475

PELAGIC FUR SEAL INVESTIGATIONS, ALASKA WATERS, 1962

by Clifford H. Fiscus, Gary A. Baines, and Ford Wilke

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DEPARTMENT OF THE INTERIOR
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ERRATA SHEET

Special Scientific Report--Fisheries No. 475 ("Pelagic fur seal investigations, Alaska waters, 1962" by Clifford H. Fiscus, Gary A. Baines, and Ford Wilke).

p. 55: 1st paragraph, 2nd line, omit out of 13; 2nd line after the word Sea insert and in 1 stomach collected in Unimak Pass, ...

p. 55: 1st paragraph, possible change in identification:

Most fish identified as Thaleichthys pacificus in 1962 may have been species of the family Bathylagidae. In 1963, bathylagids were identified from the stomachs of 92 fur seals collected in the Bering Sea; all fish identified as Thaleichthys in 1962 were found in the same area but for one from Unimak Pass. No undigested fish were found in 1962 or 1963, and identifications were made from skull bones and vertebrae and from vertebral counts. The characteristic black skin of the bathylagids was evident in many of the 1963 stomachs. The only sample of Thaleichthys saved from 1962 proved identical to the 1963 Bathylagidae specimens, and it is possible that some or all of the other Thaleichthys identified in 1962 were bathylagids.

p. 58: 3rd paragraph, 8th line, the 4th word Mallotus should be changed to Theragra.

p. 59: Under Schultz, Keyes should be changed to Keys.

UNITED STATES DEPARTMENT OF THE INTERIOR
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James K. Carr, *Under Secretary*
Frank P. Briggs, *Assistant Secretary for Fish and Wildlife*
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ABSTRACT

A fifth year of pelagic fur seal research under the terms of the Interim Convention on Conservation of North Pacific Fur Seals was conducted in Unimak Pass, Alaska, and vicinity, from May to October 1962. Unimak Pass is an important route for seals passing between the Pacific Ocean and the Bering Sea. Major feeding areas are located 10 to 15 miles north of Akun Island and 20 miles southeast of Tigalda Island. They are utilized by concentrations of seals from late July to October. Of 1,486 seals collected, 91 percent were females and 9 percent were males. The proportion of pregnant females ranged from 63 percent in June to 15 percent in mid-July and almost none thereafter. Post partum females formed about 50 percent of seals taken from August to October, and nonpregnant mature females formed 10 percent of the total. Immature females predominated in the feeding area off Tigalda Island. Seal movements through Unimak Pass were not correlated with stomach contents or tide direction. Tagged seals, including one with a Soviet tag, made up 3.4 percent of the total. From 1958 to 1962 the pregnancy rate of all females was 72.3 percent and the rate for females 6 to 26 years of age was 83.8 percent.

Female fetuses were more numerous than males, and pregnancies in the left uterine horn were more frequent than were those in the right horn. Twin seals were smaller than an average normal fetus. Major food species of fur seals by area were: Western Alaska--squids, *Mallotus villosus*, and *Ammodytes hexapterus;* Unimak Pass--*Mallotus* and *Pleurogrammus monopterygius;* Bering Sea--*Theragra chalcogrammus*, *Mallotus*, and squids. *Mallotus*, *Theragra*, and squids have been the leading food of fur seals in this region since the first investigations in 1896. *Mallotus* formed over 50 percent of the food volume. Of the food fishes taken commercially near Unimak Pass, only salmon and *Theragra* had been eaten by seals.

INTRODUCTION

In the 4 years, 1958-61, pelagic research on fur seals as specified by the Interim Convention on Conservation of North Pacific Fur Seals carried U.S. investigators into the entire north-to-south range of the northern fur seal in the eastern Pacific. Collecting efforts in these years were concentrated primarily where seals were abundant.

Note: Clifford H. Fiscus, *Wildlife Biologist (Research)*, Gary A. Baines, *Wildlife Biologist (General)*, and Ford Wilke, *Wildlife Biologist (Research)*, Bureau of Commercial Fisheries Marine Mammal Biological Laboratory, U.S. Fish and Wildlife Service, Seattle, Washington.

In 1962, collections and observations were confined mostly to Unimak Pass and waters in the North Pacific and Bering Sea within 2 days' travel of the pass. The pass area was selected for the following reasons:

1. Seals move through the pass from May to November and can be collected more systematically and over a longer period than in coastal areas where they remain for a relatively short time.

2. The pass is an important route for salmon migrating into Bristol Bay. Predation by seals upon salmon has long been a subject of investigation.

3. The pass is a suitable location in which to determine the southern limit of feeding by nursing females. It lies about 180 to 220 miles southeast of the nursing grounds.

4. Sheltered anchorage for vessels can be found close to sealing grounds.

Collections made from 1958 to 1962 cover parts of every month in the year. Together with Canadian collections, they provide satisfactory information on the kinds of food taken by seals, the areas where seals concentrate, and the general timing of migration by age and sex. Relatively little collecting, however, has been done in October, November, and December.

METHODS, EQUIPMENT, AND PERSONNEL

Vessels and Boats

Two purse seine vessels[1] were chartered for pelagic collecting in 1962. Each vessel was required to have loran navigating equipment, a radio direction finder, ship-to-shore and ship-to-ship radio, radar, an echo sounder, and a minimum of 20 cubic feet of freezer space for specimens. One vessel was equipped with gear stabilizers, which reduced rolling; one was equipped with hydraulic steering, which made the vessel more maneuverable when pursuing seals.

Because both vessels had been chartered before and carried experienced owner-captains, vessel handling and work routines were established smoothly and quickly. Each vessel carried a crew consisting of captain, engineer, cook, and deckhand. A Bureau of Commercial Fisheries biologist and two or three biological aids comprised the biological crew. The ship's crew assisted the biologists when needed.

Nineteen-foot dories or Fiberglas skiffs powered with 10 hp. outboard motors were used for hunting during good weather.

The *Tacoma* operated in or near Unimak Pass from 16 May to 18 September. The *Harmony* operated in the same area from 20 August to 8 October.

When both vessels were working, they maintained radio contact to coordinate movements. Loran bearings were taken periodically to aid in plotting positions and in navigation. Radar and radio direction finders were used extensively because of frequent fog in the Aleutian Islands area.

Both vessels carried enough supplies, water, and fuel for at least 1 month at sea. Dutch Harbor afforded the only close supply of fuel. The longest time any one vessel operated without refueling was 20 days. Due to the hazard of drifting at night in the strong currents around the Aleutian Islands, most nights were spent in a sheltered anchorage.

Hunting Methods

During periods of calm seas and when seals were abundant, small boats were also used to collect seals. When hunting from a vessel, all crew members except the cook usually stayed on the bridge to look for seals. When a seal was sighted, two gunners would go to the bow to shoot while the rest of the crew assisted the helmsman in following the seal, or stood by to recover those that were killed. Dead animals were brought aboard by two or three men using four-pronged gaffs attached to 14-foot bamboo poles.

