

PACIFIC HERRING STOCKS AND FISHERIES
IN THE EASTERN BERING SEA:
PRELIMINARY REPORT FOR 1981

A Report to the North Pacific Fisheries Management Council
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This report presents a summary of current information on eastern Bering Sea Pacific herring stocks and fisheries within Alaskan waters. All 1981 information contained within this report is preliminary and may be revised upon further, more detailed, analysis.

COMMERCIAL FISHERY

A total of 17,650 m.t. of Pacific herring were harvested in eastern Bering Sea commercial fishing districts during 1981 (Figure 1, Table 1). This was the second highest total harvest recorded since the fishery began in the 1960's. Percent harvest of estimated available biomass ranged from 8.5, in Togiak District, to 17.9, in Norton Sound District. Roe recovery from harvested herring ranged from 7.7, in Goodnews Bay District, to 9.1%, in Togiak District. Wastage of herring was low; only about 50 m.t. were estimated to have been lost or dumped during the season. Numbers of buyers increased slightly in all areas (Table 2). Fishing effort levels decreased in Togiak District, but increased in all other areas. Roe-on-kelp harvests occurred only in Togiak and Norton Sound Districts and totaled 211,658 kg. (Table 3). Value of total herring and roe-on-kelp harvests to fishermen was estimated at \$6.5 million.

STATUS OF THE STOCKS

Aerial surveys were conducted within all fishing districts, except Cape Romanzof, to determine relative abundance, distribution and estimated biomass of herring schools. Basic methods of data collection were similar to those used in previous years. Test fishing with variable mesh gillnets and sampling of commercial

landings were conducted in all fishing districts to determine age, size and sexual maturity of herring and to estimate occurrence and abundance of other pelagic fishes.

Pacific herring stocks appeared to be much more abundant in all areas during 1981 than in 1980 (Table 4). In general, this seemed to be due to a strong recruitment of four year old herring from the 1977 year class. Spawn deposition also seemed to be good, with totals of 64, 16 and 21 linear km of milt sighted during the season in Togiak, Security Cove and Norton Sound Districts, respectively.

Two abundance peaks of herring occurred in Togiak District; an early peak on May 3 composed of age five and older herring and a later peak on May 15 composed primarily of age four herring (Table 5). A single abundance peak was noted in Security Cove and Goodnews Bay Districts on May 14 and in Norton Sound District on May 26 (Tables 6-8).

STOCK ASSESSMENT STUDIES

A total of 209 hr was spent in aerial assessment surveys of herring spawning stocks; 107 hr in Togiak (including about 11 hr of helicopter flying time), 32 hr in Security Cove/Goodnews Bay, and 70 hr in Norton Sound. This represented the highest intensity of aerial survey work ever before achieved. Although weather and water conditions were generally better than in past years, poor conditions still hampered survey coverage at least during part of the season in most districts (Tables 5-8). This posed the greatest problem in Togiak District during the period April 28 to May 3 at the time older age classes of herring peaked in

abundance. Availability of a chartered helicopter on the Togiak fishing grounds increased surveying capabilities and greatly aided test fishing, catch sampling and spawn deposition programs.

Contracted purse seine vessels provided tonnage data on three additional herring schools within Togiak District during 1981 (Table 9). As further information is collected each year the early hypothesis of herring tonnage per unit surface area of school increasing with greater water depth appears to be substantiated.

Although further increases in aerial survey coverage and additional tonnage conversion estimates will provide improved assessment capabilities, other studies and techniques are needed to refine biomass estimates. Tagging studies would provide valuable information on movement patterns of herring and estimates of residency time on the spawning grounds.

Hydroacoustic surveys might also provide useful data on school movements as well as school density. Also, other assessment techniques need to be developed and evaluated so that independent estimates of stock abundance can be calculated and compared with those determined by aerial surveys. These could include spawn deposition estimates to provide post-season determinations of spawning population size, offshore hydroacoustic/trawl surveys to provide pre-season stock estimates (along with stock separation work to provide estimates of stock components), and increased use of collected fishery statistics in mathematical models to predict future abundance and explain past fluctuations of stocks.

