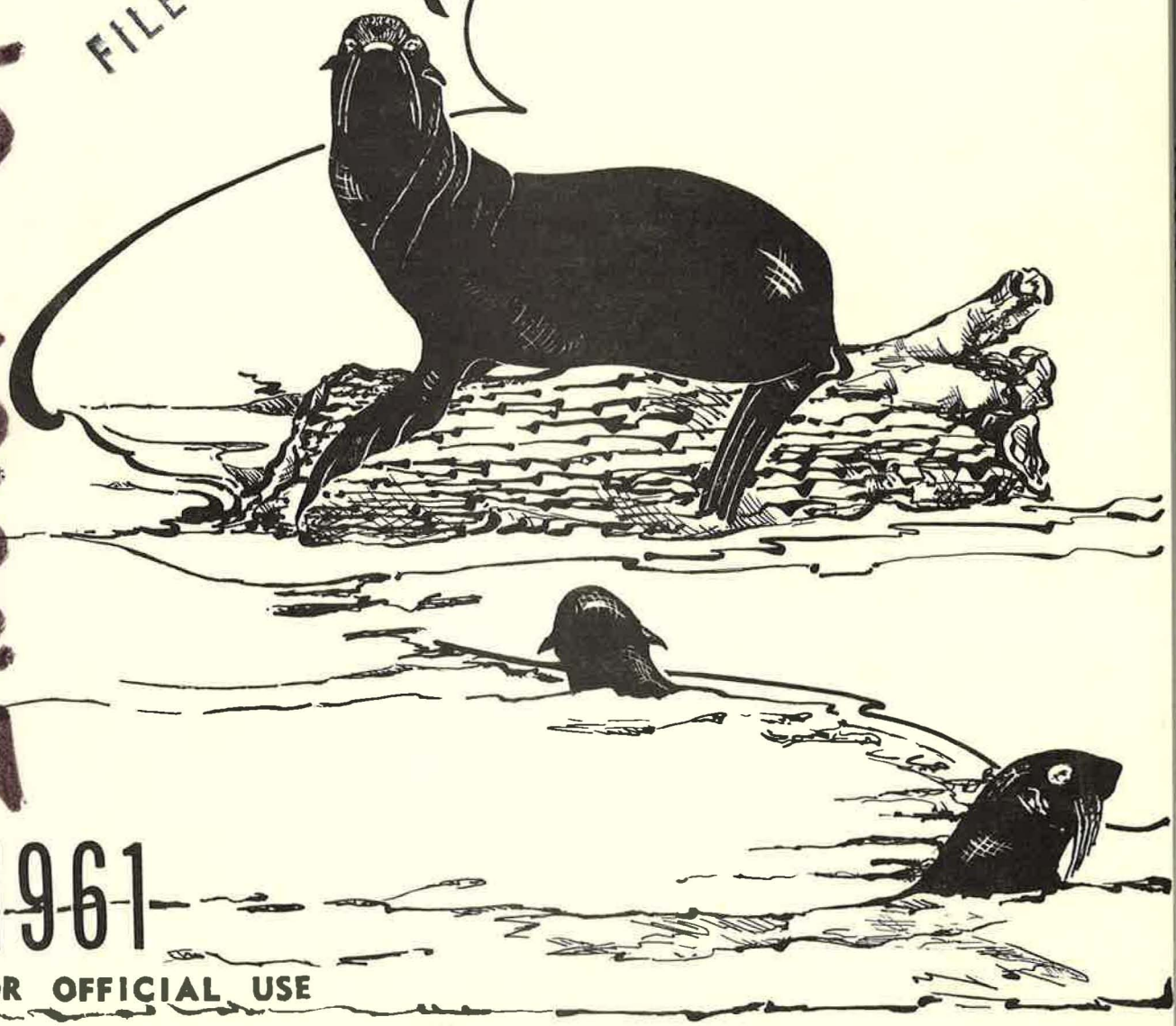
ELAGIC FUR SEAL INVESTIGATIONS ALIFORNIA TO BRITISH COLUMBIA



1961

FOR OFFICIAL USE

PELAGIC FUR SEAL INVESTIGATIONS

CALIFORNIA TO BRITISH COLUMBIA

1961

U. S. Fish and Wildlife Service
Bureau of Commercial Fisheries
Marine Mammal Biological Laboratory
Seattle, Washington

Clifford H. Fiscus
Karl Niggol
Ford Wilke

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SUMMARY

The fourth successive year of pelagic fur seal research was conducted under the terms of the Interim Convention on Conservation of North Pacific Fur Seals.

One of two vessels chartered by the United States for research, started collections in November (1960) off Point Sur, California, to determine the arrival time of seals migrating to the California wintering area. The vessel remained off California until mid-April when it moved to the Oregon and Washington coasts. It terminated in late April.

The second vessel collected through late January, February, and March off British Columbia, and in April off Washington.

A total of 1,352 seals was collected; of these, 1,275 were females and 77 males.

Yearling seals contributed 4 percent of all seals collected. This figure is twice as high as in previous years, and is the direct result of collections in British Columbia waters. Nine-year-old seals were most numerous in the sample. They represent the strong year class of 1952.

Twenty-nine tagged seals were recovered and the percent of tagged seals is only slightly lower than the recovery in the commercial kill.

The pregnancy rate for mature females, 4 years and older, was 68.5 percent. This proportion is within the range of previous collections. Well developed corpora lutea in ovaries without implantation scars in uterine horns suggest that about 14 percent of mature seals miss pregnancy through failure of egg implantation.

One seal carrying twins was collected. Male and female fetuses occurred with equal frequency in the past 4 years. Pregnancies occurred in the left horn of the uterus more frequently to a significant degree.

For the combined areas, the five most important food items were: northern anchovy (31.6 percent), squid (25.1 percent), Pacific herring (11.5 percent), rockfish (9.5 percent), and Pacific saury (7.9 percent). The most important item for each area was: California, squid; Oregon and Washington, northern anchovy; and British Columbia, Pacific herring.

At present, considering the food species consumed, fur seals are not a threat to commercial fisheries in California, Oregon, or Washington. Salmon were taken most frequently off Washington.

No predation on fur seals was observed, but the killer whale is a definite threat as can be deduced from the elephant seal, sea lion, and porpoise parts found in the stomach of a captured killer whale.

INTRODUCTION

This report gives the results of the fourth of six years of pelagic fur seal research to be conducted by the United States according to the Schedule of the Interim Convention on Conservation of North Pacific Fur Seals.

The 1961[1/] research followed a plan agreed upon by Canada and the United States to overcome sampling (data) gaps in certain areas for the months of November through March. Included in this lack of information is the meager knowledge of the migration and wintering grounds of the yearling fur seals. Operation in British Columbia was intended to give information on the distribution of yearling seals in the sounds, bays, and inlets of that province which is one of the important wintering areas for yearlings. Collecting was started early in California in order to determine the time of arrival of seals in these waters and to attempt to establish the length of the period between the time the egg is fertilized and the time it is implanted, from the size of fetuses taken in late fall and early winter.

Field operations were started off central California in November. Few seals were seen in this area by the close of the first phase of collecting on 15 December. Collecting was resumed off California in early January by one vessel which completed its field season at the end of April off Washington State.

Working in cooperation with the Canadian research group, a second vessel began collecting in British Columbia waters in late January, February, and early March and concluded the season off the Columbia River in April.

Much remains to be learned about the distribution and ocean life of seals during their first year at sea.

Work in British Columbia was hampered by unfavorable weather but that in California was aided by good weather. With efficiency improved by experience and favorable weather, a single vessel took over 1,000 seals from January to April 1961.

1/ Part of November and December 1960 are included.

METHODS, EQUIPMENT, AND PERSONNEL

Vessels

Two vessels were chartered for pelagic sealing in 1961: M/V Tacoma -- a purse seiner, registered length 71.5 feet, cruising speed 9 knots; M/V Harmony -- a purse seiner, registered length 70.5 feet, cruising speed 9 knots. Both vessels were required to have Loran navigating equipment, radio direction finders, ship-to-shore, and ship-to-ship radio, radar, and fathometers. Both vessels had been chartered in previous years and with experienced owner-captains, vessel handling and work routines were established quickly and smoothly. It is advantageous in pelagic sealing to have experienced captains, as vessel handling contributes materially to the success of the operation.

Each vessel carried a crew consisting of captain, engineer, cook, and deckhand, one United States Bureau of Commercial Fisheries biologist and three assistants. Two small boats were placed on each vessel to use for hunting during periods of good weather.

Hunting Methods

A description of hunting methods was given in the 1958 report (Wilke, Niggol, and Fiscus). These methods are still in use with minor variations and refinements.

The methods used in processing seals aboard vessels has been previously described. Methods undergo minor changes from year to year due to changes in working space aboard vessels and as changes in data and material requirements occur.

Dories were used when the combination of relatively calm seas and abundant seals occurred. One or more dories were used on 15 days and 25 percent of the seals collected in 1961 were taken from small boats.

Laboratory Methods

Age Determination

The previously described techniques, used in preparing and determining the age of teeth, continue in use with little change.

Stomach Examination

The processing of stomachs also has not changed except for minor variations. Usually one man records information on the data cards. One man and an assistant open, weigh, and take the volume of each stomach; the material is then placed in a pan and the contents are identified, counted, and percentages determined. A three-man team seems to be the most workable unit for stomach examination. The laboratory collection of whole fish, skeletons, otoliths, scales, and squid is gradually growing and is of increasing value. A technique of cleaning squid radula was used with good results this year. Literature, including identification keys and descriptive papers that have been used as an aid in identification have been included in the section, References, although, in most cases, no direct reference was made to them in the text.

Personnel

The following personnel took part in the 1961 pelagic fur seal investigation:

Permanent employees: Ford Wilke, Laboratory Director, Karl Niggol, Biologist; Clifford H. Fiscus, Biologist, and Thomas P. O'Brien, Biologist.

Mr. O'Brien died in an automobile accident on 24 June 1961. He was a valued employee and his death has been strongly felt by the Laboratory.

Temporary employees: Fishery Aids Terry S. Luoma, James P. Maddox, Lloyd H. Stebbins, John F. Stennick, and Gene Whitaker.

RESEARCH IN 1961

Distribution of Seals by Time, Place, and Numbers

The distribution of seals observed and collected is shown in figures 1, 2, 3, 4, and 5. The area through which vessels worked has been divided into a series of squares, each representing 10 square miles (nautical). The number in the upper half of the square represents the total number of seals sighted and the number in the lower half of the square represents the total number of seals collected in that area throughout the season.

Tables 1 and 2 show the numbers and relative abundance of seals seen and collected by state and 10-day periods. Grouping of seals is shown in table 3. Large groups were not seen in waters off California in 1961; this was probably due to the fact that large anchovy schools were not present in the collecting areas in any appreciable numbers, as was the case in 1959.

California

Because of the desirability of determining the arrival time of the fur seal on the wintering grounds, one vessel left Seattle on 18 November bound for coastal California. From 27 November until 14 December, the vessel worked the area from Point Arena south to Ano Nuevo Island and offshore to a distance of 50 to 70 miles. The vessel was at sea for 14 days during this period; nine seals were sighted and three were collected. Seals were reasonably numerous in this area in previous years when vessel operations commenced in January (1959) and in February (1958).

The vessel was laid up from 15 December through 4 January and during this time the seals apparently began to arrive on the grounds because, in the period 5-12 January, when the area was covered again, seals were found in fair numbers (202) and 82 were collected. At this time, the seals appeared to be continuing to move southward.

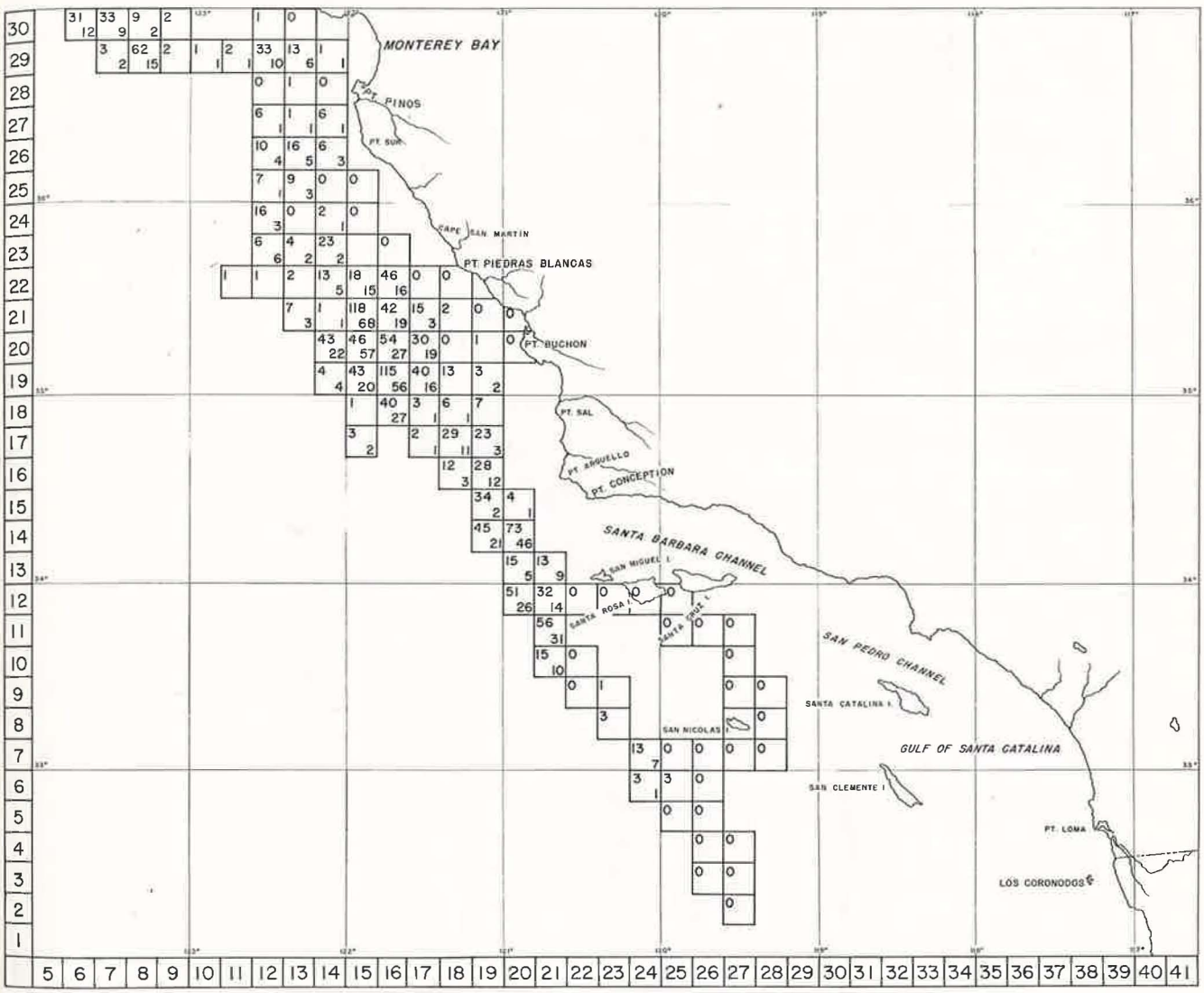

Figure 1.--Distribution of seals observed (upper number) and collected (lower number) from 32°N. to 37°N. in 1961.

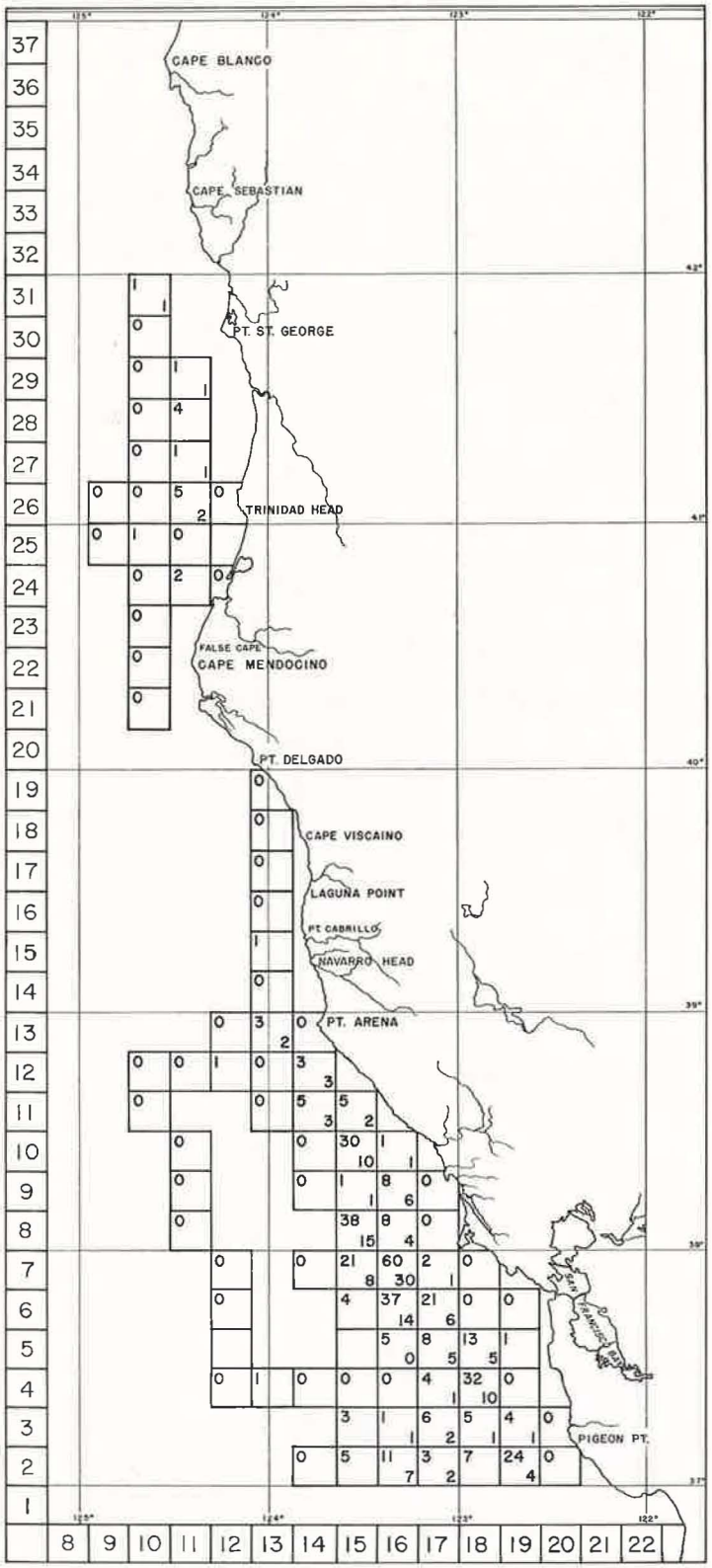

Figure 2. --Distribution of seals observed (upper number) and collected (lower number) from 37°N. to 43°N. in 1961.

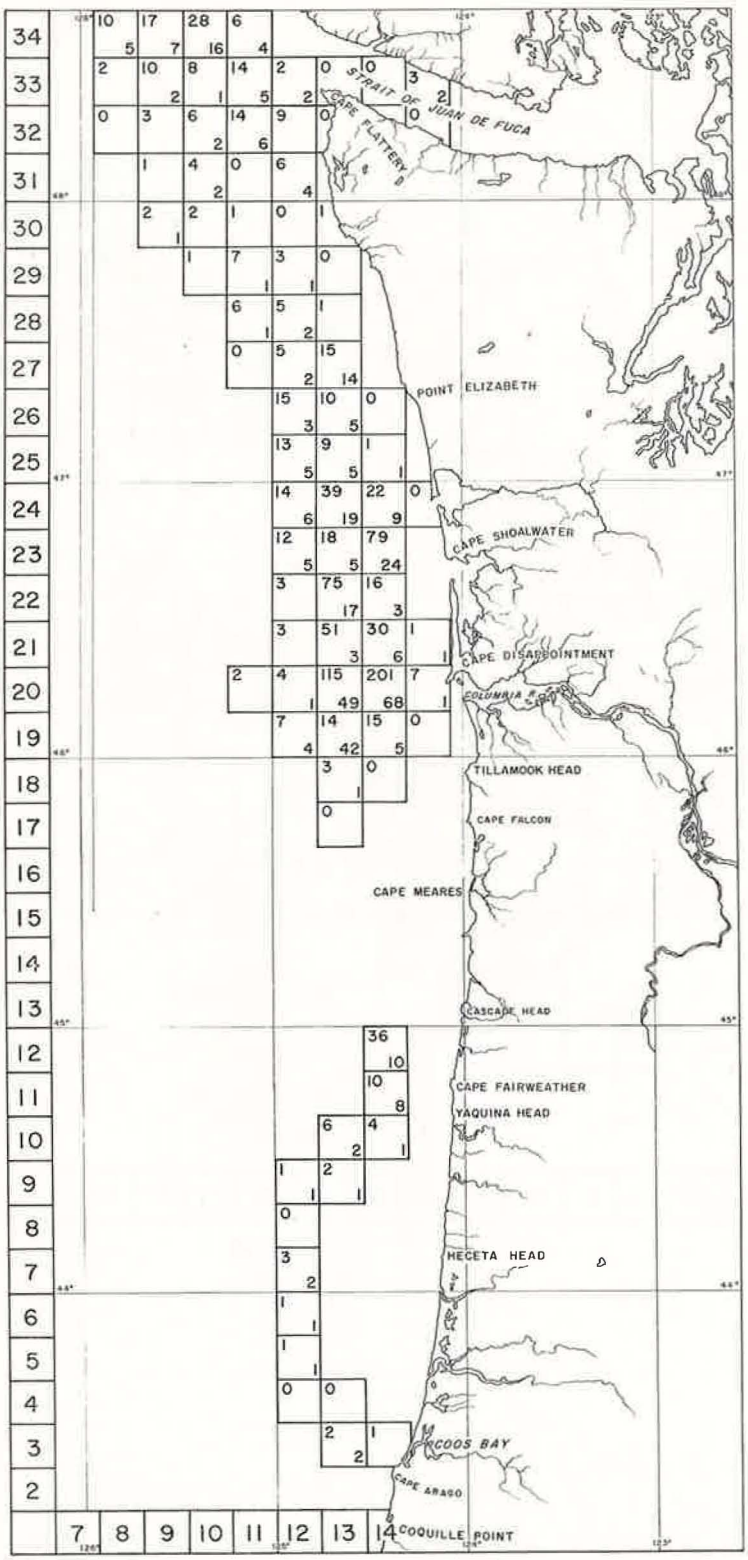

Figure 3. --Distribution of seals observed (upper number) and collected (lower number) from 43°N. to 48°40'N. in 1961.