[1] M/V *Tacoma*--registered length 71.5 feet, 76 net tons, 240 horsepower (hp.), cruising speed 9 knots; M/V *Harmony*--registered length 70.5 feet, 61 net tons, 220 hp., cruising speed 9 knots.

A major part of the hunting success of any vessel depends upon the helmsman's ability to follow a seal and, when a seal is killed, to bring the vessel alongside in the least possible time. Skill in these functions increases the number of seals killed and decreases the number lost by sinking.

Small boats ran courses paralleling the vessel at distances up to half a mile. Handheld radios were first used in 1962 to coordinate vessel and small boat movements and to improve safety.

Each boat was manned by two men. One operated the motor, and the other did the shooting. Seals were taken from the small boats more easily and with fewer losses than from the vessels because of the former's maneuverability and quick changes of speed. Also, the seals allowed small boats to approach more closely.

Seals were shot with 12-gauge shotguns using magnum loads of 00-buckshot. Success in collecting seals with a .243 caliber rifle with telescopic sights was poor.

A rough log was kept of time and courses run, course changes, and loran and radio-direction finder bearings. The rough log also included time records of seals sighted and surface water temperatures taken at collection points. Numbered aluminum tags, attached to the seals as they were brought aboard, maintained identification of the specimens and related them to pertinent data. Other notes on navigation and position of the vessel, and positions of other marine mammals sighted, were also entered in the rough log. At the end of the hunting day, the day's run and the positions of all marine mammals seen and collected were plotted. Data from the rough log and the plotted positions were transferred to the daily work sheets to complete the record.

Field Examinations

When a seal was examined on the deck it was first checked for tags, checkmarks, brands, or external abnormalities. The seal was weighed in kilograms and measured in centimeters (tip of nose to tip of tail). The snout was skinned out and removed with large lopping shears. The right half of the snout was saved in a cloth bag with an aluminum specimen-tag bearing numbers corresponding to the tag attached to the body. The left half of the snout was discarded. Later, the right half of the snout was boiled and the upper right canine tooth removed. The seal was opened, and the reproductive condition noted. The sex, length, and weight of any fetus present were recorded. Macroscopic examination of the uterine horns and ovaries was made on all females. When the reproductive condition was questionable the specimen was labeled and preserved.

The stomach was tied above the cardiac sphincter and below the pyloric sphincter, then cut free from the esophagus and intestine. The tag on the body was transferred to the stomach. The stomach was injected with 10 percent formalin and stored in a barrel of formalin.

Laboratory Methods

Ages of all seals collected are determined by making longitudinal sections of the canine teeth and counting the internal annuli. Scheffer (1950) first described age estimation by growth layers on the external surface of teeth; however, these external layers may be counted to estimate age up to about age 10, but after that age the layers tend to become obscure. Longitudinal sectioning and the counting of internal annuli make it possible to determine age of old seals that previously could only be placed in a general category, which included all teeth from seals over 10 years old.

A preliminary section of a tooth is made by cutting the tooth lengthwise, just off the center, with a bandsaw. A sliding tooth holder was developed[2] for this operation. A horizontal grinding wheel of coarse abrasive is used to grind the rough surface to the midline. Subsequent use of a fine abrasive wheel removes scratches on the cut surface and prepares the tooth for final polishing on a felt wheel to which water and polishing compound have been added. Each tooth is polished until all dull areas

[2] By C. E. Abegglen and A. Y. Roppel.

disappear. Annuli show more clearly on a polished than on an unpolished tooth. The tooth is then marked with the specimen number.

Age Determination

Growth lines on the teeth are counted by the aid of a strong lamp, spectacle-type magnifying glasses, a dissecting microscope, and dissecting probes. The annuli are counted by holding the teeth over the light and turning them to give the angle of light that best shows the growth pattern.

Five hundred teeth, including available known-age specimens from previous collections, are read by the examiner as training before he begins to examine a new collection.

Certain factors which may make age estimation difficult are described below:

Degree of grinding.--If a tooth is not completely ground to the midpoint or if it is ground past the midpoint, growth lines may not show clearly, or may show more than once. In teeth from young animals where rapid growth has made wide annuli, the degree of grinding is not as critical as in older teeth where the annual growth is reduced and annuli are narrow. Poor or careless grinding of older teeth may obscure or destroy the annuli.

Variation in tooth structure.--In teeth up to about age 5, annual growth lines are widely separated and care must be taken to avoid counting faint incremental lines. Annual external ridges are of value as a check on the internal layers in young teeth. The pulp chamber is usually open in male teeth to about age 20 and in female teeth to about age 12. The cementum layer is not very evident in young teeth but is usually plainly visible in older teeth and can be confused with an annual line in the dentin. Old teeth have growth lines that are comparatively close together and sometimes difficult to differentiate.

All teeth are examined by two biologists. Repeated examinations and conferences settle any differences of opinion. Most of the teeth are checked with the aid of a dissecting microscope and are read eight or more times before a final age is recorded.

Stomach Examinations

Stomachs are opened by slicing them from end to end, with care taken not to cut into the contents and ruin a food organism of special value or interest. After the contents are washed into a sieve and excess fluid removed by draining, the food is weighed in grams and the volume in cubic centimenters is obtained by displacement. Material weighing less than 5 g. is recorded as a "trace," unless a whole specimen or fleshy parts are present. For contents with a weight of 100 g. or less, the volume is not measured but is assigned a value as though the contents had the same density as water.

A direct count of complete specimens can be made. For specimens in an advanced state of digestion, the skeletal remains are counted. Counts are taken from total skulls, skull parts, otoliths, or numbers of vertebrae approximating a complete fish skeleton.

Specimens are identified by (1) comparing them with known skeletal remains or preserved specimens on file in the laboratory and (2) using keys by Berry (1912), Clemens and Wilby (1961), Evermann and Goldsborough (1906), Sasaki (1929), Schultz (1953), and Wilimovsky.[3] Unidentified specimens are saved for later study, and most of these are finally identified.

Data for each stomach, with the specimen number, are recorded when the stomachs are examined. When two or more species that cannot be easily separated occur in the same stomach, the examiner estimates their proportionate volume to the nearest 5 percent. The weight and volume of each individual species is calculated by multiplying its estimated percent times total weight and volume.

Personnel

The following took part in pelagic fur seal investigations in 1962:

Permanent employees: Biologists Clifford H. Fiscus and Gary A. Baines.

[3] N. J. Wilimovsky. 1958. Provisional keys to the fishes of Alaska. Bureau of Commercial Fisheries Biological Laboratory, U.S. Fish and Wildlife Service, Juneau, Alaska, 113 p. [Processed.]