Table 1. Estimated biomass and commercial harvest of Pacific herring in eastern Bering Sea fishing districts, Alaska, 1978-1981.

District	Biomass (m.t.)	Harvest (m.t.)	Roe %	% Biomass Harvested
<u>1981</u>				
Togiak	134,400	11,372	9.1	8.5
Security Cove	7,000	1,064	8.1	15.2
Goodnews Bay	4,000	596	7.7	14.9
Cape Romanzof	---	653	8.0	---
Norton Sound	22,200	3,965	8.8	17.9
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Totals	167,600	17,650		10.5
<u>1980</u>				
Togiak	62,300	17,774	9.2	28.5
Security Cove	1,400	632	8.2	45.1
Goodnews Bay	1,100	406	9.5	36.9
Cape Romanzof	3,600	554	9.8	15.4
Norton Sound	7,600	2,224	8.1	29.3
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Totals	76,000	21,590		28.4
<u>1979</u>				
Togiak	216,800	10,115	8.6	4.7
Security Cove	19,500	385	8.5	2.0
Goodnews Bay	6,700	82	4.7	1.2
Cape Romanzof	2,700	653	9.8	24.2
Norton Sound	7,000	1,172	7.0	16.7
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Totals	252,700	12,406		4.9

Table 1. Continued.

District	Biomass (m.t.)	Harvest (m.t.)	Roe %	% Biomass Harvested
		<u>1978</u>		
Togiak	172,600	7,030	8.2	4.1
Security Cove	1,200	259	---	21.6
Goodnews Bay	400	0		0.0
Cape Romanzof	2,700	0		0.0
Norton Sound	4,800	14	---	0.3
	181,700	7,303		4.0
Totals				

Table 2. Numbers of buyers (companies registered) and fishermen participating in eastern Bering Sea Pacific herring fisheries, Alaska, 1978-1981.

District	Number of Buyers	Number of Fishermen	
		Gillnet	Purse Seine
<u>1981</u>			
Togiak	28	106	83
Security Cove	2	113	**
Goodnews Bay	5	175	**
Cape Romanzof	4	69	**
Norton Sound	13	332	**
<u>1980</u>			
Togiak	27	363	140
Security Cove	8	175	**
Goodnews Bay	4	165	**
Cape Romanzof	2	111	**
Norton Sound	8	289	**
<u>1979</u>			
Togiak	33	350	175
Security Cove	6	61	**
Goodnews Bay	1	41	**
Cape Romanzof	No Fishery Conducted		
Norton Sound	7	50	17
<u>1978</u>			
Togiak	16	40	25

** Purse seine gear prohibited

Table 3. Commercial harvest of Pacific herring "roe-on-kelp" in eastern Bering Sea fishing districts, Alaska, 1978-1981.

District	Harvest (kg.)			
	1981	1980	1979	1978
Togiak	171,706	86,107	188,286	149,756
Norton Sound	39,952	22,173	11,810	3,000

Table 4. Estimated relative abundance (total surface area of fish schools sighted divided by 50 m², the size of a standard small school) of Pacific herring in eastern Bering Sea fishing districts, Alaska, 1978-1981. Information obtained from aerial surveys.

District	Relative Abundance			
	1981	1980	1979	1978
Togiak	55,262	15,249	137,630	43,050
Security Cove	2,228	407	2,912	246
Goodnews Bay	1,593	**	3,729	241
Cape Romanzof	**	**	539 ^{1/}	539 ^{1/}
Norton Sound	6,516	2,242	1,860	1,277

** No estimate possible due to water and weather conditions

^{1/} No surveys made; estimate based upon 50% of stock size at Nelson Island

Table 5. In-season biomass estimates (m.t.) of Pacific herring within Togiak fishing district, Alaska, 1981.