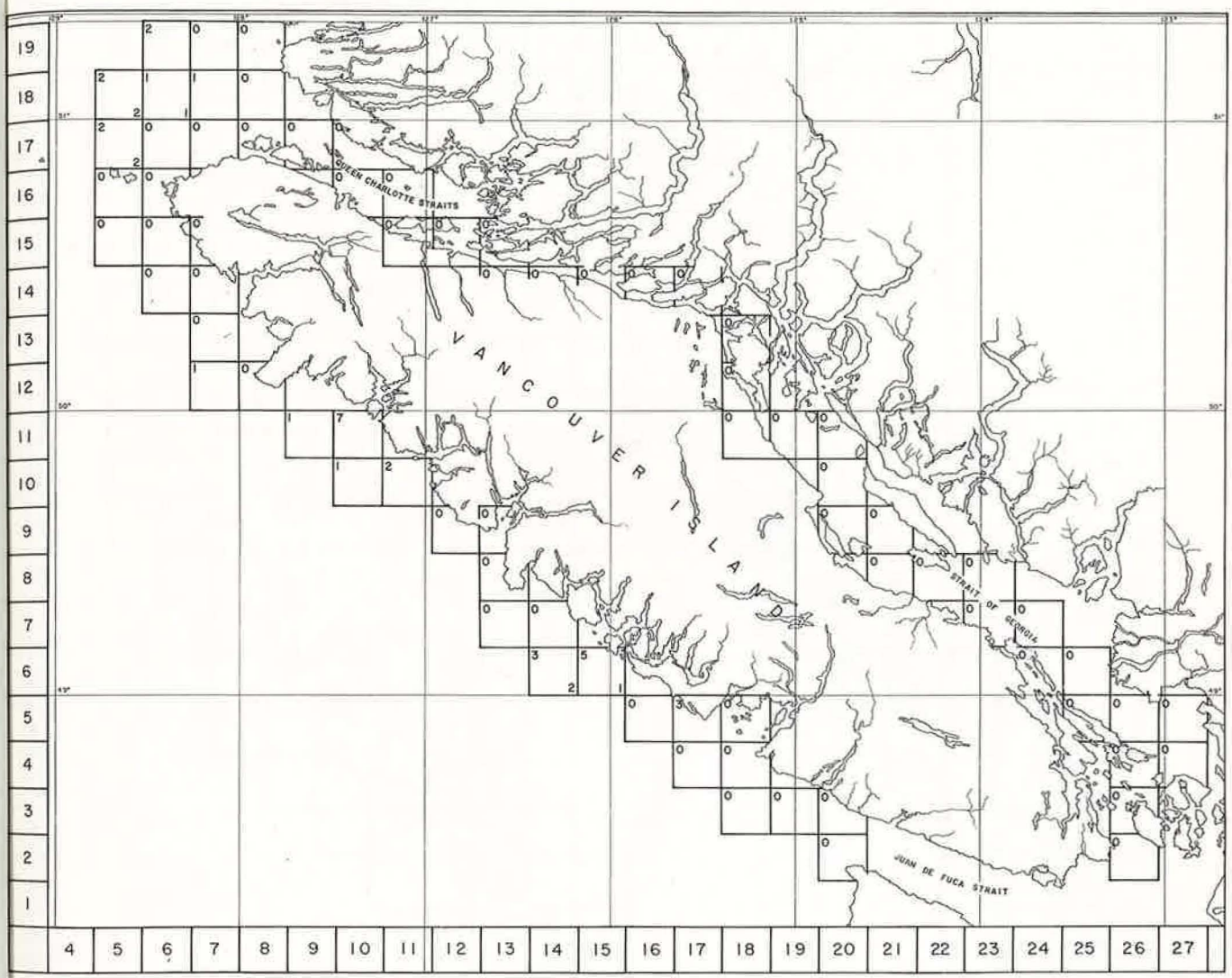

Figure 4. --Distribution of seals observed (upper number) and collected (lower number) from 48°40'N. to 51°20'N. in 1961.

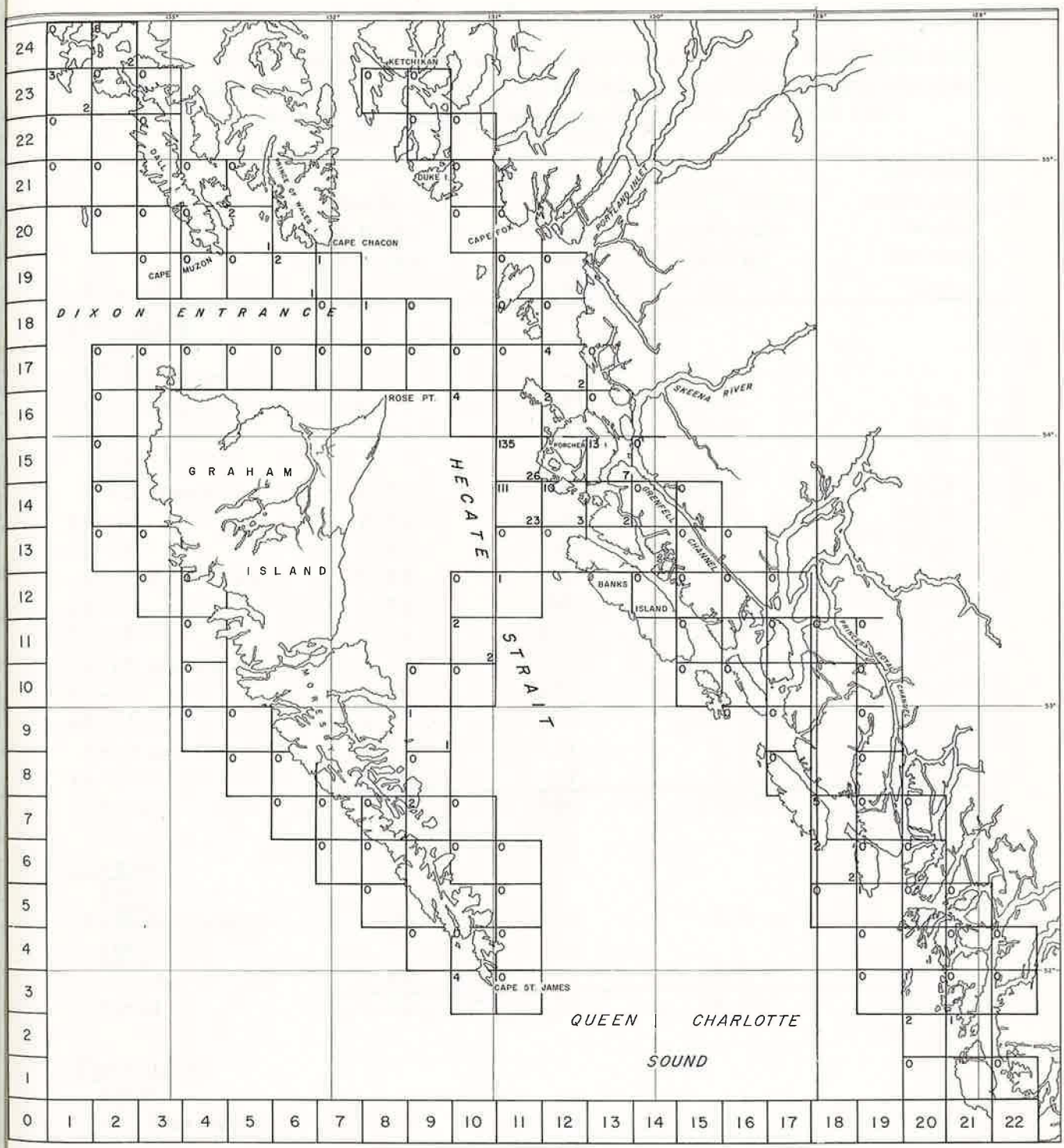

Figure 5. --Distribution of seals observed (upper number) and collected (lower number) from 51°20'N. to 55°30'N. in 1961.

Table 1.--Number and relative abundance of seals seen off California, Oregon, Washington, British Columbia, and Southeastern Alaska, by 10-day periods, 21 November 1960 to 25 April 1961

Period	Number of boat-hunting days	Total seals seen	Seals seen per boat-hunting day	Percent seen per boat-hunting day
California				
1960				
21-30 November	2.50	-	-	-
1-10 December	6.00	7	1.2	0.4
11-20 "	3.75	2	0.5	0.1
1961				
1-10 January	6.00	159	26.5	8.3
11-20 "	7.75	256	33.0	13.3
21-31 "	7.75	436	56.3	22.6
1-10 February	8.00	456	57.0	23.7
11-20 "	5.75	159	27.7	8.3
21-28 "	5.25	153	29.1	7.9
1-10 March	3.25	51	15.7	2.6
11-20 "	4.00	125	31.3	6.5
21-31 "	5.00	102	20.4	5.3
1-10 April	3.75	11	2.9	0.5
11-20 "	1.00	9	9.0	0.5
Total	69.75	1926	27.6 1/	100.0
Oregon				
1960				
21-30 November	1.00	2	2.0	2.7
1961				
11-20 April	3.00	71	23.7	97.3
Total	4.00	73	18.3 1/	100.0
Washington				
1960				
21-30 November	1.00	-	-	-
1961				
21-31 January	1.00	8	8.0	0.8
11-20 March	4.50	1	0.2	0.1
21-31 "	8.00	172	21.5	16.0
1-10 April	3.50	50	14.3	4.6
11-20 "	9.00	503	55.8	46.8
21-30 "	8.75	340	38.9	31.7
Total	35.75	1074	30.0 1/	100.0

1/ Average number of seals seen per boat day.

Table 1 (con.).--Number and relative abundance of seals seen off California, Oregon, Washington, British Columbia, and Southeastern Alaska, by 10-day periods, 21 November 1960 to 25 April 1961

Period	Number of boat-hunting days	Total seals seen	Seals seen per boat-hunting day	Percent seen per boat-hunting day
British Columbia[2/]				
1961				
21-31 January	7.00	35	5.0	10.2
1-10 February	1.75	2	1.1	0.6
11-20 "	6.50	180	27.7	52.6
21-28 "	4.25	77	18.1	22.5
1-10 March	2.50	32	12.8	9.4
11-20 "	3.00	16	5.3	4.7
Total	25.00	342	13.7[1/]	100.0
Grand total	134.50	3415		

1/ Average number of seals seen per boat day.

2/ Eleven seals sighted in Southeastern Alaskan waters are included in British Columbia.

Table 2.--Number and relative abundance of seals collected off California, Oregon, Washington, British Columbia, and Southeastern Alaska, by 10-day periods, 21 November 1960 to 25 April 1961

Period	Number of boat-hunting days	Males	Females	Total	Number collected per boat-hunting day	Percent collected per boat-hunting day
California						
1960						
21-30 November	2.50	-	-	-	-	-
1-10 December	6.00	-	3	3	0.5	0.4
11-20 "	3.75	-	-	-	-	-
1961						
1-10 January	6.00	-	65	65	10.8	7.7
11-20 "	7.75	2	150	152	19.6	17.9
21-31 "	7.75	1	216	217	28.0	25.5
1-10 February	8.00	-	214	214	26.8	25.3
11-20 "	5.75	-	46	46	8.0	5.4
21-28 "	5.25	-	43	43	8.1	5.1
1-10 March	3.25	-	22	22	6.8	2.6
11-20 "	4.00	-	45	45	11.3	5.3
21-31 "	5.00	-	31	31	6.2	3.7
1-10 April	3.75	-	6	6	1.6	0.7
11-20 "	1.00	1	2	3	3.0	0.4
Total	69.75	4	843	847	12.1 1/	100.0
Oregon						
1960						
21-30 November	1.00	-	-	-	-	-
1961						
11-20 April	3.00	3	26	29	9.7	100.0
Total	4.00	3	26	29	7.3 1/	100.0
Washington						
1960						
21-30 November	1.00	-	-	-	-	-
1961						
21-31 January	1.00	-	1	1	1.0	-
11-20 March	4.50	-	-	-	-	-
21-31 "	8.00	11	46	57	7.1	15.1
1-10 April	3.50	1	11	12	3.4	3.1
11-20 "	9.00	16	157	173	19.2	45.0
21-30 "	8.75	22	119	141	16.1	36.8
Total	35.75	50	334	384	10.7 1/	100.0

1/ Average number of seals collected per boat day.

Table 2 (con.).--Number and relative abundance of seals collected off California, Oregon, Washington, British Columbia, and Southeastern Alaska, by 10-day periods, 21 November 1960 to 25 April 1961

Period	Number of boat-hunting days	Males	Females	Total	Number collected per boat-hunting day	Percent collected per boat-hunting day
British Columbia[2/]						
1961						
21-31 January	7.00	5	14	19	2.7	20.9
1-10 February	1.75	-	1	1	0.6	1.1
11-20 "	6.50	2	36	38	5.8	41.7
21-28 "	4.25	1	11	12	2.8	13.2
1-10 March	2.50	10	4	14	5.6	15.4
11-20 "	3.00	2	6	8	2.6	7.7
Total	25.00	20	72	92	3.7[1/]	100.0
Grand total	134.50	77	1275	1352		

1/ Average number of seals collected per boat day.

2/ Five seals from Southeastern Alaska are included in British Columbia (4 males, 1 female).

Table 3.--Grouping of 3,415 seals sighted in waters off California, Oregon, Washington, British Columbia, and Southeastern Alaska, 21 November 1960-25 April 1961

Area	Number of seals per group											
	1	2	3	4	5	6	7	8	9	10	10+ 1/	Total
California												
No. of groups	605	277	109	42	24	6	6	5	-	-	2	1076
No. of seals	605	554	327	168	120	36	42	40	-	-	34	1926
Percent of seals	31.4	28.7	17.0	8.7	6.2	1.9	2.2	2.1	-	-	1.8	100.0
Oregon												
No. of groups	34	10	-	1	3	-	-	-	-	-	-	48
No. of seals	34	20	-	4	15	-	-	-	-	-	-	73
Percent of seals	46.6	27.4	-	5.5	20.5	-	-	-	-	-	-	100.0
Washington												
No. of groups	443	149	45	13	11	3	2	2	-	1	2	671
No. of seals	443	298	135	52	55	18	14	16	-	10	27	1068
Percent of seals	41.5	27.9	12.7	4.9	5.1	1.7	1.3	1.5	-	0.9	2.5	100.0
British Columbia												
No. of groups	104	30	15	13	5	2	-	2	-	1	1	173
No. of seals	104	60	45	52	25	12	-	16	-	10	13	337
Percent of seals	30.9	17.8	13.4	15.4	7.4	3.6	-	4.7	-	3.0	3.8	100.0
Southeastern Alaska												
No. of groups	5	3	-	-	-	-	-	-	-	-	-	8
No. of seals	5	6	-	-	-	-	-	-	-	-	-	11
Percent of seals	45.5	54.5	-	-	-	-	-	-	-	-	-	100.0
Grand total												
No. of groups	1191	469	169	69	43	11	8	9	-	2	5	1976
No. of seals	1191	938	507	276	215	66	56	72	-	20	74	3415
Percent of seals	34.9	27.4	14.9	8.1	6.3	1.9	1.6	2.1	-	0.6	2.2	100.0

1/ Estimated group sizes for the 10+ group = 13, 12, 15, 14, 20.

The latter part of January and the month of February were spent in the area between Point Sur and Cortez Bank. No seals were seen south of the latitude of San Nicolas Island and it appears that the latitude of San Miguel Island is about the southern limit of the fur seal in numbers, although the limit probably varies from year to year depending upon food. The majority of the seals collected during this time (655) was taken between 34°N. and 36°N. latitudes. The seals were scattered over the ocean in groups of 1, 2, and 3, with few larger groups seen. Once in January and once in February mixed groups of Risso dolphins, right whale dolphins, and fur seals were observed.

During the month of March, the area between Monterey and Point Arena was surveyed and 98 seals were collected. Seals were found in fair numbers near Guide Seamount on 19-21 March. The animals collected were mainly young females and they appeared to be in migration. The vessel sailed northward in early April, hunting off Eureka on 8, 9, and 11 April.

Mr. John Stennick, who served on the vessel Tacoma while it was sealing in waters off California, made several trips later in the spring aboard whale catcher boats out of San Francisco. On 11 and 12 May, while aboard the vessel Lynnann cruising in waters to the south and west of the Farallon Islands, he sighted 24 fur seals. On 30 May only 2 to 3 fur seals were sighted in the vicinity of Cordell Bank. On 1 June a course was run from Southeast Farallon southwest until 1800 when the vessel shut down between Pioneer and Guide Seamounts. Forty-nine fur seals were sighted with a fairly even distribution between the Farallons and Pioneer Seamount. On 2 June the vessel worked in the vicinity of Pioneer and Guide Seamounts and 40 fur seals were seen mostly in the area between the seamounts. Seals sighted on 1 and 2 June appeared to be small (young). None was collected. These June sightings are the latest (in the season) made by Fish and Wildlife Service observers in this vicinity. It is possible that young seals arrive after the older animals move north.

Oregon

During the period 13-15 April, the vessel collected 29 seals while moving northward along the Oregon coast.

Washington

Two vessels worked in the waters off Washington, one from 21 March through 24 April and the other from 16 through 25 April. One seal was collected in Washington waters in January and 183 were taken in March and April. The majority of the seals was collected from the Columbia River north to Grays Harbor. A large percent of the hunting time was spent inside the 100-fathom curve, partly because of poor weather conditions. The collecting location may have influenced the take of young animals off Washington as they are more frequently taken in shallow water.

British Columbia

One vessel left Seattle 20 January bound for waters off British Columbia, and worked in that area from 23 January through 20 March. On its northward run in January, Barkley, Clayoquot, Nootka, and Kyuquot Sounds and Esperanza Inlet on the west coast of Vancouver Island were investigated. Yearling seals had not arrived in these localities in any number by late January. Twenty seals were collected in January, 15 of these were yearlings. The yearlings were taken in Nootka Sound, Quatsino Sound, Scott Channel, Queen Charlotte Sound, Milbanke and Laredo Sounds.

During the month of February, seals collected in Hecate Strait and Dixon Entrance were mainly adult or subadult animals. In early March, the vessel circled Prince of Wales Island, Alaska, and the Queen Charlotte Islands. In March, 21 seals were collected; 18 of these were yearlings taken in well protected inlets of Prince of Wales Island and the British Columbia mainland. It is possible that a wave of yearlings was moving south in March.

Distribution by Age and Sex

Age and Sex

During 1961 pelagic operations, a total of 1,352 seals was collected. Because of incomplete or missing data for two female seals, only 1,350 seals will be shown in the following tables and computations (table 4). Of these, 1,273 (94.3 percent) were females

Table 4. -- Age and sex of 1,350 fur seals taken by U. S. research vessels in eastern Pacific in 1961

Age (years)	California 21 Nov. 1960 - 12 April				Oregon 13-15 April			
	males		females		males		females	
	number	percent	number	percent	number	percent	number	percent
1	-	-	-	-	-	-	-	-
2	1	25.0	7	0.8	1	33.3	-	-
3	1	25.0	54	6.4	2	66.7	1	3.8
4	2	50.0	47[1/]	5.6	-	-	-	-
5	-	-	41	4.9	-	-	4	15.4
6	-	-	41	4.9	-	-	2	7.7
7	-	-	63[1/]	7.5	-	-	3	11.6
8	-	-	81	9.6	-	-	3	11.6
9	-	-	78	9.3	-	-	1	3.8
10	-	-	84	10.0	-	-	2	7.7
11	-	-	59	7.0	-	-	1	3.8
12	-	-	51	6.1	-	-	3	11.6
13	-	-	57	6.8	-	-	1	3.8
14	-	-	48	5.7	-	-	2	7.7
15	-	-	44	5.2	-	-	2	7.7
16	-	-	35[1/]	4.1	-	-	-	-
17	-	-	20	2.4	-	-	-	-
18	-	-	16	1.9	-	-	-	-
19	-	-	9	1.1	-	-	-	-
20	-	-	4	0.5	-	-	-	-
21	-	-	1	0.1	-	-	1	3.8
22	-	-	-	-	-	-	-	-
23	-	-	1	0.1	-	-	-	-
24	-	-	-	-	-	-	-	-
Total	4	100.0	841	100.0	3	100.0	26	100.0
Grand total	845				29			
Percent	0.5		99.5		10.3		89.7	

[1/] Three seals, one of each age class, were taken in December, 1960.

Actual date the vessels were collecting in areas: California, 21 November-14 December, 5 January-12 April; Oregon, 13-15 April.