Temporary employees: Fishery Aids Rex Thomas, Jerry E. Burdick, Ronald M. Lee, and Lloyd H. Stebbins.

Eugene T. Lyons, of Colorado State University, carried on hookworm studies from 20 May to 9 June aboard a vessel.

RESEARCH IN 1962

Distribution of Seals by Time, Place, and Numbers

The distribution of seals observed and collected is shown in figure 1. The three areas through which vessels operated (western Alaska, Unimak Pass, and Bering Sea) have been divided into a series of squares, each representing 100 square nautical miles.

The western Alaska area includes the waters south of the Alaska Peninsula and the Aleutian Islands between Cape Pankof on the east and Samalga Island on the west. Investigations extended, at some points, to about 75 miles offshore.

Unimak Pass includes the waters in the pass and the southern and northern approaches to the pass. Included in the southern approach are Ugamak Strait, Derbin Strait, Rootok Strait, and the sea to a distance of 3 to 5 miles south of Avatanik, Tigalda, and Ugamak Islands and northeastward to Arch Point, Unimak Island. The northern approach includes the sea from 5 miles north of Cape Sarichef, Unimak Island to 10 miles north of Akun Head, Akun Island. The Unimak Pass area as described above is the locality referred to in all tables in this report with the exception of table 4. This table includes data for feeding and resting grounds slightly outside the pass, as shown in figure 2, in order to improve the clarity of discussions of seal movements in Unimak Pass and vicinity. Dates, times, and places in the text of this section of the report refer to this area, unless otherwise specified.

The Bering Sea area includes the waters of the Bering Sea north of the Alaska Peninsula and the Aleutian Islands between Cape Sarichef, Unimak Island, on the east, Samalga Island on the west, and the Pribilof Islands on the north.

Tables 1 and 2 show the numbers and relative abundance of seals seen and collected in the three areas by 10-day periods.

The largest numbers of seals were seen and collected in western Alaska during the 10-day period of 11-20 June. In Unimak Pass, 11-20 August was the period of peak abundance. In the Bering Sea, this period was during the first 20 days of August.

Grouping of seals (table 3) follows the general pattern observed in previous years. Approximately 88 percent of the total seals observed in 1962 were in groups of three seals or fewer. Larger groups, from 15 to 64 animals (as seen in 1960), were not observed. Fourteen seals made up the largest group found in 1962.

All but three fur seals collected in 1962 were taken in three areas, western Alaska, Unimak Pass, and Bering Sea. These three seals were taken on 6 May about 110 miles west of Cape Ommaney in the Gulf of Alaska.

Western Alaska.--Seal observations began on 5 May when a vessel left Cape Ommaney to cross the Gulf of Alaska to Kodiak. Seals were seen in the Gulf of Alaska on 6, 7, and 8 May. Western Alaska was entered on 16 May; a few seals were seen from Davidson Bank to Tigalda Island. During May most of the seals seen were in western Alaska rather than in Unimak Pass. In June, seals began arriving in western Alaska from the eastward in greater numbers. The population fluctuated periodically as seals moved through the area, pausing a few days to feed and rest, then moving on. In July the number of seals decreased. As the month progressed the proportion of young seals in the catch increased and in August the population was composed mainly of young animals. A few post partum females were collected each trip. Of the animals collected in 2 days during early September, 2- to 4-year-old females made up 55 percent of the catch and mature females in post partum condition 26 percent. No collecting was done in western Alaska during October.

Unimak Pass.--Unimak Pass and vicinity was selected as an area for intensive study in

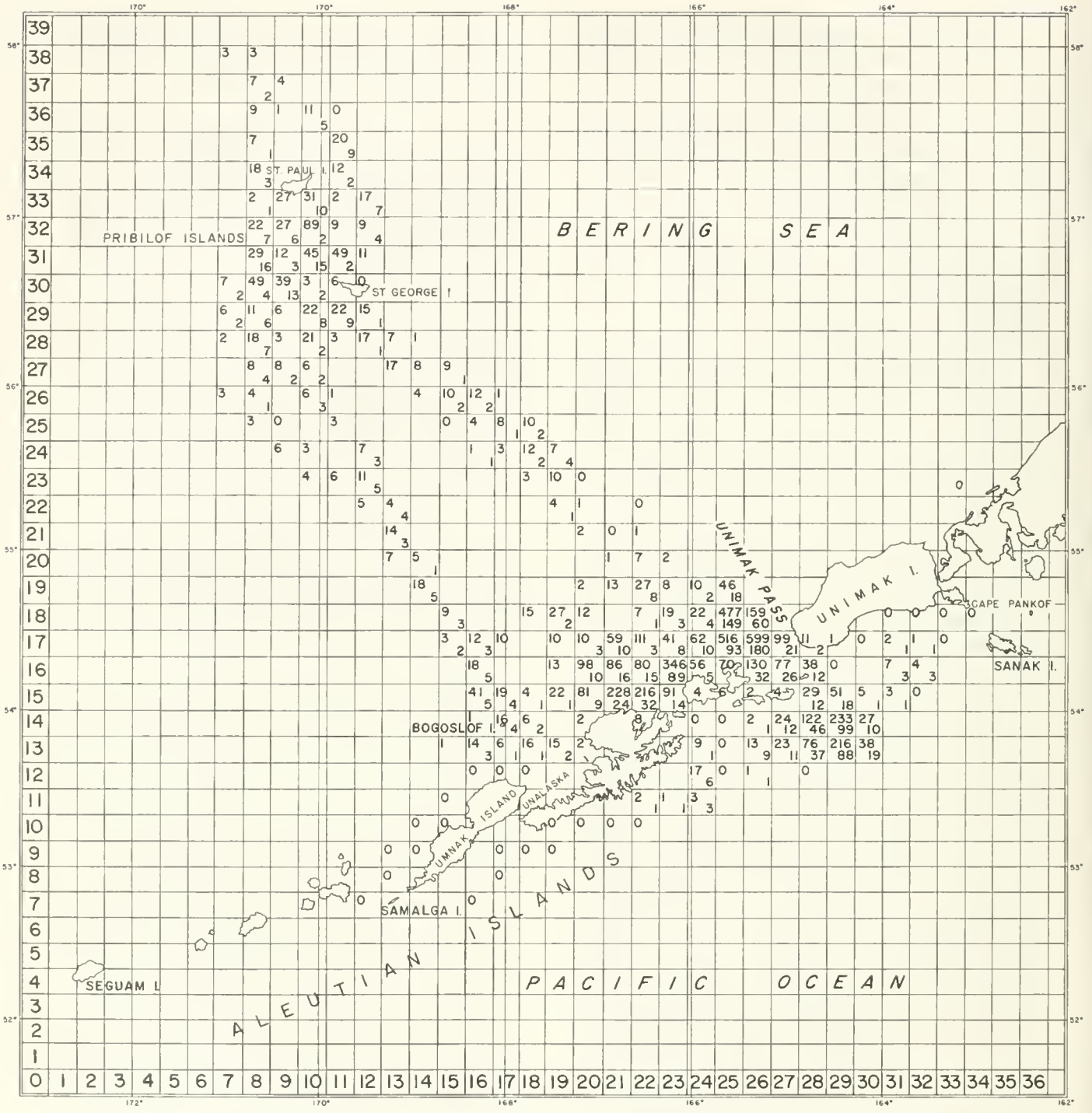

Figure 1.--Distribution of seals observed (upper number) and collected (lower number) in 1962. The number in the upper half of the square represents the total number of seals sighted and the number in the lower half of the square represents the total number of seals collected in that area throughout the season.

