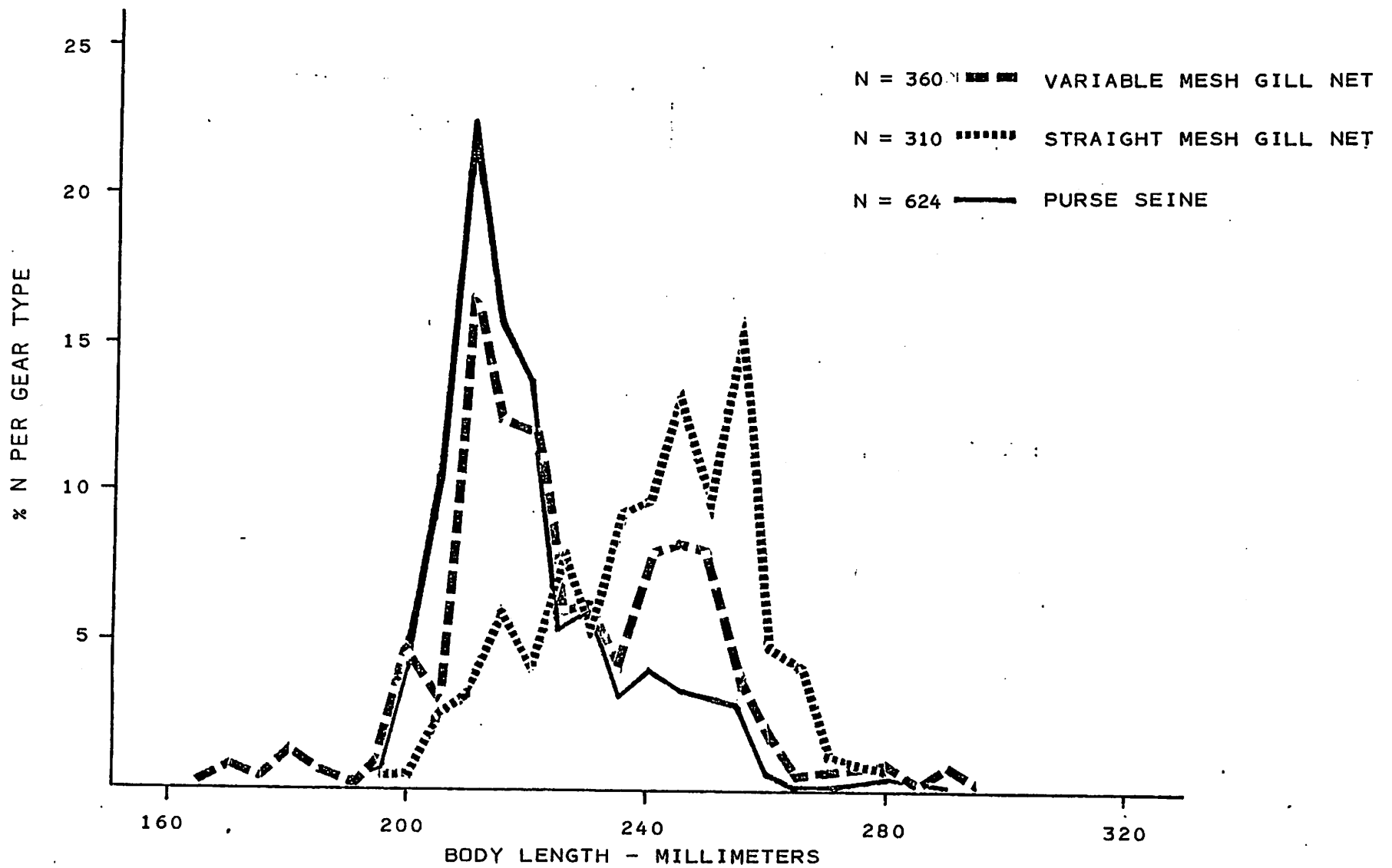


FIGURE 4 - PERCENT HERRING BODY LENGTH COMPOSITION BY GEAR TYPE TAKEN FROM SAME TIME PERIOD FOR ALL GEAR. METERVIK BAY, 1978.