Table 4 (con.). --Age and sex of 1,350 fur seals taken by U. S. research vessels in eastern Pacific in 1961

Age (years)	Washington 21 March - 25 April				British Columbia 23 January - 20 March			
	males		females		males		females	
	number	percent	number	percent	number	percent	number	percent
1	7	14.0	11	3.3	14	87.4	17	23.9
2	15	30.0	10	3.0	1	6.3	-	-
3	18	36.0	29	8.6	1	6.3	1	1.4
4	8	16.0	46	13.8	-	-	2	2.8
5	2	4.0	27	8.1	-	-	-	-
6	-	-	15	4.5	-	-	2	2.8
7	-	-	29	8.6	-	-	1	1.4
8	-	-	19	5.7	-	-	5	7.1
9	-	-	30	9.0	-	-	2	2.8
10	-	-	21	6.3	-	-	6	8.5
11	-	-	18	5.4	-	-	3	4.2
12	-	-	17	5.1	-	-	2	2.8
13	-	-	11	3.3	-	-	5	7.1
14	-	-	14	4.2	-	-	4	5.6
15	-	-	17	5.1	-	-	5	7.1
16	-	-	10	3.0	-	-	8	11.3
17	-	-	4	1.2	-	-	-	-
18	-	-	5	1.5	-	-	4	5.6
19	-	-	1	0.3	-	-	-	-
20	-	-	-	-	-	-	3	4.2
21	-	-	-	-	-	-	-	-
22	-	-	-	-	-	-	-	-
23	-	-	-	-	-	-	-	-
24	-	-	-	-	-	-	1	1.4
Total	50	100.0	334	100.0	16	100.0	71	100.0
Grand total	384				87			
Percent	13.0		87.0		18.4		81.6	

Actual date the vessels were collecting in areas: Washington, 22-23 January, 21 March-25 April; British Columbia, 23 January-6 February, 9 February-3 March, 6 March-20 March.

Table 4 (con.). --Age and sex of 1,350 fur seals taken by U. S. research vessels in eastern Pacific in 1961

Age (years)	Southeastern Alaska 6 Feb.-5 March				Combined areas 21 Nov. 1960 - 25 April 1961					
	males		females		males		females		males and females	
	number	percent	number	percent	number	percent	number	percent	number	percent
1	4	100.0	1	100.0	25	32.4	29	2.3	54	4.0
2	-	-	-	-	18	23.4	17	1.3	35	2.6
3	-	-	-	-	22	28.6	84	6.6	106	7.8
4	-	-	-	-	10	13.0	96	7.5	106	7.8
5	-	-	-	-	2	2.6	68	5.3	70	5.2
6	-	-	-	-	-	-	62	4.9	62	4.6
7	-	-	-	-	-	-	95	7.4	95	7.0
8	-	-	-	-	-	-	107	8.4	107	8.0
9	-	-	-	-	-	-	114	8.9	114	8.4
10	-	-	-	-	-	-	112	8.8	112	8.3
11	-	-	-	-	-	-	82	6.4	82	6.1
12	-	-	-	-	-	-	71	5.6	71	5.3
13	-	-	-	-	-	-	76	6.0	76	5.6
14	-	-	-	-	-	-	67	5.2	67	5.0
15	-	-	-	-	-	-	68	5.3	68	5.0
16	-	-	-	-	-	-	55	4.3	55	4.1
17	-	-	-	-	-	-	24	1.9	24	1.8
18	-	-	-	-	-	-	25	2.0	25	1.8
19	-	-	-	-	-	-	10	0.8	10	0.7
20	-	-	-	-	-	-	7	0.5	7	0.5
21	-	-	-	-	-	-	2	0.2	2	0.2
22	-	-	-	-	-	-	-	-	-	-
23	-	-	-	-	-	-	1	0.2	1	0.1
24	-	-	-	-	-	-	1	0.2	1	0.1
Total	4	100.0	1	100.0	77	100.0	1,273	100.0		
Grand total	5				1,350				1,350	
Percent	80.0		20.0		5.7		94.3			100.0

Actual date the vessels were collecting in areas: Southeastern Alaska, 6-9 February, 4-5 March.

and 77 (5.7 percent) males. Compared with previous collections (1958-60) the age groups for comparable areas and times are similar in proportion.

Yearling seals constituted 4 percent of the collection in 1961, a proportion that is almost twice as high as in previous years. The change is the result of collecting in wintering areas in British Columbia where yearlings were concentrated. Yearlings are relatively scarce in collections from both the eastern and western Pacific even though they are the most numerous age class.

Seals of ages 3 to 6 are normally abundant in the western Pacific but are not sufficiently numerous to account for the lack of seals of these ages in collections made on the eastern side. Young seals tagged on the Pribilof Islands have been taken on the Commander Islands and on Robben Island. The total number of Pribilof seals represented by the tagged seals is, however, not great.

The reported year around presence of small seals, up to 1,000 miles west of Cape Flattery and in the western part of the Gulf of Alaska, tends to confirm the belief that seals are wintering in numbers far offshore.

Three-year-old females were more abundant in the sample from California taken in 1961 than in 1958 and 1959.

Nine-year olds were the most numerous female age class in 1961. This is consistent with the numerous 7- and 8-year-old seals taken in 1959. Seals 7 years old in 1959 and 9 years old in 1961 would come from the strong year-class of 1952. Another strong year-class, that of 1950, was the source of the 12-year-old seals that were most numerous in 1958. Although the difference between the most numerous age and some other ages is not great, the fact that successful year classes are strongly represented in pelagic samples is of interest. Conceivably, it could be of use in forecasting the relative success of year classes arriving on rookery islands.

Of 5,236 females taken during the 4-year period (1958-61), 2,387 (46 percent) were 11 years old or older, whereas, the younger age groups, which should be much more numerous, are represented by 2,849 (54 percent) seals (table 5).

Table 5.--Observed distribution of females in age group of 11 to 26 years, taken by U. S. research vessels in eastern Pacific in 1958, 1959, 1960, and 1961

Age	1958		1959		1960		1961		Total	
	no.	%	no.	%	no.	%	no.	%	no.	%
10+[1]										
11	113	17.3	98	17.6	137	19.8	82	16.8	430	18.0
12	134	20.6	76	13.7	106	15.3	71	14.5	387	16.2
13	110	16.9	56	10.1	120	17.4	76	15.5	362	15.2
14	92	14.1	70	12.6	107	15.5	67	13.7	336	14.1
15	71	10.9	87	15.6	67	9.7	68	13.9	293	12.3
16	56	8.6	69	12.4	51	7.4	55	11.3	231	9.7
17	35	5.4	36	6.5	46	6.7	24	4.9	141	5.9
18	22	3.4	27	4.9	23	3.3	25	5.1	97	4.1
19	14	2.1	16	2.9	19	2.8	10	2.1	59	2.5
20	3	0.5	5	0.9	7	1.0	7	1.4	22	0.9
21	1	0.1	7	1.3	6	0.9	2	0.4	16	0.7
22	1	0.1	5	0.9	-	-	-	-	6	0.2
23	-	-	1	0.2	1	0.1	1	0.2	3	0.1
24	-	-	1	0.2	1	0.1	1	0.2	3	0.1
25	-	-	-	-	-	-	-	-	-	-
26	-	-	1	0.2	-	-	-	-	1	trace
Total	652	100.0	555	100.0	691	100.0	489	100.0	2387	100.0

1/ Seals classified as 10+ are omitted: two seals in 1958 and one in 1959.

The proportion of males of each age collected is in agreement with those taken in 1959 when sampling was done in comparable areas. Few males were collected in either year.

A thorough study of fur seal distribution will require collections to be made out to the mid-Pacific. This is prohibitively expensive and too time consuming to combine with current Convention Schedule requirements.

Tag Recoveries

Twenty-nine seals (2.1 percent of all seals collected in 1961) were tagged (table 6). The percent of tagged seals recovered at sea is only slightly lower than the same percent taken on the Pribilof Islands. The difference can be explained by failure to locate all seals that have lost tags and by the small samples (table 7). The low representation of males more than 4 years old is expected from their habit of remaining in northern waters and from the fact that they have been much reduced in number by the commercial harvest.

Size and Reproductive Condition

Size

Young seals of both sexes, 1 to 5 years old, tend to be smaller in length and weight in the sample taken in 1961 than in samples taken from 1958 to 1960. The comparisons and their significance, if any, will be discussed in the summary report on research from 1958 to 1961. Lengths and weights are given in tables 8-13.

A summary of lengths of fur seal fetuses, taken in the past 4 years, is shown by 10-day periods (table 14). The growth rates are comparable for all 4 years. Plotting the average weights by 10-day periods gives a slight curve. An extension of the lower end of the curve intersects the abscissa in early November (fig. 6). This time coincides with the expected time of egg implantation.

The linear growth of fur seal fetuses resembles the fetal growth described for whales, and may be a common characteristic of marine mammals (Laws, 1959).

Table 6.--Pelagic tag recoveries and catches of fur seals, by areas, taken by U. S. research vessels in eastern Pacific in 1961

Age (yrs.)	Year tag attached	Tag series	Number tagged	Number of tags recovered										total catch		
				Calif.		Ore.		Wash.		B. C.		comb.				
				♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂ and ♀
1	1960	M	59,981	-	-	-	-	-	1	1	-	1	1	25	29	54
2	1959	L	49,881	-	-	-	-	1	3	-	-	1	3	18	17	35
3	1958	K	49,917	-	3	-	-	1	3	-	-	1	6	22	84	106
4	1957	J	49,842	-	2	-	-	1	2	-	-	1	4	10	96	106
5	1956	I	49,900	-	2	-	-	-	1	-	-	-	3	2	68	70
6	1955	H[1/]	49,870	-	2	-	-	-	-	-	-	-	2	-	62	62
7	1954	G	10,000	-	-	-	-	-	-	-	-	-	-	-	95	95
8	1953	F	10,388	-	1	-	-	-	-	-	-	-	1	-	107	107
9	1952	E	19,979	-	2	-	-	-	-	-	-	-	2	-	114	114
10	1951	D	1,000	-	-	-	-	-	-	-	-	-	-	-	112	112
11	1950	-	-	-	-	-	-	-	-	-	-	-	-	-	82	82
12	1949	CS	19,960	-	-	-	-	-	1	-	-	-	1	-	71	71
13	1948	B	19,532	-	2	-	-	-	-	-	-	-	2	-	76	76
14	1947	A	19,183	-	-	-	-	-	-	-	-	-	-	-	67	67
20[2/]	1941	USA	10,000	-	-	-	-	-	-	-	-	-	-	-	7	7
Total				-	14	-	-	3	11	1	-	4	25	77	1087	
Combined total												29				1,164[3/]

1/ Includes H Nos. 1-10,000, no series letter Nos. 10,001-50,000.
2/ No seals were tagged from 1942-1946, inclusive, and before 1941.
3/ Additional 186 seals are not shown in this total (footnote 2/).

Table 7.--Percent of tagged seals recovered in Pribilof Island and pelagic catches

Age (yrs.)	Year tag attached	Number tagged	Pelagic recovery: number seals tagged ♂	tagged ♀	untagged ♂	untagged ♀	percent seals ♂	percent seals ♀	Pribilof Island recovery: percent seals 1956-1959 ♂	1956-1959 ♀	1960 ♂	1960 ♀
1	1960	59,981	1	1	25	29	4.0	3.4	-	-	-	-
2	1959	49,881	1	3	18	17	5.6	17.6	-	-	6.2	-
3	1958	49,917	1	6	22	84	4.5	7.1	-	-	6.8	6.0
4	1957	49,842	-	4	10	96	10.0	4.2	-	-	6.0	4.4
5	1956	49,794	-	3	2	68	-	4.4	-	-	3.7	5.0
6	1955	49,870	-	2	-	62	-	3.2	-	-	-	1.8
7	1954	10,000	-	-	-	-	-	-	-	-	-	1.0
8	1953	10,833	-	1	-	106	-	0.9	-	-	-	4.0
9	1952	19,979	-	2	-	112	-	1.8	-	-	-	-
10	1951	1,000	-	-	-	-	-	-	-	-	-	-
11	1950	-	-	-	-	-	-	-	-	-	-	-
12	1949	19,960	-	1	-	70	-	1.4	-	3.4[1/]	-	-
13	1948	19,532	-	2	-	74	-	2.7	-	4.9[2/]		

1/ Tag percentage among 9- and 10-year-old females in 1958 and 1959.
2/ Tag percentage among 8- and 9-year-old females in 1956 and 1957.

Table 8.--Monthly mean length in centimeters of 840 pregnant female fur seals taken by U. S. research vessels in eastern Pacific in 1961

	January		February		March		April		Combined			
Age	no.	mean cm.	no.	mean cm.	no.	mean cm.	no.	mean cm.	mean cm.	range	standard deviation	no. seals
4	1	115.0	-	-	-	-	-	-	115.0	115	-	1
5	6	115.8	2	117.0	2	116.5	4	113.5	115.4	106-120	4.37	14
6	13	118.2	21	117.7	4	118.5	9	120.3	118.4	109-127	4.73	47
7	27	119.0	21	120.9	1	123.0	22	121.2	120.2	105-133	5.58	72[1/]
8	36	120.1	27	121.7	7	122.1	15	122.1	121.1	110-134	5.94	85
9	40	121.2	32	120.7	6	120.3	29	124.8	122.0	111-137	5.77	107
10	45	122.9	35	121.4	12	125.5	13	125.7	123.0	107-133	5.58	105
11	29	124.1	18	123.6	11	129.1	15	122.6	124.4	114-140	5.03	73
12	23	124.6	23	122.2	4	126.3	16	124.3	123.8	112-142	6.27	66
13	25	126.4	17	124.4	13	129.6	8	126.8	126.6	113-141	6.58	63
14	24	125.8	15	124.4	9	127.7	14	124.9	126.6	114-142	6.02	62
15	22	126.9	13	128.8	6	130.8	13	128.7	128.0	119-137	4.69	54
16	11	128.5	22	127.7	7	129.7	6	128.5	126.6	114-141	6.43	47[1/]
17	4	131.8	5	123.9	3	125.0	3	126.3	127.5	119-136	5.04	15
18	6	127.2	4	126.4	5	133.0	1	137.0	129.6	115-140	6.95	16
19	2	128.5	2	124.5	1	132.0	-	-	127.6	112-137	9.02	5
20	2	126.5	4	125.8	1	142.0	-	-	128.3	121-142	7.56	7
21	-	-	-	-	-	-	1	140.0	140.0	140	-	1
Total	316		261		92		169					840[1/]

1/ Includes one 7-year-old, length 117.0 cm., and one 16-year-old, length 131.0 cm., collected in December 1960.

Table 9.--Monthly mean weight in kilograms of 840 pregnant female fur seals taken by U. S. research vessels in eastern Pacific in 1961

	January		February		March		April		Combined			
Age	no.	mean kg.	no.	mean kg.	no.	mean kg.	no.	mean kg.	mean kg.	range	standard deviation	no. seals
4	1	25.0	-	-	-	-	-	-	25.0	25	-	1
5	6	25.7	2	27.5	2	30.0	4	30.0	27.8	24-32	2.95	14
6	13	29.4	21	29.7	4	27.1	9	33.0	30.2	23-40	4.05	47
7	27	29.7	21	32.7	1	29.5	22	36.6	31.0	21-41	3.62	72 1/
8	36	30.9	27	34.1	7	31.7	15	34.0	32.5	25-48	3.94	85
9	40	31.8	32	33.9	6	31.5	29	36.7	33.8	24-45	4.27	107
10	45	33.4	35	35.3	12	35.0	13	38.2	34.8	27-52	4.19	105
11	29	35.0	18	35.6	11	37.9	15	36.5	35.9	27-44	3.96	73
12	23	36.0	23	36.0	4	36.3	16	35.8	36.0	23-51	5.37	66
13	25	36.6	17	37.4	13	38.4	8	39.7	37.6	26-51	5.24	63
14	24	36.2	15	41.5	9	40.4	14	37.9	38.4	28-55	4.77	62
15	22	35.3	13	42.5	6	42.8	13	39.0	40.8	30-51	4.90	54
16	11	43.1	22	36.6	7	41.4	6	39.9	40.1	31-55.5	6.47	47 1/
17	4	40.0	5	37.0	3	40.0	3	42.2	39.4	29-47	4.90	15
18	6	40.7	4	42.3	5	45.6	1	46.0	42.9	28-56	7.24	16
19	2	42.3	2	39.0	1	41.0	-	-	40.7	30-48	6.56	5
20	2	37.0	4	39.3	1	59.0	-	-	41.3	32-59	8.64	7
21	-	-	-	-	-	-	1	46.0	46.0	46	-	1
Total	316		261		92		169					840 1/

1/ Includes one 7-year-old, weight 26.0 kg., and one 16-year-old, weight 37.0 kg., collected in December 1960.

Table 10.--Monthly mean length in centimeters of 433 nonpregnant female fur seals taken by U. S. research vessels in eastern Pacific in 1961

	January		February		March		April		Combined			
Age	no.	mean cm.	no.	mean cm.	no.	mean cm.	no.	mean cm.	mean cm.	range	standard deviation	no. seals
1	10	71.9	2	78.0	9	72.8	8	74.6	73.3	66-80	4.13	29
2	2	92.5	-	-	5	91.8	10	86.6	88.8	83-97	3.97	17
3	27	99.9	17	98.8	15	102.0	25	97.2	99.3	88-108	4.44	84
4	19	105.5	17	107.1	14	108.9	44	105.3	106.2	92-117	5.17	95 1/
5	14	111.6	13	108.2	4	117.3	23	112.1	111.4	99-127	7.09	54
6	-	-	5	116.8	2	120.5	8	115.1	116.4	107-127	5.72	15
7	7	120.6	7	115.0	-	-	9	117.1	117.5	107-132	6.43	23
8	10	121.3	6	119.5	-	-	6	119.8	120.4	113-129	4.67	22
9	5	122.4	-	-	-	-	2	118.5	121.3	112-131	6.37	7
10	1	123.0	1	115.0	2	128.0	3	119.0	121.6	114-130	6.80	7
11	3	126.3	3	120.0	1	127.0	2	123.5	124.4	118-134	5.08	9
12	2	131.0	3	124.7	-	-	-	-	127.2	122-135	4.82	5
13	7	127.3	2	125.0	1	134.0	3	125.3	127.0	116-135	6.61	13
14	3	126.7	2	125.5	-	-	-	-	123.8	120-129	3.63	5
15	6	126.8	3	121.7	1	127.0	4	123.3	124.7	111-137	7.06	14
16	3	128.7	1	124.0	2	126.0	2	132.0	128.3	121-143	7.33	8
17	5	125.4	2	116.5	-	-	2	127.5	123.9	116-133	5.30	9
18	2	125.0	3	127.0	3	126.7	1	127.0	126.4	120-132	4.64	9
19	1	120.0	2	124.5	2	137.5	-	-	128.8	120-138	8.23	5
20	-	-	-	-	-	-	-	-	-	-	-	-
21	1	122.0	-	-	-	-	-	-	122.0	122	-	1
22	-	-	-	-	-	-	-	-	-	-	-	-
23	1	122.0	-	-	-	-	-	-	122.0	122	-	1
24	-	-	1	132.0	-	-	-	-	132.0	132	-	1
Total	129		90		61		152					433 1/

1/ Includes one 4-year-old, length 112.0 cm., collected in December 1960.

Table 11.--Monthly mean weight in kilograms of 433 nonpregnant female fur seals taken by U. S. research vessels in eastern Pacific in 1961

	January		February		March		April		Combined			
Age	no.	mean kg.	no.	mean kg.	no.	mean kg.	no.	mean kg.	mean kg.	range	standard deviation	no. seals
1	10	8.0	2	9.5	9	7.8	8	7.6	7.9	6-10	1.31	29
2	2	13.5	-	-	5	12.2	10	11.1	11.7	10-15	1.32	17
3	27	17.4	17	17.6	15	16.2	25	16.0	16.8	13-23	2.29	84
4	19	20.3	17	21.2	14	19.9	44	19.5	19.8	13-27	3.35	95[1/]
5	14	25.1	13	23.2	4	23.6	23	23.4	23.8	16-30	3.15	54
6	-	-	5	27.0	2	28.0	8	25.1	26.1	22-30	2.24	15
7	7	29.9	7	28.3	-	-	9	27.3	28.4	21-36	4.11	23
8	10	31.2	6	32.2	-	-	6	27.3	30.4	22-39	4.09	22
9	5	31.0	-	-	-	-	2	30.5	30.9	28-35	2.41	7
10	1	27.0	1	30.0	2	37.5	3	33.3	33.1	27-38	4.30	7
11	3	36.0	3	35.0	1	38.0	2	34.5	35.6	30-45	5.71	9
12	2	39.0	3	36.7	-	-	-	-	37.6	31-42	4.28	5
13	7	38.1	2	32.5	1	42.5	3	29.3	35.6	26-45	5.91	13
14	3	34.7	2	36.5	-	-	-	-	35.4	32-41	2.61	5
15	6	39.0	3	40.0	1	37.0	4	39.8	39.3	32-48	4.87	14
16	3	38.8	1	33.0	2	40.0	2	45.0	39.9	33-50	6.73	8
17	5	39.2	2	33.0	-	-	2	37.0	37.3	32-44	3.43	9
18	2	40.0	3	41.3	3	35.3	1	39.0	38.7	30-40	3.83	9
19	1	40.0	2	40.0	2	45.5	-	-	42.2	39-50	4.44	5
20	-	-	-	-	-	-	-	-	-	-	-	-
21	1	35.0	-	-	-	-	-	-	35.0	35	-	1
22	-	-	-	-	-	-	-	-	-	-	-	-
23	1	36.0	-	-	-	-	-	-	36.0	36	-	1
24	-	-	1	43.0	-	-	-	-	43.0	43	-	1
Total	129		90		61		152					433[1/]

1/ Includes one 4-year-old, weight 23.0 kg., collected in December 1960.