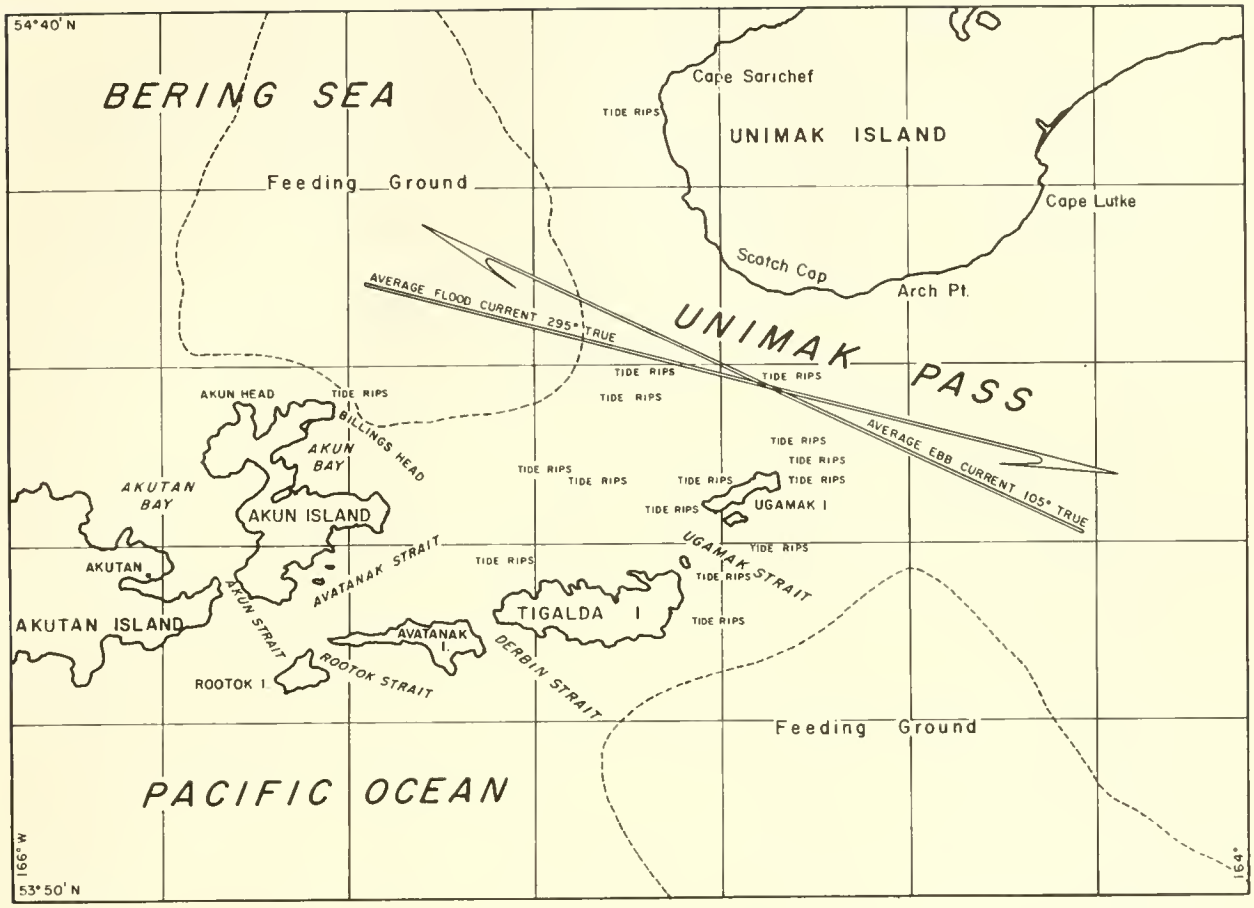

Figure 2.--Unimak Pass and vicinity.

1962. Fur seals were observed and collected in the area from late May through early October in order to obtain information on migration, food habits, and behavior.

According to the Coast Pilot,[4] the current in Unimak Pass is probably strongest between Scotch Cap Light and Ugamak Island where at the peak of flood or ebb the average velocity is about 3 knots. The maximum velocity may exceed this at the time of tropic tides when 6-knot currents during the flood and 6 1/2-knot currents during the ebb are to be expected. The current has a large diurnal constituent which at the time of tropic tides may cause the current to set continuously in a flood direction for as long as 18 hours. The set of the flood is 295° true and of the ebb 105° true.

[4] United States Coast Pilot 9, Alaska, Cape Spencer to Arctic Ocean. 1955. 6th ed. U.S. Department of Commerce, Coast and Geodetic Survey, Washington, D.C., 673 p.

The current along the south shore of the Alaska Peninsula and the Aleutian Islands sets to the westward and drifts through the passes into the Bering Sea. Along the north side of the Aleutian Islands the current sets easterly.

Tide rips off Billings Head, Akun Island, are particularly noticeable at flood tide and off the east end of Ugamak Island at ebb tide. Tide rips are found in the northern approach to the pass on the flood and in the southern approach on the ebb. Wind and seas coming against the current have a pronounced effect on the tide rips.

The southern approach and entrance to Unimak Pass is relatively shallow (30-50 fathoms), but in the pass proper is a basin with depth of 50-100 fathoms. The northern entrance has depths of 40-50 fathoms, deepening to over 100 fathoms within 10 miles to the northwestward.