## APPENDIX 1

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#### Herring

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## Appendix II

## Aerial census areas, NPFC herring surveys, Bering Sea, 1978.

Area	Census Areas		North Latitude	West Longitude	Linear Shoreline Distance		Census Area Mid point (km)	1/
	No.				Miles	km		
Cape Sarichef - Cape Mordvinof	1-A		54°38'30"	164°40'32"	18.0	29	14.5	
Cape Mordvinof - Cape Lapin	1-B		54°54'20"	164°17'32"	13.7	22	11.0	
Cape Lapin - Chunak Point	1-C		55°03'15"	163°47'25"	31.1	50	25.0	
Chunak Point - False Pass	2-A		54°58'28"	163°26'53"	20.5	33	16.5	
False Pass - Cape Krenitizin	2-B		54°57'28"	163°15'50"	46.0	74	37.0	
Cape Krenitizin - Cape Glazenap	2-C		55°08'55"	163°14'08"	21.1	34	17.0	
Cape Glazenap - Moffet Point & Amak Is.	2-D		55°21'01"	162°41'30"	73.3	118	59.0	
Moffet Point - Lagoon Point	3-A		55°48'21"	161°57'30"	70.8	114	57.0	
Nelson Lagoon & Walrus & Kritskoi Is.	3-B		55°58'00"	161°07'40"	54.1	87	43.5	
Herendeen Bay	3-C		55°42'50"	160°42'25"	75.2	121	60.5	
Point Divide - Entrance Point	3-D		55°46'21"	160°46'16"	64.6	104	52.0	
Entrance Point - Ilnik	4-A		56°20'30"	160°14'53"	62.1	100	50.0	
Ilnik - Reindeer Creek	4-B		56°50'45"	158°57'29"	96.3	155	77.5	
Reindeer Creek - Cinder River Lagoon	5-A		57°13'11"	158°28'05"	32.9	53	26.5	
Cinder River Lagoon - Smokey Point	5-B		57°30'54"	157°50'59"	44.7	72	36.0	
Smoky Point - Kvichak River	6		58°14'00"	157°30'00"	118.1	190.0	95.0	
Kvichak River - Nusagak	7		58°38'50"	158°00'20"	79.5	128.0	64.0	
Coffee Point - Ivativak Bay	8		58°23'10"	158°48'00"	83.9	135.0	67.5	
Kulukak Bay	9		58°55'10"	159°36'30"	28.0	45.0	22.5	
Hetervik Bay - Togiak	10		58°52'00"	160°00'00"	46.6	75.0	37.5	
Summit Island	11		58°51'00"	160°14'20"	6.4	10.3	Perimeter	
Round Island	12		58°36'20"	159°58'00"	4.7	7.5	Perimeter	
Crooked Island	13		58°43'40"	160°17'40"	14.9	24.0	Perimeter	
High Island	14		58°45'00"	160°24'10"	10.9	17.5	Perimeter	
Togiak - Asigyukpak Spit	15		58°48'30"	160°49'20"	77.7	125.0	62.5	
Hagemeister Island	16		58°48'50"	160°42'00"	66.8	107.5	Perimeter	
Asigyukpak Spit - Cape Hewenham	17		58°36'30"	161°43'20"	60.6	97.5	48.5	
Cape Hewenham - Chagvan Bay	18		58°39'40"	161°52'00"	32.6	52.5	26.3	
Chagvan Bay	19		58°50'00"	161°46'00"	14.3	23.0	11.5	
Chagvan Bay - Goodnews Bay	20-A		58°54'40"	161°47'10"	20.2	32.5	16.3	
Goodnews Bay	20-B		59°07'00"	161°36'10"	30.8	49.5	24.8	
Goodnews Bay - Kuskokwim River	21		59°25'30"	161°51'20"	104.9	168.6	84.4	
Kuskokwim River - Kolavinarak River	22		59°47'10"	163°46'20"	109.4	176.0	88.0	
Kolavinarak River - Cape Vancouver	23		60°29'00"	165°00'50"	47.7	76.8	38.4	
Cape Vancouver - Kinglick River	24		60°39'00"	165°09'00"	27.3	44.0	22.0	
Runivak Island	25		60°17'30"	165°41'00"	290.0	466.0	Perimeter	
Hazen Bay	26		61°40'00"	165°00'00"	50.0	80.5	40.3	
Angyoyaravak Bay	27		61°12'40"	165°38'30"	40.4	65.0	32.5	
Hooper Bay	28		61°31'30"	166°02'00"	46.6	75.0	37.5	
Kokechik Bay	29		61°39'40"	165°48'00"	35.7	57.5	28.8	
Scammon Bay - Black River	30		61°57'00"	165°43'20"	60.6	97.5	48.8	
Black River - North Mouth Yukon River	31		63°08'30"	164°33'50"	120.0	193.0	96.5	

1/ Linear shoreline distance on either side of census area mid point.

\* Latitude and Longitude of mid point of census area.

## Aerial census areas, NPFC herring surveys, Bering Sea 1978.

Census Area		No.	North* Latitude	West* Longitude	Linear Shoreline Distance		Census Area Mid point (km)
Area	Miles				km		
North Mouth Yukon River - Canal Point	32	63°12'30"	162°47'20"	40.9	65.8	32.9	
Canal Point - Cape Stebbins	33	63°28'40"	162°18'00"	12.3	19.8	9.9	
Stuart Island	34	63°33'05"	162°20'30"	41.9	67.5	Perimeter	
Cape Stebbins - St. Michael	35	63°30'50"	162°08'00"	15.5	25.0	12.5	
St. Michael - Klikitarik	36	63°27'05"	161°57'05"	18.3	29.5	14.8	
Klikitarik - Unalakleet River	37	63°37'30"	161°01'00"	40.4	65.0	32.5	
Unalakleet River - Cape Denbigh	38	64°13'45"	160°58'15"	52.8	85.0	42.5	
Cape Denbigh - Bald Head	39	64°38'40"	160°47'30"	80.8	130.0	65.0	
Bald Head - Cape Darby	40	64°41'10"	162°08'10"	70.5	113.5	56.8	
Cape Darby - South Spit	41	64°36'10"	163°06'00"	55.9	90.0	45.0	
South Spit - Topkok Head	42	64°30'20"	163°20'35"	36.0	58.0	29.0	
Topkok Head - Point Spencer	43	64°30'00"	165°24'20"	94.4	152.0	76.0	
Point Spencer - Cape Prince of Wales	44	65°18'40"	166°17'54"	124.3	200.0	100.0	
Cape Prince of Wales - Cape Espenberg	45	66°15'50"	166°04'00"	149.1	240.0	120.0	
Cape Espenberg - Kiwalik	46	66°07'10"	163°51'00"	127.4	205.0	102.5	
Kiwalik - Point Garnet (Choris Pen.)	47	66°11'35"	160°59'30"	90.1	145.0	72.5	
Point Garnet - Selawik Lake entrance	48	66°56'15"	162°31'20"	119.6	192.5	96.3	
Selawik Lake entrance - Sheshalik	49	67°00'40"	161°38'50"	111.8	180.0	90.0	
Sheshalik - Point Hope	50	67°43'25"	164°36'00"	149.1	240.0	120.0	

1/ Linear shoreline distance on either side of census area mid point.

\* Latitude and Longitude of mid point of census area.