Table 12.--Monthly mean length in centimeters of 77 male fur seals taken by U. S. research vessels in eastern Pacific in 1961

	January		February		March		April		Combined			
Age	no.	mean cm.	no.	mean cm.	no.	mean cm.	no.	mean cm.	mean cm.	range	standard deviation	no. males
1	5	75.6	1	75.0	13	77.1	6	77.3	76.8	64-83	4.44	25
2	1	98.0	1	93.0	5	92.0	11	94.8	94.1	85-101	4.54	18
3	1	108.0	1	99.0	4	99.8	16	103.3	102.6	93-113	5.46	22
4	1	110.0	-	-	-	-	9	110.0	110.0	104-115	3.97	10
5	-	-	-	-	1	109.0	1	129.0	119.0	109-129	-	2
Total	8		3		23		43					77

Table 13.--Monthly mean weight in kilograms of 77 male fur seals taken by U. S. research vessels in eastern Pacific in 1961

	January		February		March		April		Combined			
Age	no.	mean kg.	no.	mean kg.	no.	mean kg.	no.	mean kg.	mean kg.	range	standard deviation	no. males
1	5	9.8	1	9.0	13	9.7	6	7.8	9.2	6-14	1.94	25
2	1	15.0	1	15.0	5	13.2	11	13.7	13.7	11-17	1.70	18
3	1	26.0	1	23.0	4	18.0	16	18.7	19.1	15-26	2.56	22
4	1	40.0	-	-	-	-	9	22.2	22.0	15-20	3.66	10
5	-	-	-	-	1	24.0	1	35.0	29.5	24-35	-	2
Total	8		3		23		43					77

Table 14.--Mean lengths in centimeters of fur seal fetuses taken in eastern Pacific, by U. S. research vessels, 1958-1961

Period	1958 male cm.	1958 male no.	1958 female cm.	1958 female no.	1959 male cm.	1959 male no.	1959 female cm.	1959 female no.
21-31 January	-	-	-	-	18.2	36	18.9	56
1-10 February	22.9	12	26.4	7	23.4	144	21.8	134
11-20 "	27.8	23	26.6	28	26.9	89	25.8	85
21-28 "	30.3	43	28.3	35	29.8	61	27.7	64
1-10 March	34.2	52	32.9	44	32.7	17	32.0	23
11-20 "	36.6	58	35.5	60	36.5	34	35.4	43
21-31 "	39.5	46	37.9	42	39.0	17	37.4	22
1-10 April	43.0	4	40.7	4	43.5	74	41.1	71
11-20 "	46.7	25	44.6	30	47.0	36	46.1	29
21-30 "	49.6	25	48.0	26	49.1	18	47.1	23
1-10 May	54.1	35	52.2	45	-	-	-	-
11-20 "	54.4	56	53.0	37	-	-	-	-
21-31 "	58.0	81	53.8	65	-	-	-	-
1-10 June	58.7	13	57.6	18	-	-	-	-
11-20 "	59.6	33	57.4	26	-	-	-	-
Total		506		467		526		550
Grand total			973				1076	

Period	1960 male cm.	1960 male no.	1960 female cm.	1960 female no.	1961 male cm.	1961 male no.	1961 female cm.	1961 female no.
1-10 January	-	-	-	-	15.3	24	13.3	24
11-20 "	-	-	-	-	17.2	40	16.3	58
21-31 "	-	-	-	-	20.3	76	18.9	89
1-10 February	-	-	-	-	25.1	75	24.2	81
11-20 "	-	-	-	-	26.9	27	26.9	39
21-28 "	-	-	-	-	29.9	18	30.8	12
1-10 March	35.1	14	34.5	17	33.9	10	33.2	9
11-20 "	38.9	15	37.2	25	38.2	10	35.5	15
21-31 "	42.3	22	40.4	16	41.4	23	39.6	18
1-10 April	-	-	43.8	5	41.8	5	43.0	3
11-20 "	47.9	17	45.8	19	46.5	52	43.6	46
21-30 "	49.0	76	46.8	93	48.2	28	46.2	26
1-10 May	51.6	60	49.6	59	-	-	-	-
11-20 "	53.3	43	51.6	51	-	-	-	-
21-31 "	56.9	44	53.2	64	-	-	-	-

Table 14 (con.).--Mean lengths in centimeters of fur seal fetuses taken in eastern Pacific, by U. S. research vessels, 1958-1961

Period	1960 male cm.	1960 male no.	1960 female cm.	1960 female no.	1961 male cm.	1961 male no.	1961 female cm.	1961 female no.
1-10 June	60.4	17	58.2	10	-	-	-	-
11-20 "	60.6	11	59.3	22	-	-	-	-
21-30 "	59.9	48	56.8	42	-	-	-	-
1-10 July	63.3	10	59.1	14	-	-	-	-
11-20 "	64.1	9	66.0	2	-	-	-	-
21-31 "	63.0	2	59.0	1	-	-	-	-
1-10 December	6.9	2 1/	-	-	-	-	-	-
Total		390		440		388		420
Grand total			830				808	

Period	Combined years male cm.	Combined years male no.	Combined years female cm.	Combined years female no.	Combined sexes cm.	Combined sexes no.
1-10 January	15.3	24	13.3	24	14.3	48
11-20 "	17.2	40	16.3	58	16.8	98
21-31 "	19.3	112	18.9	145	19.1	257
1-10 February	23.8	231	24.1	222	24.0	453
11-20 "	27.2	139	26.4	152	26.8	291
21-28 "	30.0	122	28.9	111	29.5	233
1-10 March	34.0	93	33.2	93	33.6	186
11-20 "	37.6	117	35.9	143	36.7	260
21-31 "	40.6	108	37.1	98	39.7	206
1-10 April	42.8	83	42.1	83	42.4	166
11-20 "	47.0	130	45.0	124	46.0	254
21-30 "	49.0	147	47.0	168	48.0	315
1-10 May	52.9	95	50.9	104	51.9	199
11-20 "	53.9	99	52.3	88	53.1	187
21-31 "	57.5	125	53.5	129	55.5	254
1-10 June	59.6	30	57.9	28	58.7	58
11-20 "	60.1	44	58.4	48	59.2	92
21-30 "	59.9	48	56.8	42	58.4	90
1-10 July	63.3	10	59.1	14	61.2	24
11-20 "	64.1	9	66.0	2	65.0	11
21-31 "	63.0	2	59.0	1	61.0	3
1-10 December	6.9	2	-	-	6.9	2
Total		1810		1877		3687
Grand total			3687			

1/ Taken during 1961 pelagic season starting in November 1960.

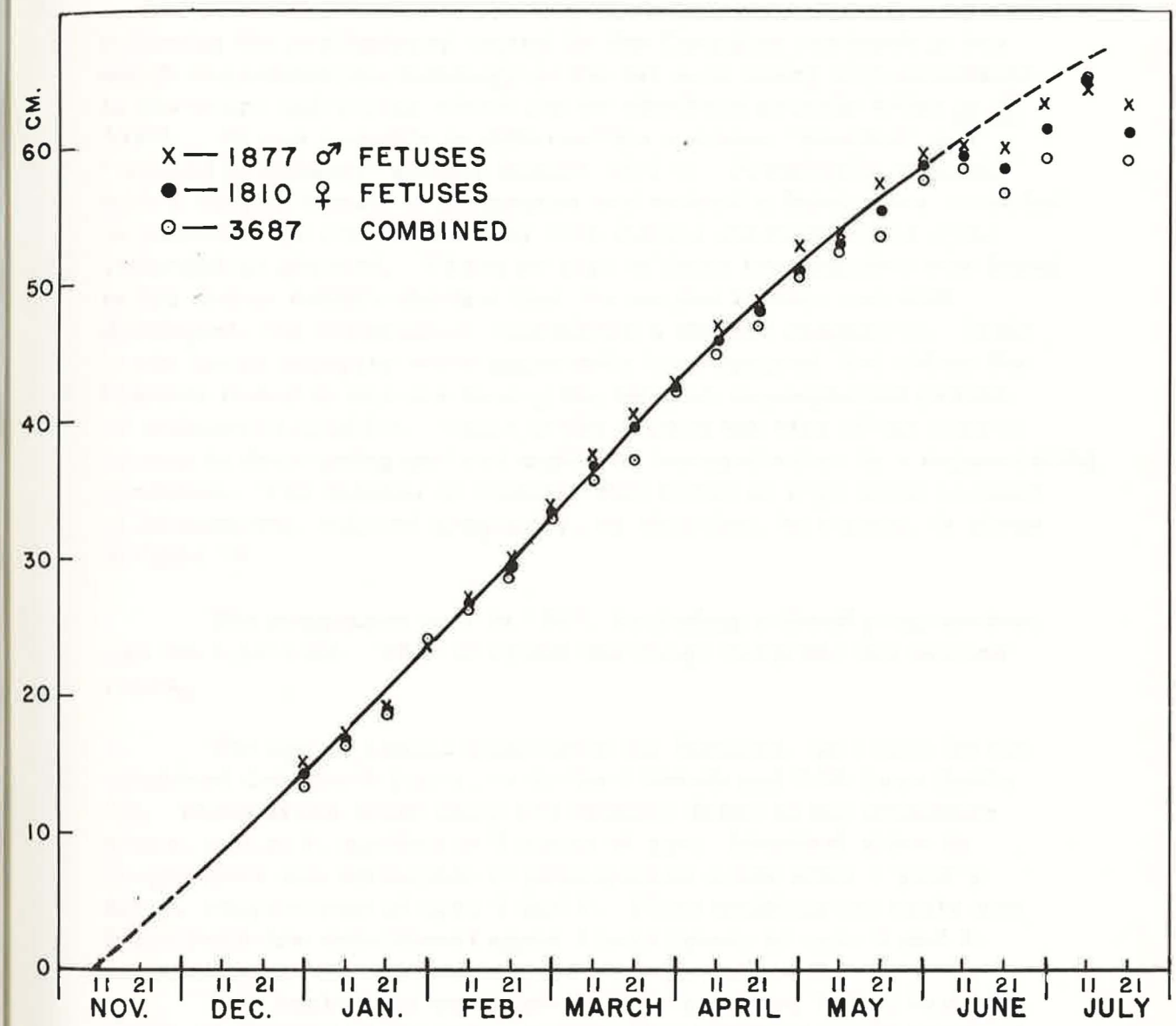

Figure 6.--Length of 3,687 fur seal fetuses by 10-day periods for 1958-1961.

Reproductive Condition

A more precise evaluation of pregnancies was made in 1961, following the preliminary report by the Canadian research group which correlated the histology of the fur seal ovary with conditions in the ovary and uterus which can be observed grossly (Pike et al., 1960). It was possible to differentiate between "aborted" and "missed pregnancy" groups (tables 15-17). Previously all seals with a corpus luteum of pregnancy and without a fetus were recorded as aborted. In 1961 seals only with visible abortion scars were recorded as aborted. Where no sign of fetus implantation was found in the uterus despite the fact that the corpus luteum was well developed, the condition is considered a missed pregnancy. Seals in the latter category were apparently impregnated but either the blastula failed to survive during the delayed impregnation period, or it failed to implant. Later in the season the size of the corpus luteum is decreasing and can easily be recognized as in a degenerating condition. The number of females that failed to reproduce because of immaturity, missed pregnancy, or abortion, by month, is given in table 18.

The pregnancy rate in 1961, excluding missed pregnancies, was 68.5 percent. This is within the range recorded for earlier years.

The age of sexual maturation for females, as shown by the combined data for 4 years, is in their fourth and fifth year (table 19). Nulliparous seals show two distinct drops in the immature group, one at 4, another at 5 years of age. Identical rises in pregnancies are noticeable in primiparous seals after 1 year's delay, respectively at ages 5 and 6. First multiparous seals are found (with few exceptions) again 1 year later, at ages 6 and 7.

Few seals bear young at age 4 or younger, but in seals 20 years or older it is not uncommon to find pregnant seals carrying a healthy pup.

A summary of reproductive condition by age and month is presented in table 20.

Table 15.--Reproductive condition of multiparous female seals, by age and area, taken by U. S. research vessels in eastern Pacific in 1961

Age	Calif.			Ore.			Wash.			B. C.			Combined		
	P	MP	A	P	MP	A	P	MP	A	P	MP	A	P	MP	A
1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	1	-	-	1	-
5	2	-	-	-	-	-	1	-	1	-	-	-	3	-	1
6	22	-	-	-	-	-	6	-	1	2	-	-	30	-	1
7	40 1/	4	-	2	-	-	16	3	-	1	-	-	59	7	-
8	59	14	-	1	1	-	14	2	-	4	1	-	78	18	-
9	73	3	-	3	-	-	23	2	4	2	-	-	101	5	4
10	78	3	1	1	-	-	17	4	-	6	-	-	102	7	1
11	51	7	1	2	-	-	16	2	-	3	-	-	72	9	1
12	43	5	3	1	-	-	14	-	3	2	-	-	60	5	6
13	47	10	-	2	1	-	8	2	1	5	-	-	62	13	1
14	43	5	-	1	-	-	13	-	1	4	-	-	61	5	1
15	31	11	2	1	1	-	14	2	1	5	-	-	51	14	3
16	30 1/	5	-	1	1	-	9	1	-	6	1	1	46	8	1
17	12	7	-	-	-	-	3	1	-	-	-	-	15	8	-
18	10	5	-	-	-	-	2	1	2	1	1	1	13	7	3
19	5	4	-	-	-	-	-	1	-	-	-	-	5	5	-
20	4	-	-	-	-	-	-	-	-	3	-	-	7	-	-
21	-	1	-	1	-	-	-	-	-	-	-	-	1	1	-
22	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
23	-	1	-	-	-	-	-	-	-	-	-	-	-	1	-
24	-	-	-	-	-	-	-	-	-	-	1	-	-	1	-
Total	550	85	7	16	4	-	156	21	14	44	5	2	766	115	23
Percent	85.7	13.2	1.1	80.0	20.0	-	81.7	11.0	7.3	86.3	9.8	3.9	84.8	12.7	2.5
Grand total		642			20			191			51			904	

1/ One seal of each year class was taken in December 1960.

P = pregnant
MP = missed pregnancy
A = aborted

Table 16.--Reproductive condition of primiparous female seals, by age and area, taken by U. S. research vessels in eastern Pacific in 1961

Age	Calif.			Ore.			Wash.			B.C.			Combined		
	P	MP	A	P	MP	A	P	MP	A	P	MP	A	P	MP	A
1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	1	-	-	-	-	-	-	-	-	-	-	-	1	-	-
5	8	-	-	-	-	-	2	-	-	-	-	-	10	-	-
6	12	-	-	1	1	-	3	-	-	-	-	-	16	1	-
7	9	6	-	-	-	-	3	1	1	-	-	-	12	7	1
8	4	1	1	-	-	-	2	-	-	-	-	-	6	1	1
9	1	-	-	-	-	-	1	-	-	-	-	-	2	-	-
10	1	-	1	-	-	-	-	-	-	-	-	-	1	-	1
Total	36	7	2	1	1	-	11	1	1	-	-	-	48	9	3
Percent	80.0	15.6	4.4	50.0	50.0	-	84.6	7.7	7.7	-	-	-	80.0	15.0	5.0
Grand total		45			2			13			-			60	

No primiparous female seals over 10 years of age taken.

P = pregnant
MP = missed pregnancy
A = aborted

Table 17.--Reproductive maturity of nulliparous female seals, by age and area, taken by U. S. research vessels in eastern Pacific in 1961

	Calif.		Ore.		Wash.		B. C. 1/		Combined	
Age	imm.	mat.	imm.	mat.	imm.	mat.	imm.	mat.	imm.	mat.
1	-	-	-	-	11	-	18	-	29	-
2	7	-	-	-	10	-	-	-	17	-
3	54	-	-	-	29	-	1	-	84	-
4	45	1 2/	1	-	46	-	1	-	93	1
5	28	3	-	-	23	-	-	-	51	3
6	3	4	2	-	5	-	-	-	10	4
7	3	1	-	-	5	-	-	-	8	1
8	2	-	1	-	1	-	-	-	4	-
9	-	1	-	-	-	-	-	-	-	1
10	-	-	-	-	-	-	-	-	-	-
11	-	-	-	-	-	-	-	-	-	-
12	-	-	-	-	-	-	-	-	-	-
13	-	-	-	-	-	-	-	-	-	-
14	-	-	-	-	-	-	-	-	-	-
15	-	-	-	-	-	-	-	-	-	-
16	-	-	-	-	-	-	-	-	-	-
17	1	-	-	-	-	-	-	-	1	-
18	1	-	-	-	-	-	1	-	2	-
19	-	-	-	-	-	-	-	-	-	-
20	-	-	-	-	-	-	-	-	-	-
21	-	-	-	-	-	-	-	-	-	-
22	-	-	-	-	-	-	-	-	-	-
23	-	-	-	-	-	-	-	-	-	-
24	-	-	-	-	-	-	-	-	-	-
Total	144	10	4	-	130	-	21	-	299	10
Percent	93.5	6.5	100.0	-	100.0	-	100.0	-	96.8	3.2
Grand total	154		4		130		21		309	

1/ One 1-year-old immature seal taken in Southeastern Alaska included with British Columbia.

2/ Taken in December 1960.

imm. = immature
mat. = mature

Table 18.--Reproductive condition of female seals, by age and month, taken by U. S. research vessels in eastern Pacific in 1961

	December 1960							
	Nulliparous		Primiparous			Multiparous		
				missed			missed	
Age	imm. 1/	mat. 2/	preg.	preg.	abort. 3/	preg.	preg.	abort.
1	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-
3	-	-	-	-	-	-	-	-
4	-	1	-	-	-	-	-	-
5	-	-	-	-	-	-	-	-
6	-	-	-	-	-	-	-	-
7	-	-	-	-	-	1	-	-
8	-	-	-	-	-	-	-	-
9	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-
11	-	-	-	-	-	-	-	-
12	-	-	-	-	-	-	-	-
13	-	-	-	-	-	-	-	-
14	-	-	-	-	-	-	-	-
15	-	-	-	-	-	-	-	-
16	-	-	-	-	-	1	-	-
17	-	-	-	-	-	-	-	-
18	-	-	-	-	-	-	-	-
19	-	-	-	-	-	-	-	-
20	-	-	-	-	-	-	-	-
21	-	-	-	-	-	-	-	-
22	-	-	-	-	-	-	-	-
23	-	-	-	-	-	-	-	-
24	-	-	-	-	-	-	-	-
Total	-	1	-	-	-	2	-	-
Percent		100.0				100.0		
Group total		1					2	
Group percent		33.3					66.7	
Grand total					3			

1/ Immature, without corpora lutea or developing follicles.
2/ Maturing, with corpora lutea and/or developing follicles.
3/ Aborted or resorbed fetus; these figures not included under preg. or missed preg.