Table 1.--Number and relative abundance of seals seen off western Alaska, Unimak Pass, and in the Bering Sea, by 10-day periods, 11 May to 10 October 1962

Period	Boat-hunting days	Seals seen	Seals seen per boat-hunting day	Seals seen per 10-day interval
	Number	Total	Number	Percent
Western Alaska				
11-20 May	1.25	12	9.6	1.3
21-31 "	5.00	45	9.0	5.0
1-10 June	2.75	76	27.6	8.4
11-20 "	5.00	468	93.6	51.8
21-30 "	0.75	7	9.3	0.8
1-10 July	-	-	-	-
11-20 "	2.00	50	25.0	5.5
21-31 "	-	-	-	-
1-10 August	-	-	-	-
11-20 "	2.00	89	44.5	9.8
21-31 "	2.25	59	26.2	6.5
1-10 September	1.25	86	68.8	9.5
11-20 "	1.00	12	12.0	1.3
21-30 "	-	-	-	-
1-10 October	0.25	1	4.0	0.1
Total	23.50	905	38.5[1]	100.0
Unimak Pass				
11-20 May	0.50	1	2.0	-
21-31 "	1.00	3	3.0	0.2
1-10 June	2.50	34	13.6	2.0
11-20 "	1.75	80	45.7	4.8
21-30 "	4.00	124	31.0	7.4
1-10 July	1.75	45	25.7	2.7
11-20 "	4.75	312	65.7	18.6
21-31 "	-	-	-	-
1-10 August	2.00	126	63.0	7.5
11-20 "	2.00	325	162.5	19.4
21-31 "	2.00	152	76.0	9.1
1-10 September	4.50	219	48.6	13.0
11-20 "	1.50	45	30.0	2.7
21-30 "	1.00	22	22.0	1.3
1-10 October	2.50	189	75.6	11.3
Total	31.75	1,677	52.8[1]	100.0
Bering Sea				
11-20 May	0.25	2	8.0	-
21-31 "	-	-	-	-
1-10 June	2.00	22	11.0	0.6
11-20 "	0.25	9	36.0	0.3
21-30 "	2.00	110	55.0	3.1
1-10 July	4.25	171	40.2	4.8
11-20 "	3.00	143	47.7	4.1
21-31 "	7.25	494	68.1	14.0
1-10 August	3.75	423	112.8	12.0
11-20 "	2.00	483	241.5	13.7
21-31 "	10.50	401	38.2	11.4
1-10 September	4.25	264	62.1	7.5
11-20 "	7.50	842	112.3	23.8
21-30 "	2.50	64	25.6	1.8
1-10 October	1.75	101	57.7	2.9
Total	51.25	3,529	68.9[1]	100.0

[1] Mean number of seals seen per boat day.

Table 2. --Number and relative abundance of seals collected off western Alaska, Unimak Pass, and in the Bering Sea, by 10-day periods, 11 May to 10 October 1962

Period	Boat-hunting days	Males	Females	Total	Seals collected per boat-hunting day	
	Number	Number	Number	Number	Number	Percent
Western Alaska						
11-20 May	1.25	-	6	6	4.8	1.6
21-31 "	5.00	2	13	15	3.0	4.0
1-10 June	2.75	4	18	22	8.0	5.9
11-20 "	5.00	14	195	209	41.8	55.9
21-30 "	0.75	-	1	1	1.3	0.3
1-10 July	-	-	-	-	-	-
11-20 "	2.00	1	13	14	7.0	3.7
21-31 "	-	-	-	-	-	-
1-10 August	-	-	-	-	-	-
11-20 "	2.00	4	44	48	24.0	12.8
21-31 "	2.25	2	24	26	11.5	7.0
1-10 September	1.25	2	31	33	26.4	8.8
11-20 "	1.00	-	-	-	-	-
21-30 "	-	-	-	-	-	-
1-10 October	0.25	-	-	-	-	-
Total	23.50	29	345	374	15.9 1/	100.0
Unimak Pass						
11-20 May	0.50	-	-	-	-	-
21-31 "	1.00	1	-	1	1.0	0.2
1-10 June	2.50	7	16	23	9.2	5.2
11-20 "	1.75	4	14	18	10.2	4.1
21-30 "	4.00	1	29	30	7.5	6.8
1-10 July	1.75	2	13	15	8.5	3.4
11-20 "	4.75	8	98	106	22.3	24.1
21-31 "	-	-	-	-	-	-
1-10 August	2.00	5	20	25	12.5	5.7
11-20 "	2.00	9	97	106	53.0	24.1
21-31 "	2.00	1	25	26	13.0	5.9
1-10 September	4.50	4	48	52	11.5	11.8
11-20 "	1.50	-	-	-	-	-
21-30 "	1.00	-	2	2	2.0	0.4
1-10 October	2.50	-	37	37	14.8	8.4
Total	31.75	42	399	441	13.8 1/	100.0
Bering Sea						
11-20 May	0.25	-	1	1	4.0	0.1
21-31 "	-	-	-	-	-	-
1-10 June	2.00	-	1	1	0.5	0.1
11-20 "	0.25	-	4	4	16.0	0.6
21-30 "	2.00	4	15	19	9.5	2.8
1-10 July	4.25	6	48	54	12.7	8.1
11-20 "	3.00	1	33	34	11.3	5.1
21-31 "	7.25	19	69	88	12.1	13.2
1-10 August	3.75	8	128	136	36.2	20.4
11-20 "	2.00	3	103	106	53.0	15.9
21-31 "	10.50	8	81	89	8.4	13.3
1-10 September	4.25	1	28	29	6.8	4.3
11-20 "	7.50	7	75	82	10.9	12.3
21-30 "	2.50	3	12	15	6.0	2.3
1-10 October	1.75	-	10	10	5.7	1.5
Total	51.25	60	608	668	13.0 1/	100.0

1/ Average number of seals collected per boat day.

Table 3.--Grouping of 6,111 seals sighted in waters off western Alaska, Unimak Pass, and in the Bering Sea, 16 May to 8 October 1962

Area	Number of seals per group											
	1	2	3	4	5	6	7	8	9	10	10+[1]	Total
Western Alaska												
No. of groups	343	139	48	14	12	2	-	-	-	-	1	559
No. of seals	343	278	144	56	60	12	-	-	-	-	12	905
Percent of seals	37.9	30.8	15.9	6.2	6.6	1.3	-	-	-	-	1.3	100.0
Unimak Pass												
No. of groups	787	235	72	20	7	6	1	2	1	1	1	1,133
No. of seals	787	470	216	80	35	36	7	16	9	10	11	1,677
Percent of seals	47.0	28.0	12.9	4.8	2.1	2.1	0.4	0.9	0.5	0.6	0.7	100.0
Bering Sea												
No. of groups	1,536	553	174	47	17	6	2	1	1	-	2	2,339
No. of seals	1,536	1,106	522	188	85	36	14	8	9	-	25	3,529
Percent of seals	43.7	31.3	14.7	5.3	2.4	1.0	0.4	0.2	0.3	-	0.7	100.0
Grand total												
No. of groups	2,666	927	294	81	36	14	3	3	2	1	4	4,031
No. of seals	2,666	1,854	882	324	180	84	21	24	18	10	48	6,111
Percent of seals	43.7	30.4	14.4	5.2	2.9	1.4	0.3	0.4	0.3	0.2	0.8	100.0

[1]Estimated group sizes for the 10+ group = 11, 11, 12, 14.