Date	Survey 1/ Rating	Kulukak	Nunavachak	Togiak	Hagemeister	District2/ Total
4/20	G-F	0	0	0	0	0
4/22	E-G	116	0	262	919	1,297
4/23	E-G	0	0	1,126	2,535	3,661
4/24	G-P	316	0	1,751	1,683	3,750
4/25	G	340	0	2,896	2,443	5,676
4/26	E-G	238	1,556	3,728	864	6,386
4/27	G-F	259	483	3,100	3,137	6,979
4/28	P	1,516	680	4,575	--	6,771
4/30	U	--	--	--	--	--
5/1	U	425	1,444	0	--	1,869 a/
*5/2	P-U	184	262	--	--	446
*5/3	G-P	605	3,721	58,279	2,335	64,940 a/
*5/4	G	408	880	3,608	130	5,026 a/
*5/5	P	--	122	38	36	196
*5/6	P	51	--	3,111	60	3,222
5/7	G	833	1,149	21,915	559	24,456
5/8	E-G	2,139	1,189	25,270	1,537	30,135
5/9	E-G	6,469	1,002	22,679	1,074	31,224
5/10	P-U	--	987	801	1,176	2,964
*5/12	G-F	3,580	3,484	21,294	7,076	35,434
*5/13	E-G	29,971	1,745	20,507	3,278	55,501
5/14	E	51,439	2,110	21,949	3,910	79,408 a/
*5/15	E-G	65,304	2,972	25,245	1,792	95,313
*5/16	P-U	9,963	305	629	466	11,363
5/17	U	--	--	--	--	--
5/20	U	--	--	--	--	--
5/22	P-U	--	--	--	--	--
5/23	F-P	469	1,234	--	--	1,703
5/26	G	469	703	26,217	61	27,450
6/3	G-F	1,285	87	178	0	1,550

* Commercial fishing periods occurred on these dates:
 5/2-3 (10 hr), 5/3-4 (24 hr), 5/5 (24 hr), 5/6 (24 hr),
 5/12-13 (10 hr), 5/15-16 (9 hr)

1/ E=excellent, G=good, F=fair, P=poor, U=unsatisfactory

2/ Conversion factor = sliding scale based upon water depth
 (shallow water, 3 m or less = 1.2 m.t. per RAI unit;
 medium depths, 5-6 m = 2.4 m.t. per RAI unit;
 deep water, 7 m or greater = 3.4 m.t. per RAI unit)

a/ Two surveys flown on these days; highest biomass estimate used

Table 6. In-season biomass estimates (m.t.) of Pacific herring within Security Cove fishing district, Alaska, 1981.

Date	Survey <u>1</u> / Rating	Security <u>2</u> / Cove	Red <u>2</u> / Mountain	Carter <u>3</u> / Bay	District Total
4/20	G	0	0	0	0
4/24	G-F	0	0	0	0
4/27	F-P	10	20	0	30
4/30	U	0	0	--	0
5/2	F-P	0	--	--	0
5/3	F-P	14	17	--	31
*5/5	F-P	10	0	--	10 <u>a</u> /
5/6	U	0	0	--	0
5/7	F-P	31	629	--	660
*5/8	F-P	479	1,238	52	1,769 <u>b</u> /
*5/9	F-P	1,008	860	7	1,875
5/10	F-P	2,649	20	24	2,693
*5/11	F-P	432	--	--	432
*5/12	G-P	1,540	751	--	2,291
5/13	F-P	765	3,750	872	5,387
5/14	G-F	2,359	3,393	1,314	7,066
*5/15	U	--	--	--	--
*5/16	U	--	--	--	--
*5/17	G-P	2,312	3,499	80	5,819
5/23	F-P	255	218	--	473
5/26	P	133	211	--	344
6/2	P	173	112	132	417

*Commercial fishing periods occurred on these dates:
 5/5 (10 hr), 5/8 (12 hr), 5/9 (12 hr), 5/11 (12 hr), 5/12 (12 hr),
 5/15-16 (12 hr), 5/17-18 (9 hr), 5/20 (11 hr)

1/ E=excellent, G=good, F=fair, P=poor, U=unsatisfactory

2/ Conversion factor = 3.4 m.t. per RAI unit

3/ Conversion factor = 2.5 m.t. per RAI unit

a/ Two surveys flown on this day; highest biomass estimate used

b/ Three surveys flown on this day; highest biomass estimate used

Table 7. In-season biomass estimates (m.t.) of Pacific herring within Goodnews Bay fishing district, Alaska, 1981.