Table 18 (con.).--Reproductive condition of female seals, by age and month, taken by U. S. research vessels in eastern Pacific in 1961

	January							
	Nulliparous		Primiparous			Multiparous		
				missed			missed	
Age	imm.	mat.	preg.	preg.	abort.	preg.	preg.	abort.
1	10	-	-	-	-	-	-	-
2	2	-	-	-	-	-	-	-
3	27	-	-	-	-	-	-	-
4	19	-	1	-	-	-	-	-
5	12	2	4	-	-	2	-	-
6	-	-	3	-	-	10	-	-
7	1	-	3	3	-	24	3	-
8	-	-	3	-	1	32	10	-
9	-	1	1	1	-	39	3	-
10	-	-	-	-	1	43	1	1
11	-	-	-	-	-	29	3	-
12	-	-	-	-	-	21	2	2
13	-	-	-	-	-	25	7	-
14	-	-	-	-	-	24	3	-
15	-	-	-	-	-	21	6	1
16	-	-	-	-	-	11	3	-
17	-	-	-	-	-	4	5	-
18	-	-	-	-	-	6	2	-
19	-	-	-	-	-	2	1	-
20	-	-	-	-	-	2	-	-
21	-	-	-	-	-	-	1	-
22	-	-	-	-	-	-	-	-
23	-	-	-	-	-	-	1	-
24	-	-	-	-	-	-	-	-
Total	71	3	15	4	2	295	51	4
Percent	95.9	4.1	71.4	19.1	9.5	84.3	14.6	1.1
Group total	74		21			350		
Group percent	16.6		4.7			78.7		
Grand total	445							

Table 18 (con.).--Reproductive condition of female seals, by age and month, taken by U. S. research vessels in eastern Pacific in 1961

	February							
	Nulliparous		Primiparous			Multiparous		
				missed			missed	
Age	imm.	mat.	preg.	preg.	abort.	preg.	preg.	abort.
1	2	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-
3	17	-	-	-	-	-	-	-
4	16	-	-	-	-	-	1	-
5	12	1	2	-	-	-	-	-
6	1	4	9	-	-	12	-	-
7	2	1	6	3	-	15	1	-
8	1	-	1	-	-	26	5	-
9	-	-	-	-	-	32	-	-
10	-	-	1	-	-	34	1	-
11	-	-	-	-	-	17	3	1
12	-	-	-	-	-	22	3	1
13	-	-	-	-	-	17	2	-
14	-	-	-	-	-	15	2	-
15	-	-	-	-	-	12	3	1
16	-	-	-	-	-	21	1	1
17	-	-	-	-	-	5	2	-
18	1	-	-	-	-	3	2	1
19	-	-	-	-	-	2	2	-
20	-	-	-	-	-	4	-	-
21	-	-	-	-	-	-	-	-
22	-	-	-	-	-	-	-	-
23	-	-	-	-	-	-	-	-
24	-	-	-	-	-	-	1	-
Total	52	6	19	3	-	237	29	5
Percent	89.7	10.3	86.4	13.6	-	87.5	10.7	1.8
Group total	58		22			271		
Group percent	16.5		6.3			77.2		
Grand total	351							

Table 18 (con.).--Reproductive condition of female seals, by age and month, taken by U. S. research vessels in eastern Pacific in 1961

	March							
	Nulliparous		Primiparous			Multiparous		
				missed			missed	
Age	imm.	mat.	preg.	preg.	abort.	preg.	preg.	abort.
1	9	-	-	-	-	-	-	-
2	5	-	-	-	-	-	-	-
3	15	-	-	-	-	-	-	-
4	14	-	-	-	-	-	-	-
5	4	-	2	-	-	-	-	-
6	2	-	-	-	-	4	-	-
7	-	-	2	-	-	1	-	-
8	-	-	-	-	-	5	-	-
9	-	-	-	-	-	3	-	3
10	-	-	-	-	-	12	2	-
11	-	-	-	-	-	11	1	-
12	-	-	-	-	-	4	-	-
13	-	-	-	-	-	12	1	1
14	-	-	-	-	-	9	-	-
15	-	-	-	-	-	6	1	-
16	-	-	-	-	-	7	2	-
17	-	-	-	-	-	3	-	-
18	1	-	-	-	-	3	2	2
19	-	-	-	-	-	1	2	-
20	-	-	-	-	-	1	-	-
21	-	-	-	-	-	-	-	-
22	-	-	-	-	-	-	-	-
23	-	-	-	-	-	-	-	-
24	-	-	-	-	-	-	-	-
Total	50	-	4	-	-	82	11	6
Percent	100.0	-	100.0	-	-	82.8	11.1	6.1
Group total	50		4			99		
Group percent	32.7		2.6			64.7		
Grand total	153							

Table 18 (con.).--Reproductive condition of female seals, by age and month, taken by U. S. research vessels in eastern Pacific in 1961

	April							
	Nulliparous		Primiparous			Multiparous		
				missed			missed	
Age	imm.	mat.	preg.	preg.	abort.	preg.	preg.	abort.
1	8	-	-	-	-	-	-	-
2	10	-	-	-	-	-	-	-
3	25	-	-	-	-	-	-	-
4	44	-	-	-	-	-	-	-
5	23	-	2	-	-	1	-	1
6	7	-	3	1	1	4	-	1
7	5	-	4	1	-	18	3	-
8	3	-	-	-	-	15	3	-
9	-	-	1	-	-	27	2	1
10	-	-	-	-	-	13	3	-
11	-	-	-	-	-	15	2	-
12	-	-	-	-	-	13	-	3
13	-	-	-	-	-	8	3	-
14	-	-	-	-	-	13	-	1
15	-	-	-	-	-	12	4	1
16	-	-	-	-	-	6	2	-
17	1	-	-	-	-	3	1	-
18	-	-	-	-	-	1	1	-
19	-	-	-	-	-	-	-	-
20	-	-	-	-	-	-	-	-
21	-	-	-	-	-	1	-	-
22	-	-	-	-	-	-	-	-
23	-	-	-	-	-	-	-	-
24	-	-	-	-	-	-	-	-
Total	126	-	10	2	1	150	24	8
Percent	100.0		76.9	15.4	7.7	82.4	13.2	4.4
Group total	126			13			182	
Group percent	39.3			4.0			56.7	
Grand total				321				

Table 18 (con.).--Reproductive condition of female seals, by age and month, taken by U. S. research vessels in eastern Pacific in 1961

	Combined							
	Nulliparous		Primiparous			Multiparous		
				missed			missed	
Age	imm.	mat.	preg.	preg.	abort.	preg.	preg.	abort.
1	29	-	-	-	-	-	-	-
2	17	-	-	-	-	-	-	-
3	84	-	-	-	-	-	-	-
4	93	1	1	-	-	-	1	-
5	51	3	10	-	-	3	-	1
6	10	4	15	1	1	30	-	1
7	8	1	15	7	-	59	7	-
8	4	-	4	-	1	78	18	-
9	-	1	2	1	-	101	5	4
10	-	-	1	-	1	102	7	1
11	-	-	-	-	-	72	9	1
12	-	-	-	-	-	60	5	6
13	-	-	-	-	-	62	13	1
14	-	-	-	-	-	61	5	1
15	-	-	-	-	-	51	14	3
16	-	-	-	-	-	46	8	1
17	1	-	-	-	-	15	8	-
18	2	-	-	-	-	13	7	3
19	-	-	-	-	-	5	5	-
20	-	-	-	-	-	7	-	-
21	-	-	-	-	-	1	1	-
22	-	-	-	-	-	-	-	-
23	-	-	-	-	-	-	1	-
24	-	-	-	-	-	-	1	-
Total	299	10	48	9	3	766	115	23
Percent	96.8	3.2	80.0	15.0	5.0	84.8	12.7	2.5
Group total	309		60			904		
Group percent	24.3		4.7			71.0		
Grand total	1273							

Table 19.--Pregnancy rate of seals taken by U. S. research vessels in eastern Pacific from 1958 to 1961

Age	Number females taken					Number pregnant					Percent pregnant				
(yrs.)	1958	1959	1960	1961	comb.	1958	1959	1960	1961	comb.	1958	1959	1960	1961	comb.
1 1/	34	15	14	29	92										
2 1/	4	34	4	17	59										
3	39	43	18	84	184	1	-	-	-	1	2.6	-	-	-	0.5
4	42	93	36	96	267	1	6	1	1	9	2.4	6.4	2.8	1.0	3.4
5	70	114	55	68	307	32	64	27	14	137	45.7	56.1	49.1	20.6	44.6
6	99	118	45	62	324	80	91	36	47	254	80.8	77.1	80.0	75.8	78.4
7	103	143	66	95	407	92	109	52	72	325	89.3	76.2	78.8	75.8	79.9
8	102	164	105	107	478	91	142	90	85	408	89.2	86.6	85.7	79.4	85.4
9	81	108	144	114	447	78	96	133	107	414	96.3	88.9	92.4	93.9	92.6
10	97	96	129	112	434	85	82	118	105	390	87.6	85.4	91.5	93.8	89.9
11	113	98	136	82	429	104	88	124	73	389	92.0	89.8	91.2	89.0	90.7
12	134	76	106	71	387	110	67	96	66	339	82.0	88.2	90.6	93.0	87.6
13	110	56	120	76	362	91	50	105	63	309	82.7	89.3	87.5	82.9	85.4
14	92	70	107	67	336	75	59	86	62	282	81.5	84.3	80.4	92.5	83.9
15	71	87	67	68	293	56	77	56	54	243	78.9	88.5	83.6	79.4	82.9
16	56	69	53	55	233	44	52	38	47	181	78.6	75.4	71.7	85.5	77.7
17	36	36	46	24	142	20	29	31	15	95	55.6	80.6	67.4	62.5	66.9
18	22	27	23	25	97	13	23	19	16	71	59.1	85.2	82.6	64.0	73.2
19	14	16	19	10	59	4	13	11	5	33	28.6	81.3	57.9	50.0	55.9
20	3	5	6	7	21	1	2	1	7	11	33.3	40.0	16.7	100.0	52.4
21	1	7	6	2	16	1	6	3	1	11	100.0	85.7	50.0	50.0	68.8
22	1	5	-	-	6	-	2	-	-	2	-	40.0	-	-	33.3
23	-	1	1	1	3	-	-	-	-	-	-	-	-	-	-
24	-	1	1	1	3	-	-	-	-	-	-	-	-	-	-
25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
26	-	1	-	-	1	-	-	-	-	-	-	-	-	-	-
Total	1286	1434	1289	1227	5236	979	1058	1027	840	3904	76.1	73.8	79.7	68.5	74.6

1/ Immature female seals, not included in pregnancy computations.

Table 20.--Summary of reproductive condition of female seals by age and month, taken by U. S. research vessels in eastern Pacific in 1961

Age	Nonpregnant			Pregnant	
	nulli-parous	primi-parous	multi-parous	primi-parous	multi-parous
			December, 1960		
1	-	-	-	-	-
2	-	-	-	-	-
3	-	-	-	-	-
4	1	-	-	-	-
5	-	-	-	-	-
6	-	-	-	-	-
7	-	-	-	-	1
8	-	-	-	-	-
9	-	-	-	-	-
10	-	-	-	-	-
11	-	-	-	-	-
12	-	-	-	-	-
13	-	-	-	-	-
14	-	-	-	-	-
15	-	-	-	-	-
16	-	-	-	-	1
17	-	-	-	-	-
18	-	-	-	-	-
19	-	-	-	-	-
20	-	-	-	-	-
21	-	-	-	-	-
22	-	-	-	-	-
23	-	-	-	-	-
24	-	-	-	-	-
Total	1	-	-	-	2
Grand total			3		

Table 20 (con.).--Summary of reproductive condition of female seals, by age and month, taken by U. S. research vessels in eastern Pacific in 1961

Age	Nonpregnant			Pregnant	
	nulli-parous	primi-parous	multi-parous	primi-parous	multi-parous
			January		
1	10	-	-	-	-
2	2	-	-	-	-
3	27	-	-	-	-
4	19	-	-	1	-
5	14	-	-	4	2
6	-	-	-	3	10
7	1	3	3	3	24
8	-	-	10	4	32
9	1	1	3	1	39
10	-	-	1	1	44
11	-	-	3	-	29
12	--	-	2	-	23
13	-	-	7	-	25
14	-	-	3	-	24
15	-	-	6	-	22
16	-	-	3	-	11
17	-	-	5	-	4
18	-	-	2	-	6
19	-	-	1	-	2
20	-	-	-	-	2
21	-	-	1	-	-
22	-	-	-	-	-
23	-	-	1	-	-
24	-	-	-	-	-
Total	74	4	51	17	299
Grand total			445		

Table 20 (con.).--Summary of reproductive condition of female seals, by age and month, taken by U. S. research vessels in eastern Pacific in 1961

Age	Nonpregnant			Pregnant	
	nulli-parous	primi-parous	multi-parous	primi-parous	multi-parous
			February		
1	2	-	-	-	-
2	-	-	-	-	-
3	17	-	-	-	-
4	16	-	1	-	-
5	13	-	-	2	-
6	5	-	-	9	12
7	3	3	1	6	15
8	1	-	5	1	26
9	-	-	-	-	32
10	-	-	1	1	34
11	-	-	3	-	18
12	-	-	3	-	23
13	-	-	2	-	17
14	-	-	2	-	15
15	-	-	3	-	13
16	-	-	1	-	22
17	-	-	2	-	5
18	1	-	2	-	4
19	-	-	2	-	2
20	-	-	-	-	4
21	-	-	-	-	-
22	-	-	-	-	-
23	-	-	-	-	-
24	-	-	1	-	-
Total	58	3	29	19	242
Grand total			351		

Table 20 (con.).--Summary of reproductive condition of female seals, by age and month, taken by U. S. research vessels in eastern Pacific in 1961

Age	Nonpregnant			Pregnant	
	nulli-parous	primi-parous	multi-parous	primi-parous	multi-parous
			March		
1	9	-	-	-	-
2	5	-	-	-	-
3	15	-	-	-	-
4	14	-	-	-	-
5	4	-	-	2	-
6	2	-	-	-	4
7	-	-	-	-	1
8	-	-	-	2	5
9	-	-	-	-	6
10	-	-	2	-	12
11	-	-	1	-	11
12	-	-	-	-	4
13	-	-	1	-	13
14	-	-	-	-	9
15	-	-	1	-	6
16	-	-	2	-	7
17	-	-	-	-	3
18	1	-	2	-	5
19	-	-	2	-	1
20	-	-	-	-	1
21	-	-	-	-	-
22	-	-	-	-	-
23	-	-	-	-	-
24	-	-	-	-	-
Total	50	-	11	4	88
Grand total			153		

Table 20 (con.). --Summary of reproductive condition of female seals, by age and month, taken by U. S. research vessels in eastern Pacific in 1961

Age	Nonpregnant			Pregnant	
	nulli-parous	primi-parous	multi-parous	primi-parous	multi-parous
			April		
1	8	-	-	-	-
2	10	-	-	-	-
3	25	-	-	-	-
4	44	-	-	-	-
5	23	-	-	2	2
6	7	1	-	4	5
7	5	1	3	4	18
8	3	-	3	-	15
9	-	-	2	1	28
10	-	-	3	-	13
11	-	-	2	-	15
12	-	-	-	-	16
13	-	-	3	-	8
14	-	-	-	-	14
15	-	-	4	-	13
16	-	-	2	-	6
17	1	-	1	-	3
18	-	-	1	-	1
19	-	-	-	-	-
20	-	-	-	-	-
21	-	-	-	-	1
22	-	-	-	-	-
23	-	-	-	-	-
24	-	-	-	-	-
Total	126	2	24	11	158
Grand total			321		

Table 20 (con.).--Summary of reproductive condition of female seals, by age and month, taken by U. S. research vessels in eastern Pacific in 1961

Age	Nonpregnant			Pregnant	
	nulli-parous	primi-parous	multi-parous	primi-parous	multi-parous
			Combined		
1	29	-	-	-	-
2	17	-	-	-	-
3	84	-	-	-	-
4	94	-	1	1	-
5	54	-	-	10	4
6	14	1	-	16	31
7	9	7	7	13	59
8	4	-	18	7	78
9	1	1	5	2	105
10	-	-	7	2	103
11	-	-	9	-	73
12	-	-	5	-	66
13	-	-	13	-	63
14	-	-	5	-	62
15	-	-	14	-	54
16	-	-	8	-	47
17	1	-	8	-	15
18	2	-	7	-	16
19	-	-	5	-	5
20	-	-	-	-	7
21	-	-	1	-	1
22	-	-	-	-	-
23	-	-	1	-	-
24	-	-	1	-	-
Total	309	9	115	51	789
Grand total			1273		

Anomalies

Each year since 1958, one or more seals carrying twins were collected, as shown below:

Year of collection	Number of seals	Uterine horn	Sex of fetuses
1958	1	L, R	F, F
1959	2	L	M, F
		L	M, F
1960	1	L, R	M, F
1961	1	L	M, F

Twin seals appear to be more common than was considered to be true before the beginning of extensive pelagic collecting. The difficulty in the past has been to recognize twins on the breeding grounds. Probably only one pup usually survives.

Fetal Sex Ratio and Uterine Horn of Pregnancy

As shown in the text table below the female fetuses are slightly more numerous than males. The deviation in the sex ratio from 50:50 is not significant and the sexes can be considered as equal in estimating fetuses or pups.

Pregnancies occur more frequently in the left uterine horn (see table) but the difference between the right and left horns is slight. When the data for each year are treated separately only data for 1958 showed a significantly higher pregnancy rate in the left horn. In the combined data for 4 years (1958-61) the tendency for pregnancies to occur more frequently in the left horn is significant.

	Percent of pregnancies		Percent of fetus sex	
Date	left horn	right horn	male	female
1958	53.5	46.5	52.4	47.6
1959	51.2	48.8	48.9	51.1
1960	52.3	47.7	46.9	53.1
1961	52.2	47.8	48.0	52.0

Food Habits

The fur seal has a cosmopolitan taste, apparently taking almost indiscriminately fish and squid that happen to be available. Stomach analyses indicate a possible preference for the smaller schooling fishes and for squid, although this tendency may be a result of availability and abundance rather than preference.

In 1961, 27 species of fish, 1 species of octopus, and 5 species of squid were identified in fur seal stomachs.

The fur seal has been described as primarily a night and early morning feeder. This has been determined from observations at sea and from stomach examinations. Graphs have been made to illustrate feeding time by showing the degree of fullness of stomachs in relation to time of day (figs. 7 and 8). Generally the number of stomachs containing food is greatest early in the morning; there is a decline until late afternoon when an increase is sometimes shown. Exceptions to this general condition occur, however. In areas where fish that remain in the upper water layers in daylight are abundant seals will sometimes be found actively feeding throughout the day. Observations made in 1961 on time of feeding do not differ materially from those made in previous years.

In several locations along the coast from California to British Columbia, fur seals are taken in relatively shallow water (100 fathoms or less), and in these locations food species that normally occur on or near the bottom are occasionally found in fur seal stomachs. Bottom species sometimes constitute a considerable percent of the food of the fur seal taken in these areas, but when compared in quantity with food species utilized over the entire range of the collection their importance is negligible.

Water temperature affects the fur seal only indirectly. The fact that water temperature influences the distribution of fish has some affect on the distribution of the fur seal in its winter range. During the course of the 1961 pelagic season, the surface water temperatures encountered ranged from 4° to 8°C. off the British Columbia coast to 10° to 14°C. off the California coast.

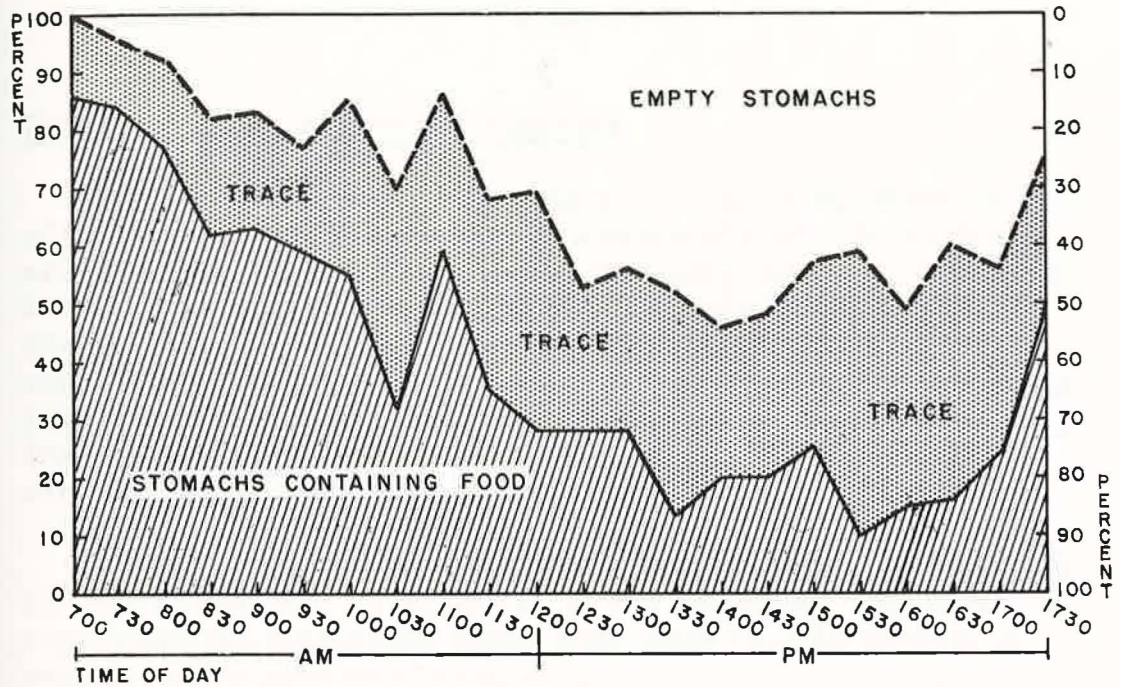

Figure 7. --The percentage of seal stomachs containing a measureable amount of food, and no food, in relation to the time of day in which they were collected, California, 1961.

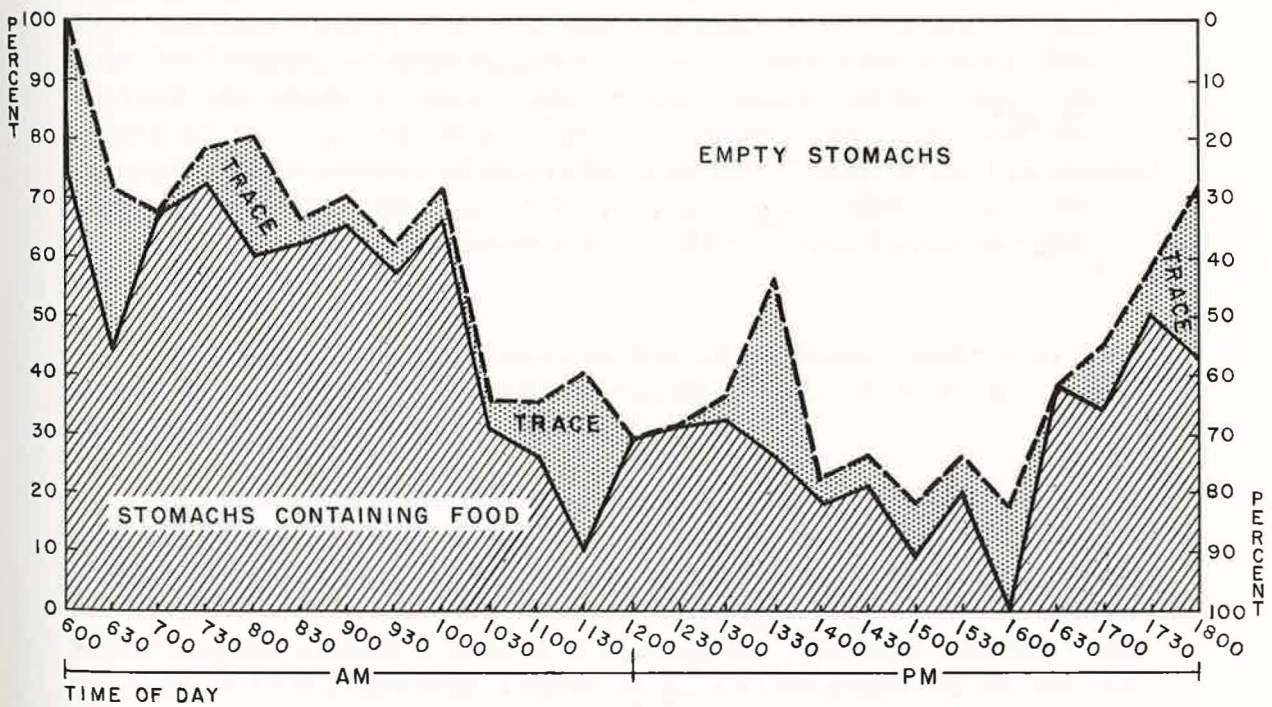

Figure 8. --The percentage of seal stomachs containing a measureable amount of food, and no food, in relation to the time of day in which they were collected, Washington, 1961.