Surface water temperatures in Unimak Pass changed from about 5° C. in May to 5°-8° C. in June, 7°-8° C. in July, 7°-9° C. in August and September, and 7°-8° C. in October. At the same time surface water temperatures increased on the Pacific side from 6° to 9° C. in June to 10° to 13° C. in August and September. In the Bering Sea, surface water temperatures increased from 7° to 8° C. in June to 8° to 12° C. in July, August, and September, although the average temperature in the area adjacent to Unimak Pass was 8°-9° C.

Fur seals are believed to use most of the passes and straits in the Aleutian Islands in making their way to and from the Bering Sea and the Pacific Ocean; however, it is likely that many of the seals that winter in the eastern North Pacific use Unimak Pass. There are several reasons why this pass might be favored over others. Unimak Pass is the widest in the area and has a relatively weak current. Fur seals appeared to have little difficulty going through Unimak Pass against the current. It is also the shortest route (except False Pass which apparently is seldom used by fur seals) from the eastern Pacific to the Pribilof Islands. Abundant food is present in the pass and its approaches.

In this area the three other entrances to the Bering Sea are Akun Strait, Akutan Pass, and Unalga Pass, which are relatively small and have average current velocities about double that in Unimak Pass. Maximum velocities of 9 knots in Unalga Pass and 12 knots in Akun Strait have been reported.

Small numbers of fur seals were observed in Akutan Pass and Akun Strait in 1962. Hugh McGlashon, trader and longtime resident at Akutan, reported that he had observed fur seals on at least one occasion in years past off Akun Strait on the Pacific side. On the change of tide, according to his statement, they went through the Strait in a relatively compact group which dispersed after passing into Akutan Bay on the Bering Sea side of the Strait.

Fur seals in Unimak Pass appear to be traveling, feeding, or temporarily resident. Traveling seals seldom spend much time at the surface. They jump out of the water or roll at the surface to breath and submerge immediately. If pursued, they usually move in one direction. Because of the short length of time spent at the surface, they are difficult to observe unless the sea is calm and favorable light exists. Traveling seals are more in evidence during May, June, and early July than in later months. There is some evidence to suggest that they stop to rest after moving through the pass and reaching an area outside the influence of strong currents.

Feeding seals concentrate in areas of abundant feed. When actively feeding, they roll at the surface to breath and return immediately to feed. If feeding in a school of fish at or near the surface they appear at the surface frequently. In a calm sea they are easy to locate. If a large fish is caught, the seal surfaces to eat it, but when feeding on small schooling fish and squids, the seal does not need to surface. After feeding they rest or sleep at the surface. At this time they are lethargic and easy to approach. Some seals can be approached almost to within touching distance before they awaken. From late July to early October, many feeding seals were present in the northern approaches and in the north and central parts of Unimak Pass. They were primarily adult females ranging southeastward from the Pribilof Islands.

A few immature fur seals seen in Unimak Pass and vicinity were believed to be resident throughout most of the study period. Some could usually be found even when traveling and feeding animals were not present.

During May, June, and July, a principal feeding area was centered approximately 20 miles southeast of Tigalda Island. The main food of seals here was a squid, *Gonatus magister*. Two lesser food species were *Mallotus villosus* (capelin) and *Ammodytes hexapterus* (sand lance).

Another feeding ground was located in the northern approach to Unimak Pass north and northeast of Akun Island. This was frequented during July, August, September, and October. Seals moving northward probably feed in this locality after coming through Unimak Pass.

In early July, post partum females from the Pribilof Islands began to appear here and became the dominant class. The main food species here was *Mallotus*, with *Pleurogrammus monopterygius* (Atka mackerel) of secondary importance.

Feeding seals were common within Unimak Pass where *Mallotus* was the leading food species. Occasionally seals would be seen feeding along the edge of tide rips or in weak tide rips.

The first observations were made on 18 May and the last on 8 October. In order to note population changes and movements of fur seals in the area, the analysis has been made by 10-day periods beginning with 21-31 May and ending with 1-10 October.

In classifying the seals, we consider all nulliparous females under 6 years of age to be immature females. All males from age 1 through 8 are classed as immature males. Males 9 years of age and older are classed as bulls. Reproductive condition of fur seals shown in table 4 follows this classification. Males which were observed but not collected and which were definitely large animals are also classed as bulls.

Figures 3-10 show the areas of seal concentration and how the Unimak Pass area was sampled. The figures also show age and sex groups present in the study area during various periods.

From 21 to 31 May the weather was generally poor; on 6 days the sea was too rough

Table 4.--Sex and reproductive condition of seals collected in Unimak Pass and vicinity, 1962

Period	Female				Male	
	Pregnant	Non-pregnant	Immature	Post partum	Adult	Immature
	Number	Number	Number	Number	Number	Number
21-31 May	2	1	1	-	-	1
1-10 June	19	2	11	-	1	9
11-20 "	129	15	44	-	-	17
21-30 "	30	3	3	-	-	1
1-10 July	7	2	6	1	-	-
11-20 "	23	25	51	41	1	8
21-31 "	-	-	-	-	-	-
1-10 August	-	8	24	32	3	5
11-20 "	1	13	62	107	4	9
21-31 "	-	5	18	23	1	-
1-10 September	-	7	29	44	-	6
11-20 "	-	-	2	3	-	-
21-30 "	-	-	-	2	-	-
1-10 October	-	6	15	16	-	-

for hunting. No particular class is predominant in the limited sample taken (table 4). Four of the five seals collected were taken in western Alaska waters, and one young male was collected in Unimak Pass. Most of the seals were seen 20 to 30 miles south of Tigalda Island.

In the period 1-10 June a concentration of seals was found 10 to 30 miles southeast of Tigalda Island. Seals of both sexes and various ages were collected; females predominated. A 9-year-old male was the oldest of this sex taken. Seals were common in Unimak Pass only in an area approximately 10 miles northeast of Akun Island. Three males large enough to be distinguished as bulls were seen. On 10 June the seals seen in Unimak Pass were moving northeastward towards the Bering Sea.

Sixty-three percent of the 205 collected from 11 to 20 June were pregnant females. Five bulls were seen within Unimak Pass. On 11 and 12 June seals were plentiful southeast of Tigalda Island. On 13 June they were less plentiful and those seen in Unimak Pass were moving northwestward. On 14, 15, and 16 June, seals in Unimak Pass were not feeding and were very evasive when hunted. Late in this period seals again became numerous in the area southeast of Tigalda Island.

More than 80 percent of the 37 seals collected 21-30 June were pregnant females. Much of Unimak Pass was examined, and most of the seals seen were moving northwestward. Very few were seen southeast of Tigalda Island on 21 June. The sea was rough, however, and seals were hard to see. They appeared to be numerous between Unimak Pass and the Pribilof Islands, but here also rough seas hindered observations. Animals were observed feeding and also moving steadily.

Seals were not plentiful from 1 to 10 July. The first post partum female was collected on 3 July near St. George Island and the first in Unimak Pass on 7 July. A large 12-year-old bull was collected approximately 60 miles southeast of St. George Island on 4 July. Only two trips were made into Unimak Pass during this period.