Date	Survey <u>1</u> / Rating	District <u>2</u> / Total
4/20	G	0
4/24	F	0
4/27	F-P	0
5/3	P	0
*5/5	F-P	7
5/7	G-F	883
*5/8	P	225
*5/9	F	1,052
5/10	P	685
*5/12	F	1,055
5/13	F-P	1,465
*5/14	G	3,982
*5/17	P	1,040
5/23	U	0
5/26	P	770
6/2	U	0

* Commercial fishing periods occurred on these dates:
 5/5 (10 hr), 5/8 (12 hr), 5/9 (12 hr), 5/11 (12 hr), 5/12 (12 hr),
 5/14 (3 hr), 5/15-16 (12 hr), 5/17-18 (12 hr), 5/21-22 (24 hr),
 5/24 (12 hr), 5/27 (12 hr)

1/ E=excellent, G=good, F=fair, P=poor, U=unsatisfactory

2/ Conversion factor = 2.5 m.t. per RAI unit

Table 8. In-season biomass estimates (m.t.) of Pacific herring within Norton Sound fishing district, Alaska, 1981.

Date	Survey 1/ Rating	Saint Michaels	Unalakleet	Cape Denbigh	District 2/ Total
*5/8	G-U	0	112	704	816
*5/17	F-U	37	13	3	53
*5/18	F-U	71	0	3,189	3,260
*5/20	G-U	1,622	0	--	1,622
*5/21	G	1,884	146	--	2,030
*5/22	F-U	--	0	500	500
*5/23	G-U	4,815	3,516	2,924	11,255 <u>b/</u>
*5/25	G-P	13,008	2,244	2,190	17,442 <u>a/</u>
*5/26	G-F	6,722	10,842	2,621	20,185 <u>a/</u>
*5/27	P	--	163	1,995	2,158
*5/28	P	--	187	1,570	1,757 <u>a/</u>
5/30	F-U	--	0	2,292	2,292
6/1	U	--	0	7	7
6/2	F	5,198	5,804	--	11,002
6/3	F-P	--	7,473	1,459	8,932
6/5	F-P	3,682	418	3,148	7,248
6/8	F-U	7	0	894	901

* Commercial fishing opened 15 April, but first delivery 18 May; Commercial fishing closed (in the above subdistricts) 29 May (fishing was allowed in all other subdistricts through 31 July, but less than one ton reported from these areas all season)

1/ E=excellent, G=good, F=fair, P=poor, U=unsatisfactory

2/ Conversion factor = 3.4 m.t. per RAI unit

a/ Two surveys flown on these days; highest biomass estimate used

b/ Three surveys flown on this day; highest biomass estimate used

Table 9.2 Conversion estimates (metric tons of Pacific herring per 50 m² school surface area) obtained from test purse seine fishing, Togiak fishing district, Alaska, 1978-1981.

Year	Water Depth (m)	Biomass per RAI unit (m.t./50 m ²)	
1981	2	1.1	Catch landed
1980	3	1.2	Catch landed
1980	5	1.1	Catch landed
1980	5	1.2	Catch estimated in net
1979	6	2.4	Catch landed
1980	6	3.0	Catch estimated in net
1980	6	2.6	Catch estimated in net
1981	6	1.7	Catch landed
1980	8	1.6	Catch estimated in net
1981	8	4.0	Catch landed
1978	?	6.7	Catch estimated in net
1978	?	11.0	Catch estimated in net

Mean all estimates = 3.1

Mean estimates at 2-3 m = 1.2

Mean estimates at 5-6 m = 2.0

Mean estimates at 8 m = 2.8