General Account of Stomach Contents

Stomachs from 1,349 seals were examined. Sixty percent of the stomachs contained food or a trace of food. In the four areas the percentage of stomachs containing food is: California 66.7, Oregon 89.7, Washington 48.2, and British Columbia 47.9. The percentages for California and Washington do not differ appreciably from those obtained in 1959. The size of the Oregon collection is too small for the percentage of stomachs containing food to have any significance. British Columbia waters were sampled for the first time in 1961.

The stomach contents of these animals are shown in table 21, and in tables 3, 4, 5, and 6 of the appendix. Figure 8 represents the major food items from each area by percent of volume and by percent of frequency.

The feeding habits of the fur seal in California waters are relatively constant, although the degree to which any particular food fish is utilized varies from year to year. In 1961 the four leading food items by volume were: squid 41.1 percent, anchovy 29.7 percent, saury 13.3 percent and hake 7.1 percent. These four food items, considering the squids as one item rather than as separate species, also made up the majority of food found in stomachs in 1958 and 1959. Squid, anchovy, and hake composed an appreciable amount of the volume of food found in seal stomachs collected off California in 1952 (Taylor et al., 1955). The 1961 sample from California totaled 847; 565 contained food and 282 were empty.

Twenty-nine seals were collected in Oregon waters in 1961 and of these, 26 had stomachs containing food. The sample size is too small to be of any significant value.

Seals collected off Washington contained the usual food species found in other years with the exception of anchovy, which this year made up 37.6 percent of the total food by volume. Most anchovy were found in stomachs of seals collected off the Columbia River and the southern part of Washington. Anchovy was not found in 1958 or 1959, although Taylor et al. (1955) reported its occurrence in one stomach from Washington waters in 1952. It is probable

Table 21.--Analysis of the contents of seal stomachs collected in waters off California, Oregon, Washington, British Columbia, and Southeastern Alaska in 1961 by percent of total volume and frequency of occurrence

Food items	Volume (cc)	Percent of vol.	Frequency	Frequency of trace 1/
California				
21 November-14 December; 5 January-12 April				
Spiny dogfish (Squalus acanthias)	532	0.2	1	-
American shad (Alosa sapidissima)	2144	1.0	4	1
Pacific herring (Clupea harengus pallasi)	2001	1.0	4	1
Northern anchovy (Engraulis mordax)	64963	29.7	90	3
Salmon (Oncorhynchus spp.)	624	0.3	1	-
Lanternfishes, Myctophidae	211	0.1	16	8
Lanternfish (Tarletonbeania crenularis)	1346	0.6	9	-
Pacific saury (Cololabis saira)	29224	13.3	97	20
Pacific hake (Merluccius productus)	15601	7.1	27	6
Jack mackerel (Trachurus symmetricus)	2135	1.0	13	10
Halfmoon (Medialuna californiensis	44	-	1	-
Rockfishes (Sebastodes spp.)	4720	2.1	2	-
Shortbelly rockfish (Sebastodes jordani)	1295	0.6	1	-
Jacksmelt (Atherinopsis californiensis)	1235	0.6	3	1
Slender sole (Lyopsetta exilis)	147	0.1	2	1
Northern midshipman (Porichthys notatus)	159	0.1	1	-
Unidentified fish	2321	1.1	52	38
Octopus (Tremoctopus sp.)	70	-	28	26
Squid (Loligo opalescens)	24845	11.4	55	16
" (Onychoteuthis sp.)	59453	27.2	280	137
" (Abraliopsis sp.)	1326	0.6	14	9
" , Gonatidae	93	-	100	93
" (Gonatopsis sp.)	378	0.2	27	23
" , unidentified	3655	1.7	165	148
Kelp	trace	-	1	1
	218522	100.0		
Stomachs containing food			565	
Empty stomachs			282	
Missing stomachs			0	
Total stomachs collected			847	

1/ Times the food item occurred as only a trace--included in frequency totals. (Trace = No volume measured, usually only a few bones, or

Table 21(con.)--Analysis of the contents of seal stomachs collected in waters off California, Oregon, Washington, British Columbia, and Southeastern Alaska in 1961 by percent of total volume and frequency of occurrence

Food items	Volume (cc)	Percent of vol.	Frequency	Frequency of trace 1/
	Oregon 13-15 April			
Pacific lamprey (Lampetra tridentata)	70	0.3	1	-
American shad	1050	4.2	1	-
Pacific herring	530	2.1	1	-
Northern anchovy	14990	60.3	10	-
Salmon (Oncorhynchus spp.)	140	0.6	1	-
Pacific hake	trace	-	1	1
Rockfishes	8005	32.2	10	3
Slender sole	65	0.3	1	-
Unidentified fish	trace	-	1	1
Squid (Loligo opalescens)	trace	-	1	1
" , Gonatidae	trace	-	1	1
" , unidentified	trace	-	1	1
	24850	100.0		

Stomachs containing food	26
Empty stomachs	3
Missing stomachs	0
Total stomachs collected	29

1/ See first page of this table.

Table 21 (con.)--Analysis of the contents of seal stomachs collected in waters off California, Oregon, Washington, British Columbia, and Southeastern Alaska in 1961 by percent of total volume and frequency of occurrence

Food items	Volume (cc)	Percent of vol.	Frequency	Frequency of trace[1]
Washington				
22 and 23 January; 21 March-25 April				
Pacific lamprey	438	0.5	5	2
American shad	4889	5.1	8	-
Pacific herring	16595	17.3	37	-
Northern anchovy	36089	37.6	58	-
Salmon (Oncorhynchus spp.)	1967	2.0	8	1
" , pink (O. gorbuscha)	1700	1.8	1	-
" , coho (O. kisutch)	3540	3.7	3	-
" , sockeye (O. nerka)	910	0.9	1	-
" , chinook (O. tshawytscha)	1010	1.1	2	-
Steelhead trout (Salmo gairdneri)	555	0.6	1	-
Surf smelt (Hypomesus pretiosus)	83	0.1	2	-
Capelin (Mallotus villosus)	1210	1.3	6	-
Eulachon (Thaleichthys pacificus)	1864	1.9	10	2
Pacific hake	308	0.3	1	-
Walleye pollock (Theragra chalcogrammus)	15	-	1	-
Rockfishes	18697	19.5	32	3
Widow rockfish (Sebastodes entomelas)	2174	2.2	2	-
Pacific sandlance (Ammodytes hexapterus)	1910	2.0	2	-
Unidentified fish	85	0.1	35	31
Squid (Loligo opalescens)	611	0.6	3	-
" (Onychoteuthis sp.)	1170	1.2	4	2
" , Gonatidae	trace	-	4	4
" (Gonatopsis sp.)	185	0.2	1	1
" , unidentified	trace	-	5	5
Isopoda, Asellota	5	-	1	-
Pebbles	trace	-	1	1
	96010	100.0		
Stomachs containing food			184	
Empty stomachs			198	
Missing stomachs			3	
Total stomachs collected			385	

1/ See first page of this table.

Table 21 (con.)--Analysis of the contents of seal stomachs collected in waters off California, Oregon, Washington, British Columbia, and Southeastern Alaska in 1961 by percent of total volume and frequency of occurrence

Food items	Volume (cc)	Percent of vol.	Frequency	Frequency of trace 1/
British Columbia 2/ 23 January-20 March				
Pacific herring	23125	81.9	27	1
Smelts, Osmeridae	trace	-	1	1
Surf smelt	210	0.7	1	-
Eulachon	281	1.0	2	-
Codfish and hake , Gadidae	20	0.1	2	-
Pacific cod (Gadus macrocephalus)	2450	8.7	4	-
Sablefish (Anoplopoma fimbria)	1440	5.1	2	-
Pacific sandlance	140	0.5	1	-
Unidentified fish	trace	-	3	3
Squid (Loligo opalescens)	390	1.4	6	3
" , Gonatidae	trace	-	1	1
" (Gonatus magister)	67	0.2	3	-
" , unidentified	52	0.2	6	5
Hermit crab (Pagurus sp.)	trace	-	1	1
Amphipoda, Gammaridea	trace	-	1	1
Pebbles	50	0.2	2	-
	28225	100.0		

Stomachs containing food	45
Empty stomachs	46
Missing stomachs	0
Total stomachs collected	91

1/ See first page of this table.

2/ Seals collected in Southeastern Alaska (5 animals, 1 stomach containing food, 4 stomachs empty) have been included in the British Columbia section.

Table 21 (con.)--Analysis of the contents of seal stomachs collected in waters off California, Oregon, Washington, British Columbia, and Southeastern Alaska in 1961 by percent of total volume and frequency of occurrence

Food items	Volume (cc)	Percent of vol.	Frequency	Frequency of trace 1/
Total combined areas				
Pacific lamprey	508	0.1	6	2
Spiny dogfish	532	0.1	1	-
American shad	8083	2.2	12	-
Pacific herring	42251	11.5	69	1
Northern anchovy	116042	31.6	158	3
Salmon, (Oncorhynchus spp.)	2731	0.7	10	1
" , pink (O. gorbuscha)	1700	0.5	1	-
" , coho (O. kisutch)	3540	1.0	3	-
" , sockeye (O. nerka)	910	0.2	1	-
" , chinook (O. tshawytscha)	1010	0.3	2	-
Steelhead trout	555	0.2	1	-
Smelt	trace	-	1	1
Surf smelt	293	0.1	3	-
Capelin	1210	0.3	6	-
Eulachon	2145	0.6	12	2
Lanternfishes, Myctophidae	211	0.1	16	8
Lanternfish (Tarletonbeania crenularis)	1346	0.4	9	-
Pacific saury	29224	7.9	97	20
Codfish and hake	20	-	2	-
Pacific cod	2450	0.7	4	-
Pacific hake	15909	4.3	29	7
Walleye pollock	15	-	1	-
Jack mackerel	2135	0.6	13	10
Halfmoon	44	-	1	-
Rockfishes	31422	8.5	44	6
Widow rockfish	2174	0.6	2	-
Shortbelly rockfish	1295	0.4	1	-
Sablefish	1440	0.4	2	-
Pacific sandlance	2050	0.6	3	-
Jacksmelt	1235	0.3	3	1
Slender sole	212	0.1	3	1
Northern midshipman	159	-	1	-

1/ See first page of this table.

Table 21 (con.)--Analysis of the contents of seal stomachs collected in waters off California, Oregon, Washington, British Columbia, and Southeastern Alaska in 1961 by percent of total volume and frequency of occurrence

Food items	Volume (cc)	Percent of vol.	Frequency	Frequency of trace[1]
Total combined areas (con.)				
Unidentified fish	2406	0.6	91	73
Octopus	70	-	28	26
Squid (Loligo opalescens)	25846	7.0	65	20
" (Onychoteuthis sp.)	60623	16.5	284	139
" (Abraliopsis sp.)	1326	0.4	14	9
" , Gonatidae	93	-	105	93
" (Gonatus magister)	67	-	3	-
" (Gonatopsis sp.)	563	0.2	28	24
" , unidentified	3707	1.0	177	154
Isopoda, Asellota	5	-	1	-
Hermit crab	trace	-	1	1
Amphipoda, Gammaridea	trace	-	1	1
Kelp	trace	-	1	1
Pebbles	50	-	3	1
	367607	100.0		
Stomachs containing food			820	
Empty stomachs			529	
Missing stomachs			3	
Total stomachs collected			1,352	

1/ See first page of this table.

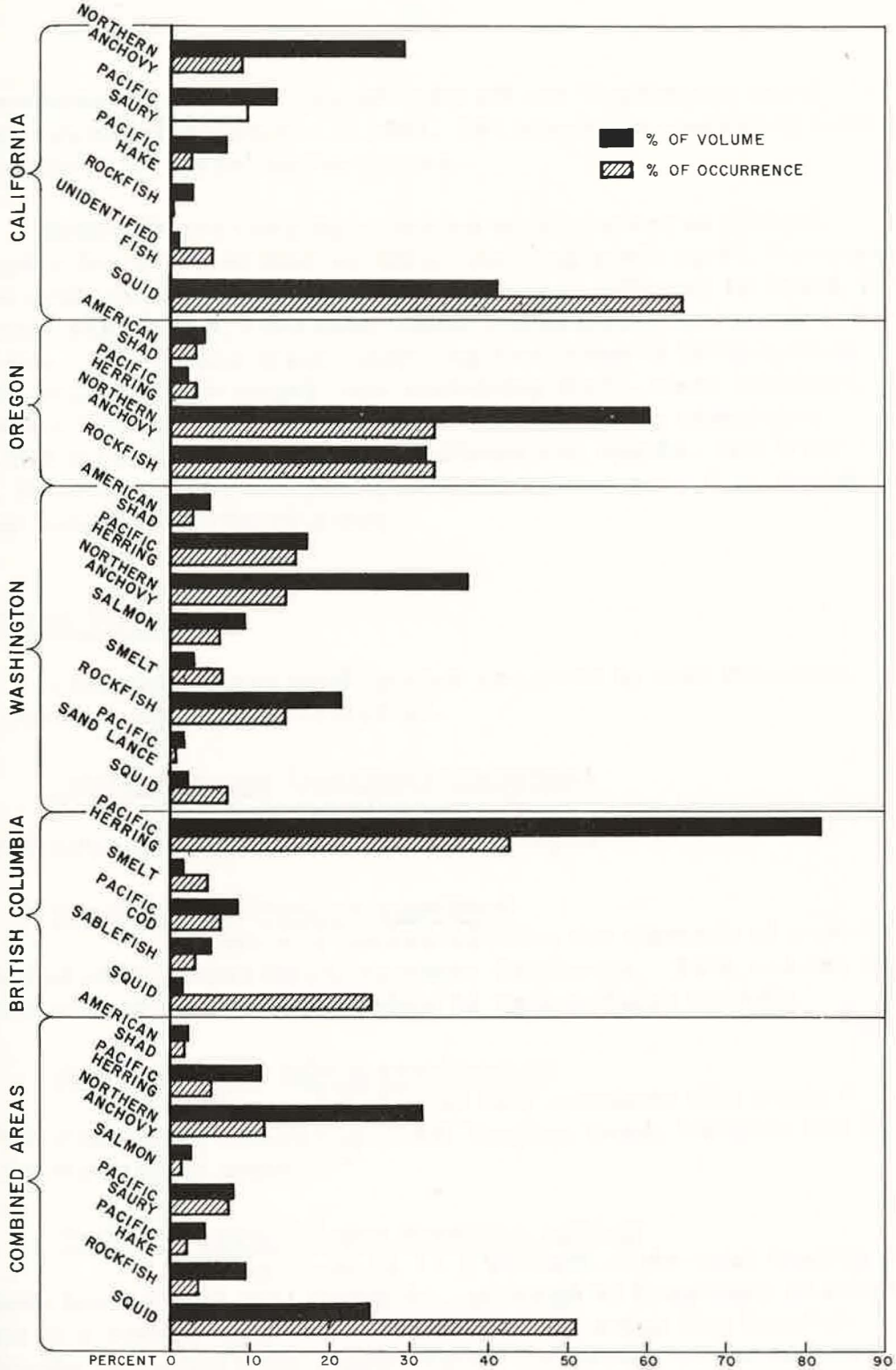

Figure 9.--Comparative volume and frequency of occurrence of the principal food species of fur seals in 1961, by area.

that anchovy occurs only sporadically off the Washington coast at this season of the year. In 1961, 184 stomachs containing food were collected in Washington waters.

United States vessels collected in the waters of British Columbia for the first time in 1961. Herring made up 81.9 percent of the total volume of food found in stomachs, followed by cod 8.7 percent, sablefish 5.1 percent, squid 1.8 percent, and smelt 1.7 percent. Ninety-one seals, including five taken in Southeastern Alaska waters (four empty, one containing food), were collected; 45 with stomachs containing food and 46 with empty stomachs. With three exceptions (one from Southeastern Alaska, two from area B) all stomachs containing food were from area D as designated by the Canadian research group.

Individual Food Items

Locations where food species occurred in seal stomachs are shown in figures 10 through 15.

Pacific lamprey (Lampetra tridentata)

Lamprey remains were found in six stomachs, five from Washington waters and one from Oregon.

Spiny dogfish (Squalus acanthias)

Dogfish was recovered from the stomach of a seal collected off Trinidad Head, northern California. This was the first record of dogfish from seals taken by United States vessels.

American shad (Alosa sapidissima)

Shad was found in 13 seal stomachs this year; 4 off San Francisco, California; 1 off Yaquina Head, Oregon; and 8 off the Washington coast.

Pacific herring (Clupea harengus pallasi)

Herring made up 11.5 percent of the total food by volume found in fur seal stomachs, although by frequency of occurrence this amounted to only 5.2 percent. Herring was found in stomachs collected from Pigeon Point, California on the south, north to Southeastern Alaska. Most occurrences were off the Washington coast, where the majority of seals collected were taken in April.

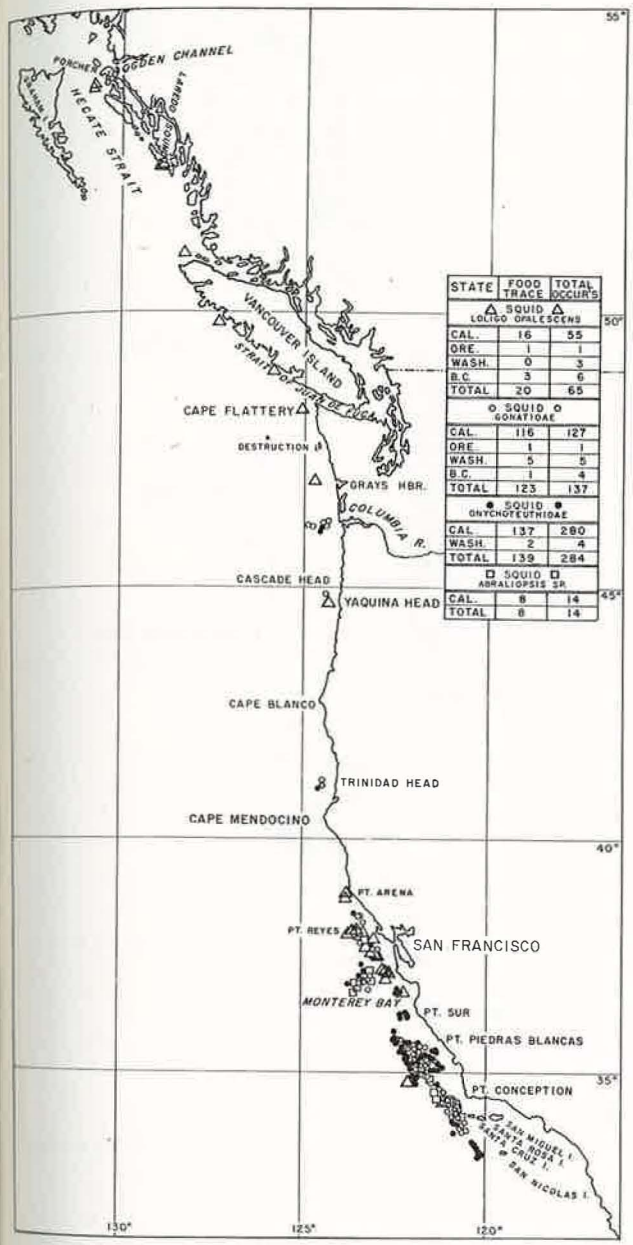

Figure 10. --Locations where squid (Loligo opalescens, Gonatidae Onychoteuthidae, and Abraliopsis) occurred in seal stomachs collected in 1961.

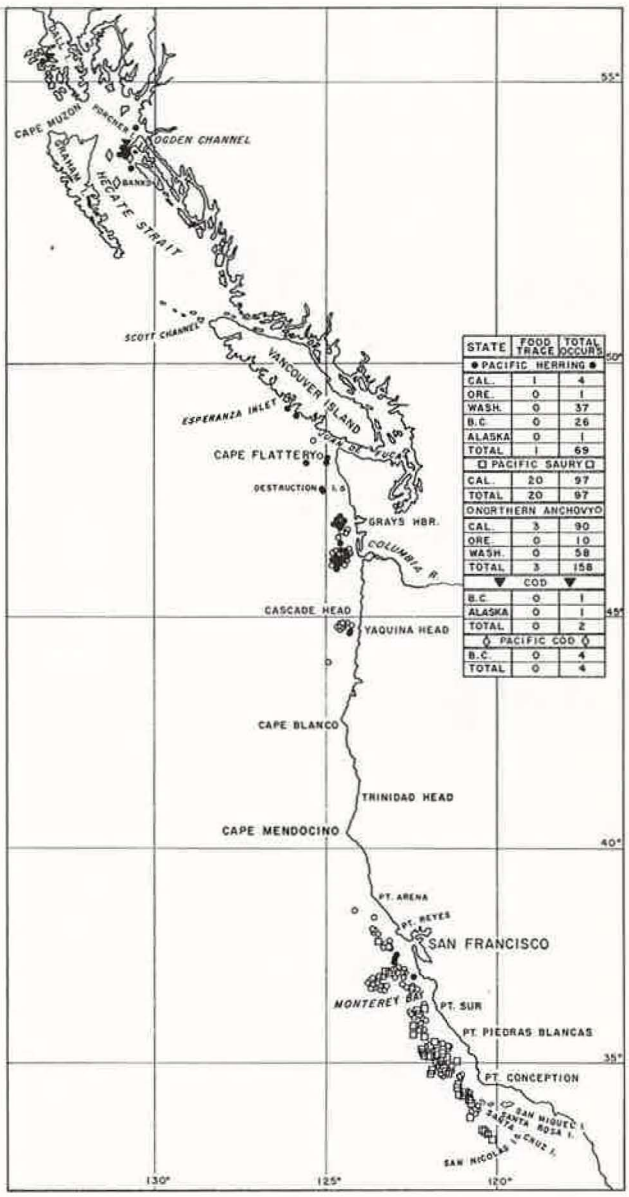

Figure 11. --Locations where Pacific herring, Pacific saury, northern anchovy, Pacific cod, and unidentified cod occurred in seal stomachs collected in 1961.