Pregnant and post partum females were taken in nearly equal proportions in the period 11-20 July. Immature females became relatively more abundant. One mature bull 12 years old was taken. Seals were numerous in the north central part of Unimak Pass, 10 to 20 miles north-northeast of Billings Head, and in an area 10 to 15 miles southeast of Tigalda Island. Eleven of fourteen collected were immature. No movements of seals through Unimak Pass were observed during this period.

No collecting was done in Unimak Pass from 21 to 31 July. Some hunting was done in the vicinity of the Pribilof Islands. The seals collected were either bulls or post partum females.

Of 72 seals collected 1-10 August, 32 were post partum females, 8 were nonpregnant mature females, 24 were immature females, and 8 were males. Of the eight males collected, three were bulls 10, 11, and 12 years old. Observations on two trips through the area 10 to 20 miles north of Akun Island disclosed a concentration of feeding and resting seals. In the center of Unimak Pass, 35 seals of mixed ages and both sexes were found. Seven large bulls were seen but not collected during this period.

Most of the 196 seals collected from 11 to 20 August were post partum and immature females. One pregnant female was taken (see Anomalies section). Three large bulls 10, 13, and 14 years old were collected in Unimak Pass. A large concentration of resting and feeding seals was found in two visits to the northwest corner of Unimak Pass. A complete survey was not possible because of storms. Numerous immature animals were located southeast of Tigalda Island. Three large bulls were seen north of Akun Island.

About 50 percent of the seals taken in or north of Unimak Pass from 21 to 31 August were post partum females. South of Unimak Pass 15 of 23 seals collected were immature females. The Bering Sea side of Unimak Pass held a concentration of feeding and resting seals. They were scarce south of Tigalda Island and in Unimak Pass except in the northern approach.

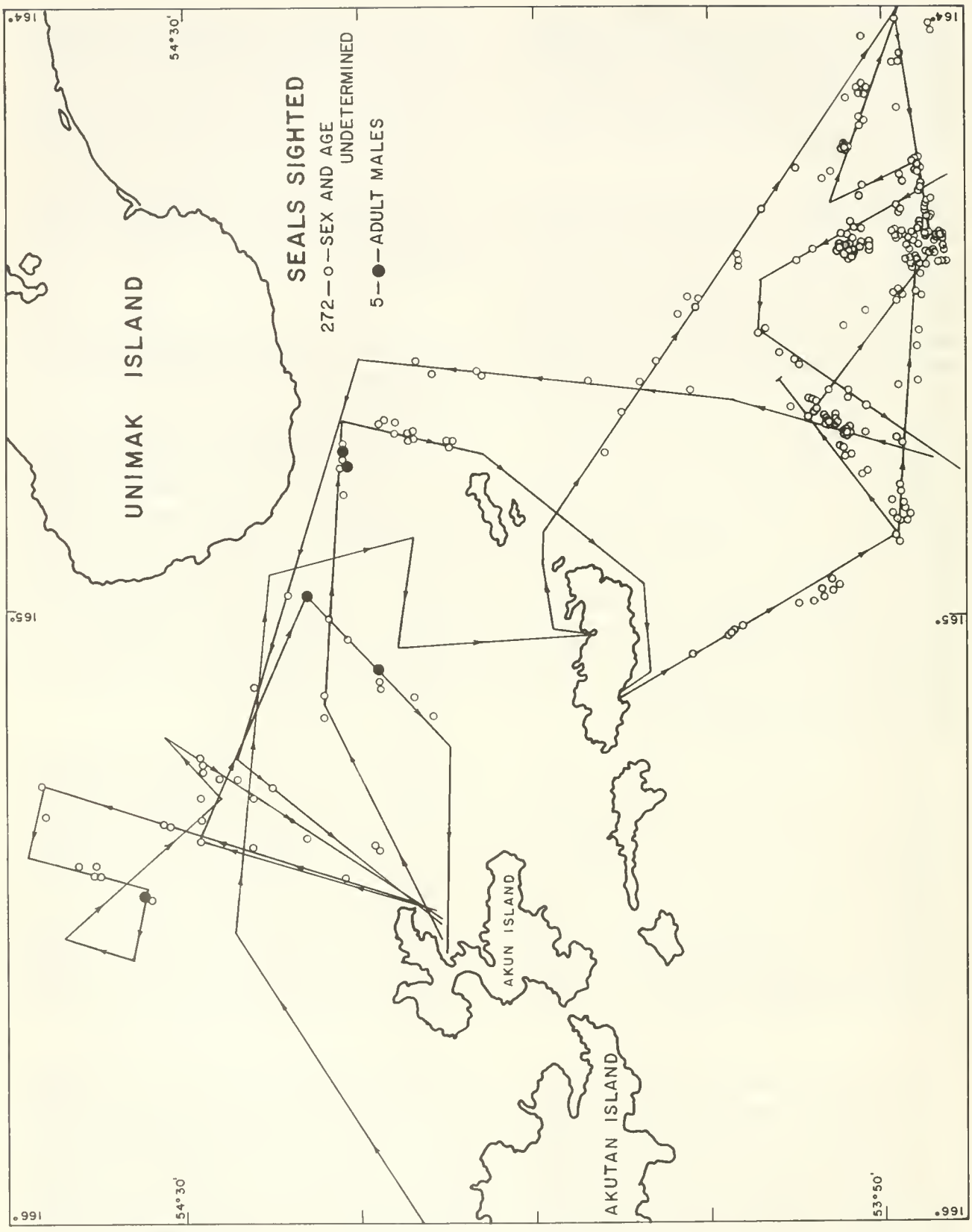

Figure 3.--Fur seals sighted during the period 11-20 June 1962 in the Unimak Pass area.