(Food traces are defined as an unmeasured volume, usually a few bones, vertebrae, or otoliths (pens, beaks, or eye lenses of squid).)

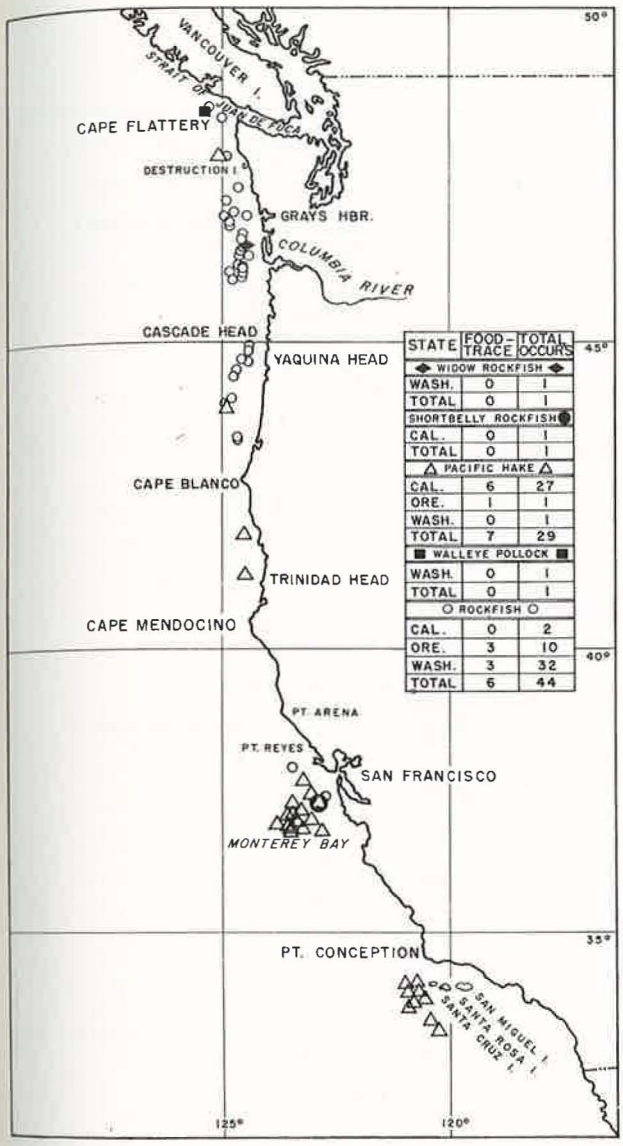

Figure 12. --Locations where widow rockfish, shortbelly rockfish, rockfishes, Pacific hake, and walleye pollock occurred in seal stomachs collected in 1961.

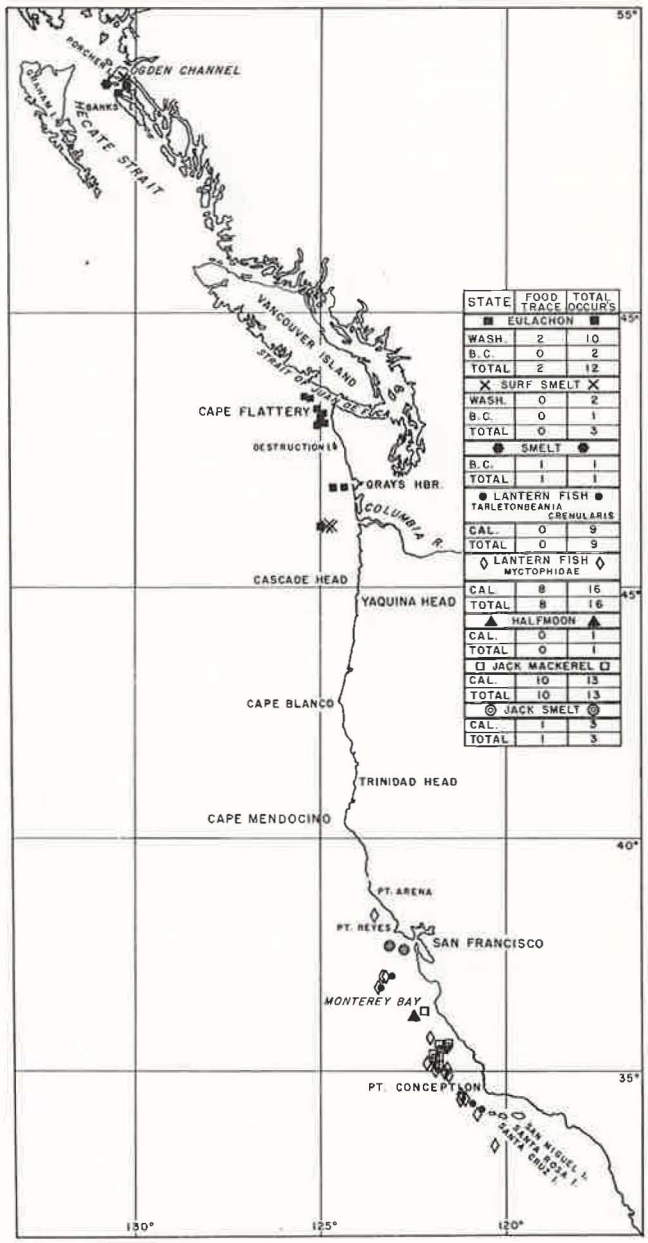

Figure 13. --Locations where eulachon, surf smelt, smelt, lanternfishes, halfmoon, jack mackerel, and jack smelt occurred in seal stomachs collected in 1961.

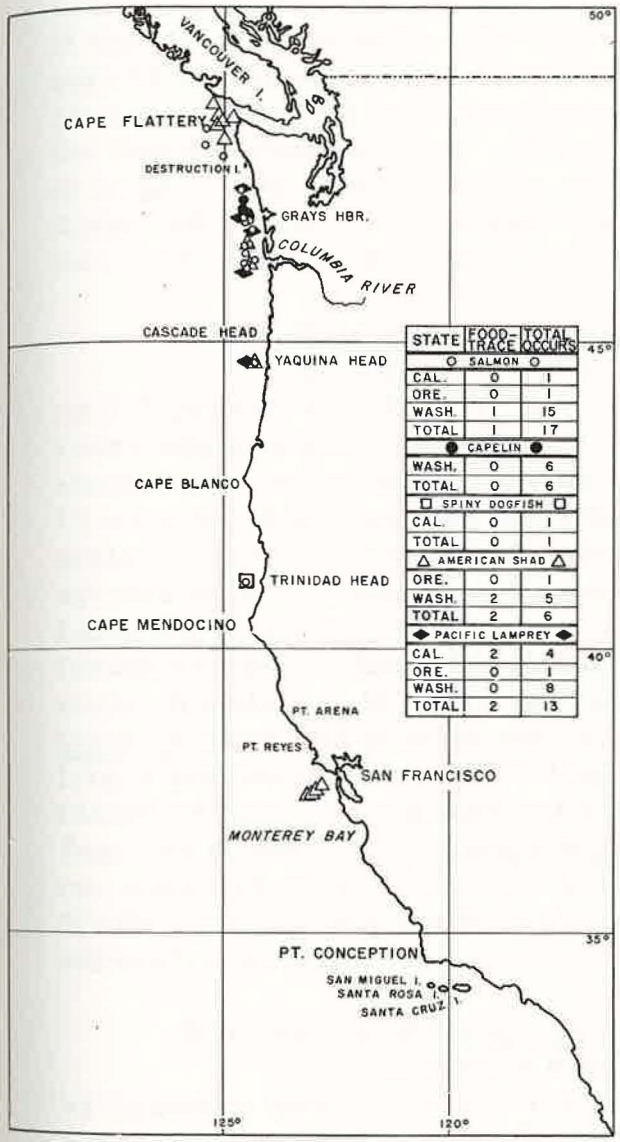

Figure 14. --Locations where salmon, capelin, spiny dogfish, American shad, and Pacific lamprey occurred in seal stomachs collected in 1961.

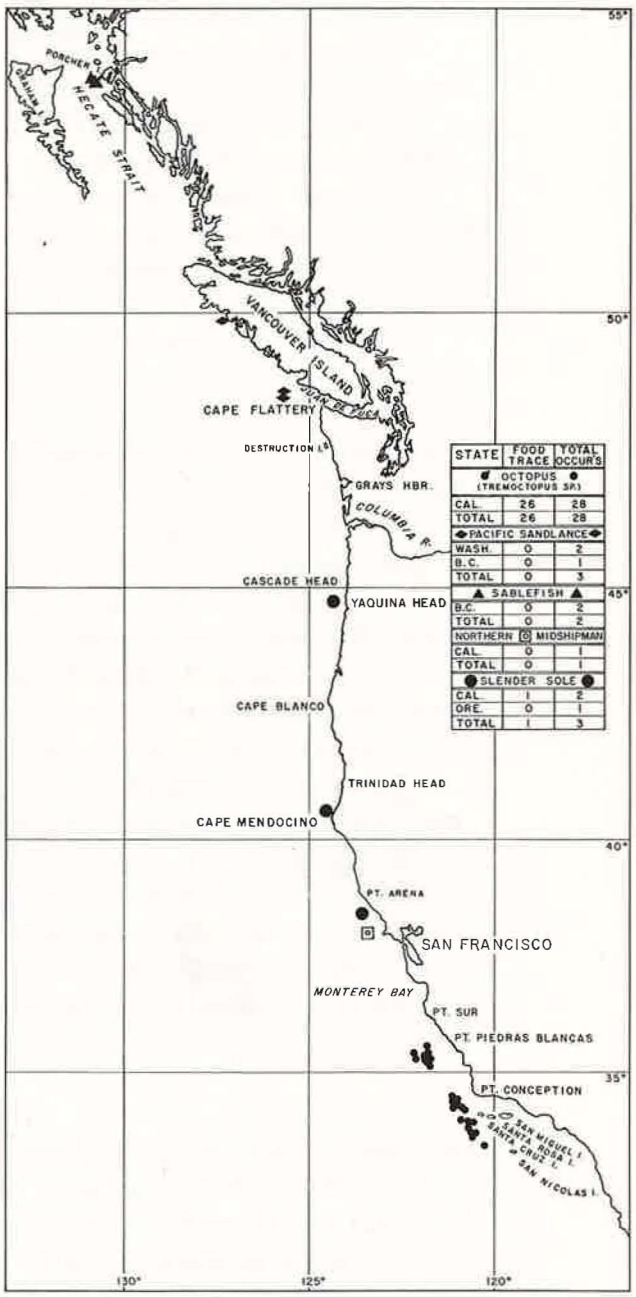

Figure 15. --Locations where octopus, Pacific sandlance, sablefish, northern midshipman, and slender sole occurred in seal stomachs collected in 1961.

Northern anchovy (Engraulis mordax)

This species ranked first in importance by total volume of food in 1961, comprising 31.6 percent of the total volume of the stomach contents. By frequency of occurrence it made up only 12.0 percent of total occurrences. Anchovy was found in seal stomachs collected from the Channel Islands, California north to the Strait of Juan de Fuca. Of particular interest was the occurrence of large numbers of anchovy in stomachs collected off the Columbia River and southern Washington coast. Anchovy was not as plentiful this year in the waters south of Point Sur, California as in 1959.

Salmon (Oncorhynchus spp.)

Salmon were found in 17 stomachs in 1961, making up 2.7 percent by volume of the total stomach contents. One occurrence was in a stomach collected off Trinidad Head, California; another was collected off Yaquina Head, Oregon. The remaining 15 were found in stomachs collected off the coast of Washington. Scale samples were saved when found, and these were identified to species by Mr. Kenneth H. Mosher of the Seattle Biological Laboratory, Bureau of Commercial Fisheries. Seven salmon were identified: pink salmon (O. gorbuscha) was identified from one stomach collected 38 miles southwest of Cape Flattery; coho (O. kisutch) was found in three stomachs, one collected off Destruction Island and two collected off Willapa Bay; sockeye (O. nerka) was identified once in a stomach collected 23 miles WSW. of Willapa Bay; and chinook (O. tshawytscha) was identified in two stomachs, one collected off Pt. Grenville and one off Grays Harbor. In Washington, salmon made up 9.5 percent of total volume of the stomach contents.

Steelhead trout (Salmo gairdneri)

Steelhead have been reported from fur seal stomachs by Canadian investigators, but this year was the first in which it appeared in the United States collections. A steelhead was found in the stomach of a seal collected west of the Columbia River mouth. Identification was made from scale samples by K. H. Mosher.

Smelts (Osmeridae)

Smelts occurred in 22 stomachs collected in Washington and British Columbia waters. One occurrence was identifiable only to family Osmeridae. The surf smelt (Hypomesus pretiosus) occurred

in three stomachs. Capelin (Mallotus villosus) was found in six stomachs collected off Grays Harbor, Washington. Capelin, one of the most important food species in Alaskan waters, has not been recorded from fur seal stomachs collected in Washington waters until this year. Eulachon (Thaleichthys pacificus) was found in 10 stomachs collected in Washington waters and in 2 from the waters of British Columbia.

Lanternfishes (Myctophidae)

Lanternfishes were found in the stomachs of 25 fur seals collected in the waters between San Nicolas Island and Point Arena, California. In 9 of the 25 stomachs the remains were complete enough to be identified as Tarletonbeania crenularis. Twenty nightlight stations were fished in this area; T. crenularis was caught at 15 of these stations.

Pacific saury (Cololabis saira)

Saury ranked fifth in importance as a seal food in this year's collection, and in California it was the third most important species. It was found in 97 seal stomachs collected between Point Reyes and San Nicolas Island, California.

Codfish and Hake (Gadidae)

Members of this family were found over the entire range of the collection. Gadidae, identifiable only to family, occurred in two stomachs; one collected in British Columbia waters, and one collected off Southeastern Alaska. The Pacific cod (Gadus macrocephalus) was found in four stomachs collected in Hecate Strait, British Columbia. It was the second most important food species in British Columbia, making up 8.7 percent of the total food by volume. Pacific hake (Merluccius productus) was found in 27 stomachs from California, 1 stomach from Oregon, and 1 stomach from Washington. In California it was the fourth most important food species, making up 7.1 percent of the total food by volume. The walleye pollock (Theragra chalcogrammus) was found in one stomach taken off the Strait of Juan de Fuca, Washington. This is the first time since 1952 that pollock has been identified from fur seal stomachs taken in Washington waters.

Jack mackerel (Trachurus symmetricus)

Jack mackerel occurred in 13 seal stomachs collected between Point Sur and Point Arguello, California. It was not as important a food species this year as it was in 1958 and 1959.

Halfmoon (Medialuna californiensis)

Halfmoon was found in one stomach collected off Point Sur, California.

Rockfishes (Sebastodes spp.)

Rockfishes ranked fourth in importance as a food item in 1961, representing 9.5 percent of the total food by volume. When seals are collected in shallow water (100 fathoms or less) rockfishes are commonly found in their stomachs. Because of the seals' habit of discarding the head of larger fishes, identification of Sebastodes to species is difficult. Rockfishes were found in seal stomachs collected from Point Montara, California north to the Strait of Juan de Fuca, Washington. The widow rockfish (S. entomelas) was identified in one stomach collected off Grays Harbor, Washington. Shortbelly rockfish (S. jordani) was identified in one stomach collected off Point Montara, California.

Sablefish (Anoplopoma fimbria)

Small sablefish were found in two stomachs collected in Hecate Strait, British Columbia. Sablefish represented 5.1 percent of total food volume in British Columbia.

Pacific sandlance (Ammodytes hexapterus)

Sandlance was found in three stomachs; one collected off Kyuquot Sound, west coast of Vancouver Island, British Columbia; and two in Washington waters off the Strait of Juan de Fuca.

Jacksmelt (Atherinopsis californiensis)

Jacksmelt occured in three stomachs collected off San Francisco.

Slender sole (Lyopsetta exilis)

Slender sole was identified in three stomachs, two from California and one from Oregon.

Northern midshipman (Porichthys notatus)

Midshipman was found in one stomach collected off Point Reyes, California.

Octopus (Tremoctopus sp.)

This small pelagic octopus was identified for the first time from fur seal stomachs. It was found in 28 stomachs collected from San Nicolas Island north to Point Piedras Blancas, California. It occurred as trace material in 26 stomachs, and as relatively complete specimens in 2 stomachs.

Squids (Decapoda)

Squids ranked second in importance as a food item in 1961, making up 25.1 percent of the total volume of food found in fur seal stomachs, and 51.2 percent by frequency of occurrence.

In California waters, squid (collectively) was the most important single food item, making up 41.1 percent of the total stomach contents. Squid appeared only as traces in the Oregon collection. In Washington, squid ranked in seventh place as a food item. Squid, by percent of total volume, ranked fifth in importance in British Columbia but by frequency of occurrence ranked second.

For the past three years squid identification has been the work of Mr. Thomas P. O'Brien. He died in an automobile accident on 24 June, at which time he had examined about half of the 1961 squid material. At that time he suspected the presence of two species of squid in the family Onychoteuthidae in the 1961 collection. In the present report, however, no attempt has been made to carry the identification past the family Onychoteuthidae. In working over material from the family Gonatidae, Mr. O'Brien was identifying certain squid as belonging to the genus Gonatopsis. After his death, material listed as Gonatopsis sp.? in preliminary drafts, has been designated as Gonatidae. Another type of Gonatid material consisting almost entirely of beaks, although probably Gonatus fabricii, has also been designated as Gonatidae. When more experience is gained in squid identification, the Gonatid material (mostly beaks) will be re-examined.

In the area between Point Arena and Cortez Bank 20 night-light stations were fished. Squids were caught at 13 stations.

Onychoteuthis fusiformis, Gonatus fabricii, and Gonatopsis sp. were identified by Mr. O'Brien from the catches. No Gonatus fabricii was identified in catches south of Pigeon Point.

Squids from four families (Loliginidae, Onychoteuthidae, Enoploteuthidae, and Gonatidae) were identified in the 1961 material.

The most important identified squid in 1958 and 1959, Loligo opalescens, dropped to second place in 1961. It was found from Point Conception, California, north to Hecate Strait, British Columbia, although it occurred most commonly from stomachs collected in the vicinity of San Francisco.

Squid belonging to the family Onychoteuthidae comprised over half of the total squid by volume found in seal stomachs in 1961. It made up 27.2 percent of the food items from California. It was found mainly in stomachs collected between San Nicolas Island and Point Sur, although it was also found in the collection from the San Francisco area. The northernmost collection of Onychoteuthids was made off the Columbia River, where it occurred in four stomachs.

An Enoploteuthid, Abraliopsis sp. was identified for the first time this year, although it had occurred in seal stomachs collected in 1959 and listed as unidentified squid. Abraliopsis sp. was identified in 14 seal stomachs collected between San Miguel Island and Point Reyes, California.

Members of the family Gonatidae made up less than 1 percent of the total volume of food collected in 1961. Most occurrences were identified only to family, although Gonatus magister was identified in 3 stomachs from Ogden Channel, British Columbia, and Gonatopsis sp. was identified 28 times. Gonatopsis sp. was found in one stomach collected off the Washington coast and the remainder were found in stomachs from California waters south of Point Reyes.

Unidentified squids, consisting primarily of traces, made up about 1 percent of the total food by volume occurring in seal stomachs.

Miscellaneous items

A small fragment of kelp was found in one stomach. An Isopod of the suborder Asellota was found in one stomach. Twelve amphipods of the suborder Gammaridea were found in one stomach. A hermit crab Pagurus sp. was found in one stomach. Pebbles were found in three stomachs.

Pebbles, rocks, shells, and various invertebrates are commonly picked up by the rockfishes and cods and the occurrence of these items in fur seal stomachs can probably, in most cases, be accounted for as having been originally in the stomach of a fish.

Relation of Fur Seals to Commercial Fisheries

At the present time, the fur seal cannot be considered a serious threat to the commercial fisheries off the coasts of California Oregon, and Washington.

In California waters, the only potentially valuable fish taken in sizable quantities by the fur seal was the anchovy. The pack of anchovy varies widely from year to year, being somewhat dependent on and related to the catch of sardines. In 1961 some 13,600 cases of anchovy were canned as compared to 615,900 cases of sardines (Commercial Fisheries Review, Vol. 23, No. 7, July 1961, p. 109). The anchovy is one of the basic food species preyed upon by other fish, birds, whales, porpoises, sea lions, and seals. At the present time, the consumption of anchovy by fur seals has a negligible effect upon the commercial fishing of the state of California.

The squid Loligo opalescens sometimes enters into the commercial catch of California, but utilization of the species is minor and at a different time of year than that in which fur seals are present off the coast. The various forms that feed on anchovy also feed on squids. There is little reason to single out the fur seal as a danger to the California squid fishery.

The fur seal is present off the Oregon coast primarily in migration and is not known to have any appreciable effect upon the commercial fisheries of Oregon.

The fur seals off the Washington coast are also a migrating population. In 1961, the first five food species, according to total volume, are or are potentially of value to the commercial fisheries of the state; however, at the present time only salmon and rockfish are being taken in any numbers. Because of the short period when seals are numerous off Washington, the take of salmon and rockfish in these waters is probably small.

Predators

No predation upon the fur seal was observed in 1961. A killer whale was collected SW. of the Farallon Islands. Stomach contents of the whale included fragments of elephant seal, California sea lion, and a small cetacean.

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Appendix A

DISTRIBUTION OF SEALS BY AGE AND DEGREE OF LATITUDE

Data were presented in 1959 (Niggol, Fiscus, and Wilke, 1959, Appendix B, p. 72-81) to illustrate the distribution of fur seals along the west coast of North America by age and degree of latitude. A brief resume of previous work along this coast, including range descriptions, sightings, and collections, was included.

The 1961 collection was made in the same area. The data are compared with those collected in 1959 in the following paragraphs. Appendix table 1 gives the age of seals collected in each degree of latitude, and also includes the average age for males, females, and both sexes combined, for each degree of latitude. Figure 16 shows the average age of seals collected in each degree of latitude (sexes are not separated) for the years 1958, 1959, and 1961. No adjustment has been made for sample size. The age of seals collected in 1961 from 51° to 55°N. have not been included in this figure. Appendix table 2 gives the number of seals collected, and the number of hunting days, by month, spent in each degree of latitude for the years 1958, 1959, and 1961.

In 1959 and 1961, collections were made south of 36°N. during the months of January (25 days), February (36 days), and March (4 days). In 1959, 55 percent of the seals collected in this area were 10 years old or older; in 1961, 50 percent were 10 years old or older. In 1959, 5 percent of the seals collected south of 36°N. were under 5 years of age; in 1961, 11 percent were under 5 years of age.

Townsend (1899, p. 252) states that there is an indication that adult females migrate farthest south, to the Santa Barbara Islands (northern Channel Islands), while the younger year classes reach the coast further northward on the Vancouver ground (Yaquina Bay to north end of Vancouver Island). This observation is verified by information obtained in 1959 and 1960 when it was found that about 90 percent of the animals collected south of 36°N. are 5 years old or older and that about 50 percent were 10 years old or older.

Appendix table 1
Ages of seals collected in 1961, by degree of latitude

Degree of lat. [1]	Age 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	Total	Avg. age	No. of males	Avg. age of males	No. of females	Avg. age of females
32°	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	1	8.0	-	-	1	8.0
33°	-	-	2	4(1)	4	1	4	11	11	9	6	5	8	6	5	4	1	3	1	1	87[2]	10.8	1	4.0	86	10.8
34°	-	-	9	3	8	8	13	17	16	20	8	12	10	14	11	4	5	3	1	-	162	10.1	-	-	162	10.1
35°	-	3(1)	26(1)	21	17	21	37	36	38	39	22	28	18	15	13	16	9	3	4	1	367	9.4	2	2.5	365	9.4
36°	-	5	16	11	7	10	1	3	3	3	6	-	6	1	1	3	-	2	-	-	78	6.9	-	-	78	6.9
37°	-	-	2	6	3	1	4	5	5	8	13	4	10	8	11	6	4	3	2	1	97[3]	11.8	-	-	97	11.8
38°	-	-	-	3	2	-	4	6	5	5	4	2	5	3	2	2	1	1	1	1	47	10.7	-	-	47	10.7
39°	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	1	8.0	-	-	1	8.0
40°	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	1	9.0	-	-	1	9.0
41°	-	-	-	1(1)	-	-	-	-	-	-	-	-	-	1	1	-	-	1	-	-	4	12.8	1	4.0	3	15.7
42°	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
43°	-	-	-	-	-	1	-	-	1	-	1	-	-	-	-	-	-	-	-	-	4[2]	11.8	-	-	4	11.8
44°	-	1(1)	2(2)	1	-	3	2	3	2	1	1	1	3	1	2	2	-	-	-	-	25	9.4	3	2.7	22	10.3
45°	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
46°	7(2)	17(9)	39(16)	42(7)	22(2)	13	23	10	19	16	14	9	7	11	15	8	1	5	1	-	279	7.4	36	2.9	243	8.1
47°	5(2)	3(3)	1(1)	6	3	1	2	6	5	1	1	4	1	1	-	1	1	-	-	-	42	7.0	6	1.8	36	7.9
48°	6(3)	5(3)	7(1)	6(1)	4	1	4	3	7	3	3	4	3	2	2	1	2	-	-	-	63	7.3	8	2.0	55	8.1
49°	2	-	-	1	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	4	4.0	-	-	4	4.0
50°	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1.0	-	-	1	1.0
51°	6(6)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6	1.0	6	1.0	-	-
52°	7(1)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	8	2.9	1	1.0	7	3.1
53°	13(6)	1(1)	2(1)	1	-	2	1	5	2	5	2	2	5	4	5	7	-	3	-	3	64[4]	10.1	8	1.4	56	11.3
54°	3(2)	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	1	-	-	5	6.4	2	1.0	3	10.0
55°	4(3)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	1.0	3	1.0	1	1.0
Total	54(25)	35(18)	106(22)	106(10)	70(2)	62	95	107	115	111	82	71	76	67	68	55	24	25	10	7	1350[5]	9.0	77	2.3	1273	9.4

Note: The number in parantheses to the right of a number indicates the number of males in that age group.

1/ A degree of latitude is defined as 00' to and including 59'.
2/ Includes one 21-year-old seal.
3/ Includes one 23-year-old seal.
4/ Includes one 24-year-old seal.
5/ 1350 + 2 (unknown age) = 1352, and includes two 21-year-old, one 23-year-old, and one 24-year-old seals.

Appendix table 2
Number of seals collected, and number of hunting days per month in each degree of latitude in 1958, 1959, and 1961

Year	Degree of latitude 44°	45°	46°	47°	48°	49°	50°	51°	52°	53°	54°	55°
Number of seals collected												
1961	25	-	279	42	63	4	1	6	8	64	5	4
1959	27	11	69	85	73	-	-	-	-	-	-	-
1958	11	18	26	20	38	-	-	-	-	-	-	-
Number of days when seals were hunted												
December												
1960[1/]	-	-	-	-	-	-	-	-	-	-	-	-
January												
1961	-	-	-	-	-	2	1	1	1	2	-	-
1959	-	1	1	-	-	-	-	-	-	-	-	-
1958	-	-	-	-	-	-	-	-	-	-	-	-
February												
1961	-	-	-	-	-	-	-	1	1	3	1	-
1959	-	-	-	-	-	-	-	-	-	-	-	-
1958	-	-	-	-	1	-	-	-	-	-	-	-
March												
1961	-	-	5	-	2	-	-	1	1	3	2	2
1959	2	-	-	-	-	-	-	-	-	-	-	-
1958	-	-	-	-	-	-	-	-	-	-	-	-
April												
1961	3	-	13	6	6	-	-	-	-	-	-	-
1959	2	3	9	10	9	-	-	-	-	-	-	-
1958	1	1	3	4	4	-	-	-	-	-	-	-

1/ The 1961 pelagic season began 21 November 1960, however, no seals were collected in November.

Appendix table 2 (con.)
Number of seals collected, and number of hunting days per month in each degree of latitude in 1958, 1959, and 1961

Year	Degree of latitude 32°	33°	34°	35°	36°	37°	38°	39°	40°	41°	42°	43°
Number of seals collected												
1961	1	87	162	367	78	97	47	1	1	4	-	4
1959	-	63	71	448	129	233	139	-	46	112	8	6
1958	-	-	40	59	118	188	13	11	14	17	8	16
Number of days when seals were hunted												
December												
1960 1/	-	-	-	-	-	-	2	-	-	-	-	-
January												
1961	1	4	8	5	1	7	5	-	-	-	-	-
1959	-	4	2	1	4	3	1	-	-	-	1	-
1958	-	-	-	-	-	-	-	-	-	-	-	-
February												
1961	-	1	3	11	4	1	-	-	-	-	-	-
1959	-	-	7	14	9	11	2	-	-	-	-	-
1958	-	-	-	3	7	8	-	-	2	2	-	-
March												
1961	-	-	-	-	4	10	2	-	-	-	-	-
1959	-	-	-	4	12	7	3	-	8	8	1	1
1958	-	-	2	5	9	12	2	-	2	-	-	-
April												
1961	-	-	-	-	-	-	2	1	1	2	-	1
1959	-	-	-	-	-	2	6	-	5	5	-	2
1958	-	-	-	-	-	1	1	1	1	3	3	3

1/ The 1961 pelagic season began 21 November 1960, however, no seals were collected in November.

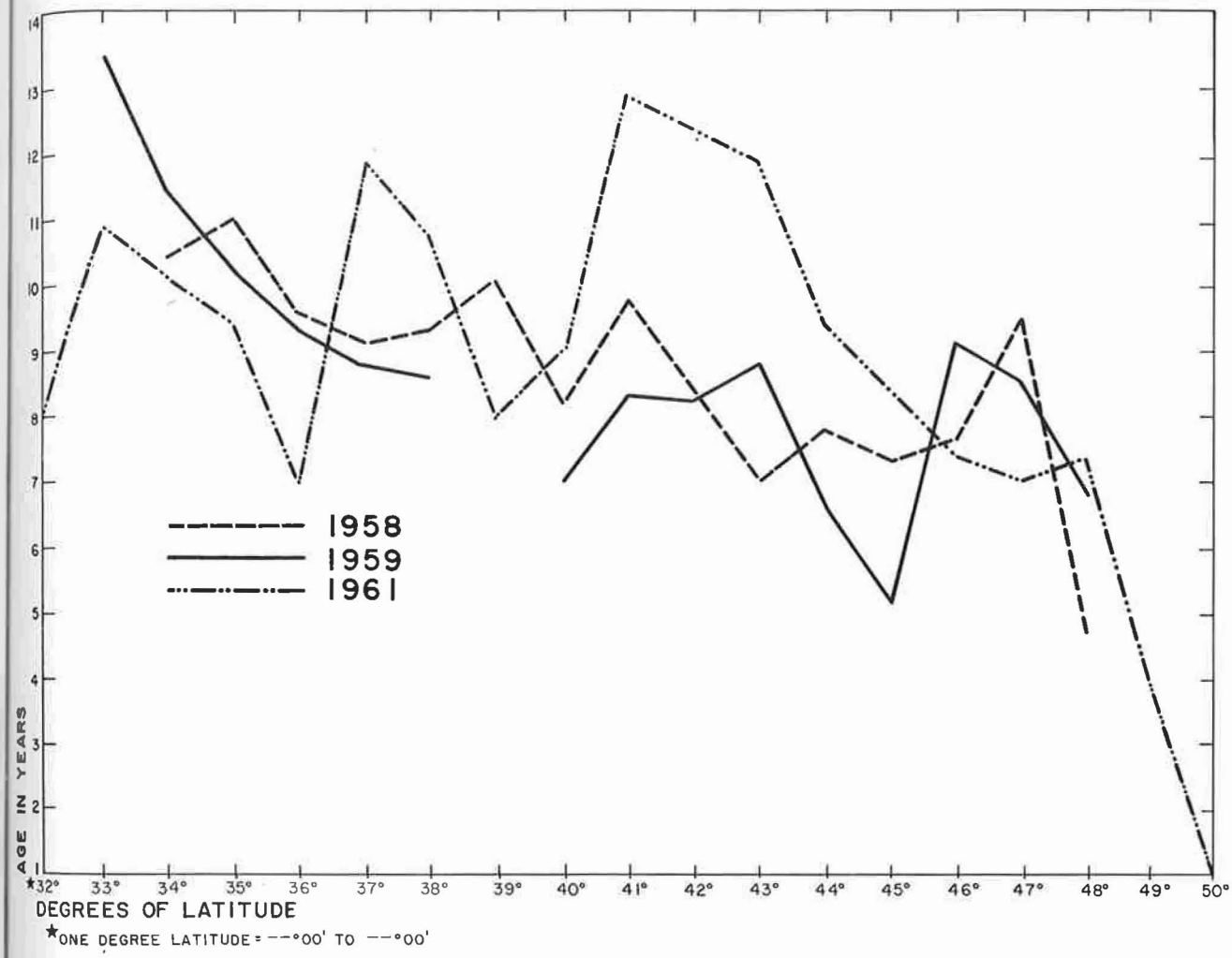

Figure 16.--Average age of seals collected in each degree of latitude in 1961.

In 1959 and 1961 collections were made in latitudes 46°, 47°, and 48° N. primarily during the month of April (53 days). At this time adult females are in migration northward. Northward migration by young animals is less apparent at this time. In 1959, 37 percent of the seals collected were 10 years old or older; in 1961, 29 percent were 10 years old or older. In 1959, 26 percent of the seals collected were under 5 years of age; in 1961, 38 percent were under 5 years of age.

As has been stated, the older animals go farther south, arriving off the California coast probably by mid-December and later. The main wintering area is between 33°N. and 39°N. The southern limit of the main wintering population varies from year to year, but 34°N. can probably be considered the limit in most years. The possibility exists that young seals (1- and 2-year-olds) arrive on the Farallon grounds in May and linger here into June (see page 17 of this report).

Younger seals do not go as far south as adult animals on the average, but they commonly stay on the Farallon and Vancouver grounds after most of the older animals have moved north.

Data from 6 years' collections in California waters are presented to show the small number of males found in waters off California.

Year	Males	Total collected	Percent of males
1961 1/	4	845	0.5
1959 1/	13	1229	1.0
1958 1/	0	460	0.0
1952 2/	4	199	2.0
1897 3/	72	1266	5.7
1896 3/	8	215	3.7

1/ Pelagic reports 1958, 1959, and 1961.
2/ Taylor et al., 1955.
3/ Townsend, 1899.

In 1952 no males over 1 year old were collected. In 1959 none over 5 years of age was collected, and in 1961 none over 4 years of age was collected. Adult males are seldom found south of the Fairweather grounds. Young males are commonly found on the Vancouver grounds, but are not found in California, at least in the winter and early spring months, in significant numbers.

Appendix B

Appendix table 3

Stomach contents of fur seals from the eastern Pacific California, 21 November 1960-11 April 1961

	Winter Dec.-Jan.-Feb.			Spring March-April			Combined totals		
Food items	Vol. (cc)	%	F	Vol. (cc)	%	F	Vol. (cc)	%	F
Squalus acanthias	-	-	-	532	0.8	1	532	-	1
Alosa sapidissima	-	-	-	2144	3.5	4	2144	1.0	4
Clupea harengus pallasi	trace	-	1	2001	3.3	3	2001	1.0	4
Engraulis mordax	43227	27.5	64	21736	35.5	26	64963	29.7	90
Oncorhynchus spp.	-	-	-	624	1.0	1	624	0.3	1
Myctophidae	178	0.1	13	33	0.1	3	211	0.1	16
Tarletonbeania crenularis	1283	0.8	7	63	0.1	2	1346	0.6	9
Cololabis saira	28246	18.0	94	978	1.6	3	29224	13.4	97
Merluccius productus	1758	1.1	9	13843	22.6	18	15601	7.1	27
Trachurus symmetricus	2135	1.4	13	-	-	-	2135	1.0	13
Medialuna californiensis	44	-	1	-	-	-	44	-	1
Sebastodes spp.	4000	2.5	1	720	1.2	1	4720	2.2	2
Sebastodes jordani	-	-	-	1295	2.1	1	1295	0.6	1
Atherinopsis californiensis	trace	-	1	1235	2.0	2	1235	0.6	3
Lyopsetta exilis	147	0.1	1	trace	-	1	147	0.1	2
Porichthys notatus	-	-	-	159	0.3	1	159	0.1	1
Unidentified fish	2321	1.5	44	trace	-	8	2321	1.1	52
Octopus-Octopoda *Tremoctopus* sp.	70	0.1	28	-	-	-	70	-	28
Squid-Decapoda *Loligo opalescens*	11854	7.5	40	12991	21.2	15	24845	11.4	55
Onychoteuthis sp.	57934	36.8	262	1519	2.5	18	59453	27.2	280
Abraliopsis sp.	19	-	9	1307	2.1	5	1326	0.6	14
Gonatidae	93	0.1	92	trace	-	8	93	-	100
Gonatopsis sp.	378	0.2	27	-	-	-	378	0.2	27
Unidentified	3595	2.3	157	60	0.1	8	3655	1.7	165
Kelp	trace	-	1	-	-	-	trace	-	1
Total	157282	100.0		61240	100.0		218522	100.0	
Stomachs with food		490			75			565	
Stomachs empty		250			32			282	

Appendix table 4
Stomach contents of fur seals from the eastern Pacific
Oregon, 13-15 April 1961

Food items	Spring April Vol. (cc)	%	F	Total Vol. (cc)	%	F
Lampetra tridentata	70	0.3	1	70	0.3	1
Alosa sapidissima	1050	4.2	1	1050	4.2	1
Clupea harengus pallasi	530	2.1	1	530	2.1	1
Engraulis mordax	14990	60.3	10	14990	60.3	10
Oncorhynchus spp.	140	0.6	1	140	0.6	1
Merluccius productus	trace	-	1	trace	-	1
Sebastodes spp.	8005	32.2	10	8005	32.2	10
Lyopsetta exilis	65	0.3	1	65	0.3	1
Unidentified fish	trace	-	1	trace	-	1
Squid-Decapoda						
Loligo opalescens	trace	-	1	trace	-	1
Gonatidae	trace	-	1	trace	-	1
Unidentified	trace	-	1	trace	-	1
Total	24850	100.0		24850	100.0	
Stomachs with food		26			26	
Stomachs empty		3			3	

Appendix table 5
Stomach contents of fur seals from the eastern Pacific
Washington, 22-23 January; 21 March-25 April 1961

	Winter January			Spring March-April			Combined totals		
Food items	Vol. (cc)	%	F	Vol. (cc)	%	F	Vol. (cc)	%	F
Lampetra tridentata	-	-	-	438	0.4	5	438	0.5	5
Alosa sapidissima	-	-	-	4889	5.1	8	4889	5.1	8
Clupea harengus pallasi	30	5.0	1	16565	17.4	36	16595	17.3	37
Engraulis mordax	-	-	-	36089	37.8	58	36089	37.6	58
Oncorhynchus spp.	-	-	-	1967	2.1	8	1967	2.0	8
O. gorbuscha	-	-	-	1700	1.8	1	1700	1.8	1
O. kisutch	-	-	-	3540	3.7	3	3540	3.7	3
O. nerka	-	-	-	910	0.9	1	910	0.9	1
O. tshawytscha	-	-	-	1010	1.1	2	1010	1.1	2
Salmo gairdneri	-	-	-	555	0.6	1	555	0.6	1
Hypomesus pretiosus	-	-	-	83	0.1	2	83	0.1	2
Mallotus villosus	-	-	-	1210	1.3	6	1210	1.2	6
Thaleichthys pacificus	-	-	-	1864	2.0	10	1864	1.9	10
Merluccius productus	-	-	-	308	0.3	1	308	0.3	1
Theragra chalcogrammus	-	-	-	15	-	1	15	-	1
Sebastodes spp.	-	-	-	18697	19.6	32	18697	19.5	32
Sebastodes entomelas	-	-	-	2174	2.3	2	2174	2.3	2
Ammodytes hexapteros	-	-	-	1910	2.0	2	1910	2.0	2
Unidentified fish	-	-	-	85	0.1	35	85	0.1	35
Squid-Decapoda									
Loligo opalescens	590	95.0	1	21	-	2	611	0.6	3
Onychoteuthis sp.	-	-	-	1170	1.2	4	1170	1.2	4
Gonatidae	-	-	-	trace	-	4	trace	-	4
Gonatopsis sp.	-	-	-	185	0.2	1	185	0.2	1
Unidentified	-	-	-	trace	-	5	trace	-	5
Isopoda, Asellota	-	-	-	5	-	1	5	-	1
Pebbles	-	-	-	trace	-	1	trace	-	1
Total	620	100.0		95390	100.0		96010	100.0	
Stomachs with food		1			183			184	
Stomachs empty[1/]		-			201			201	

1/ Includes three missing stomachs.

Appendix table 6
Stomach contents of fur seals from the eastern Pacific
British Columbia[1/], 23 January-20 March 1961

Food items	Winter January-February Vol. (cc)	%	F	Spring March Vol. (cc)	%	F	Combined totals Vol. (cc)	%	F
Clupea harengus pallasi	22440	87.9	23	685	25.4	4	23125	81.9	27
Osmeridae	trace	-	1	-	-	-	trace	-	1
Hypomesus pretiosus	-	-	-	210	7.8	1	210	0.7	1
Thaleichthys pacificus	230	0.9	1	51	1.9	1	281	1.0	2
Gadidae	20	0.1	1	trace	-	1	20	0.1	2
Gadus macrocephalus	820	3.2	1	1630	60.5	3	2450	8.7	4
Anoplopoma fimbria	1440	5.6	2	-	-	-	1440	5.1	2
Ammodytes hexapterus	140	0.6	1	-	-	-	140	0.5	1
Unidentified fish	trace	-	3	-	-	-	trace	-	3
Squid-Decapoda									
Loligo opalescens	390	1.5	6	-	-	-	390	1.4	6
Gonatidae	trace	-	1	-	-	-	trace	-	1
Gonatus magister	-	-	-	67	2.5	3	67	0.2	3
Unidentified	trace	-	2	52	1.9	4	52	0.2	6
Pebbles	50	-.2	2	-	-	-	50	0.2	2
Hermit crab									
Pagurus sp.	trace	-	1	-	-	-	trace	-	1
Amphipoda									
Gammaridea	trace	-	1	-	-	-	trace	-	1
Total	25530	100.0		2695	100.0		28225	100.0	
Stomachs with food		36			9			45	
Stomachs empty		34			12			46	

1/ Includes five seals from Southeastern Alaska.