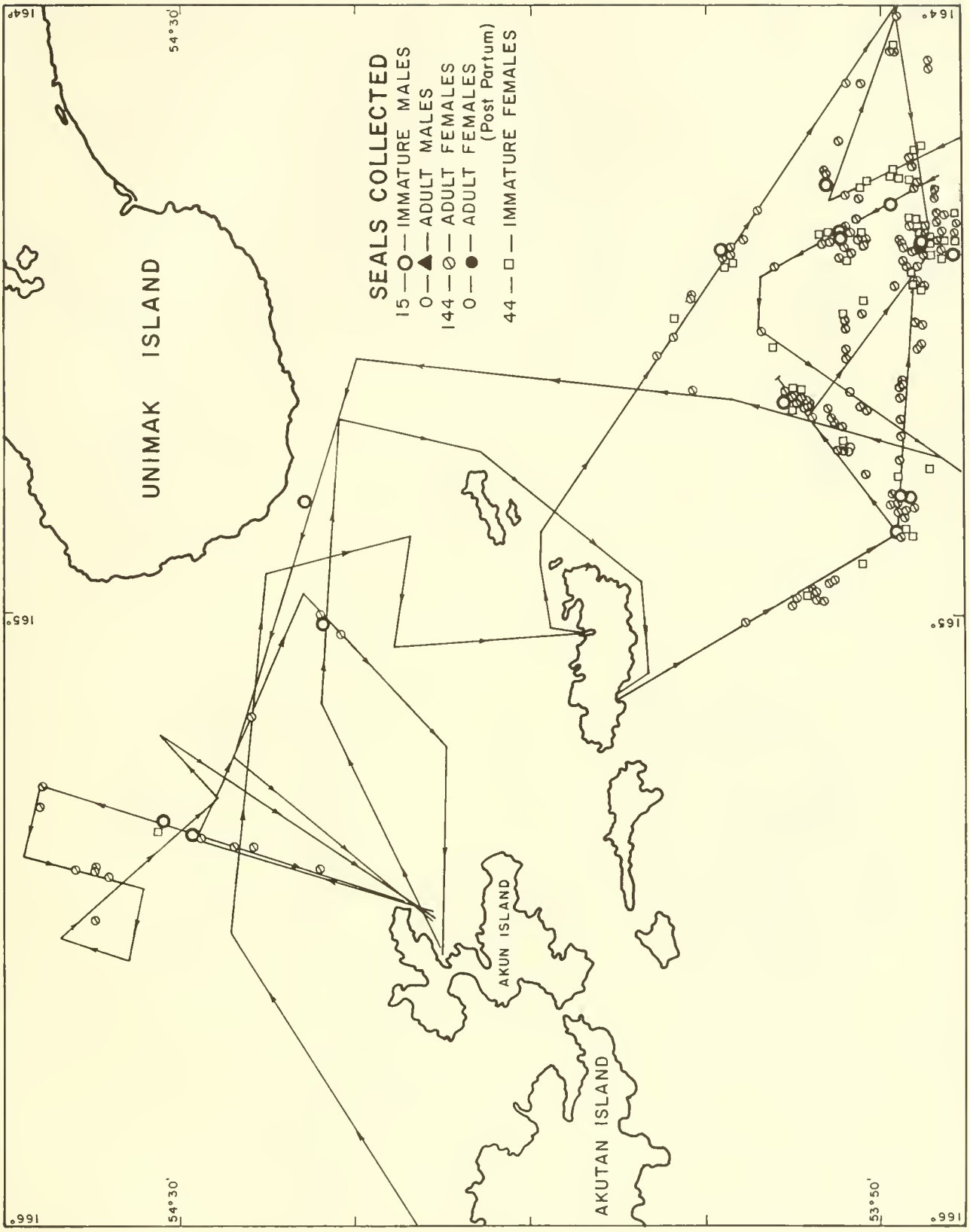

Figure 4.--Fur seals collected during the period 11-20 June 1962 in the Unimak Pass area.

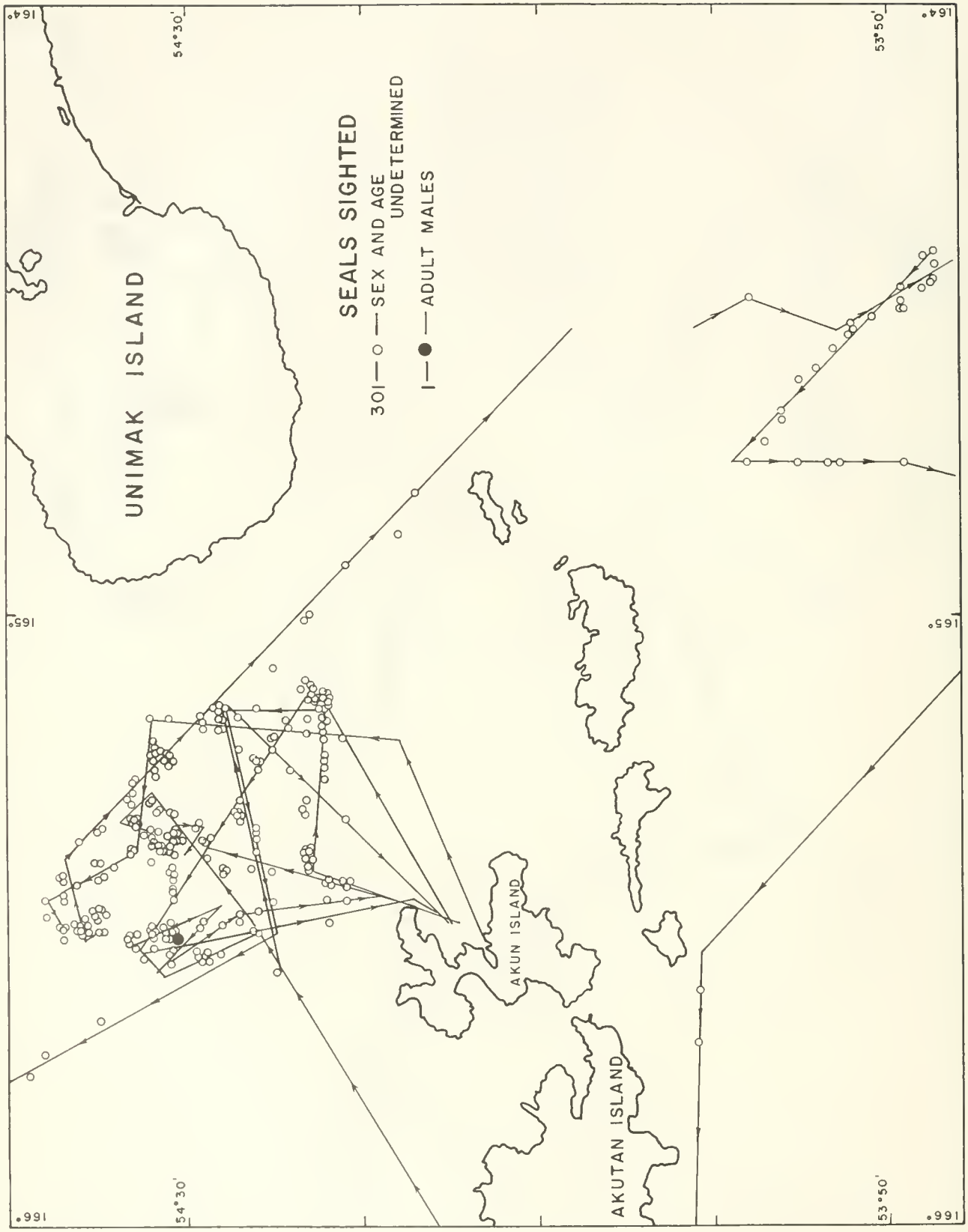

Figure 5.--Fur seals sighted during the period 11-20 July 1962 in the Unimak Pass area.

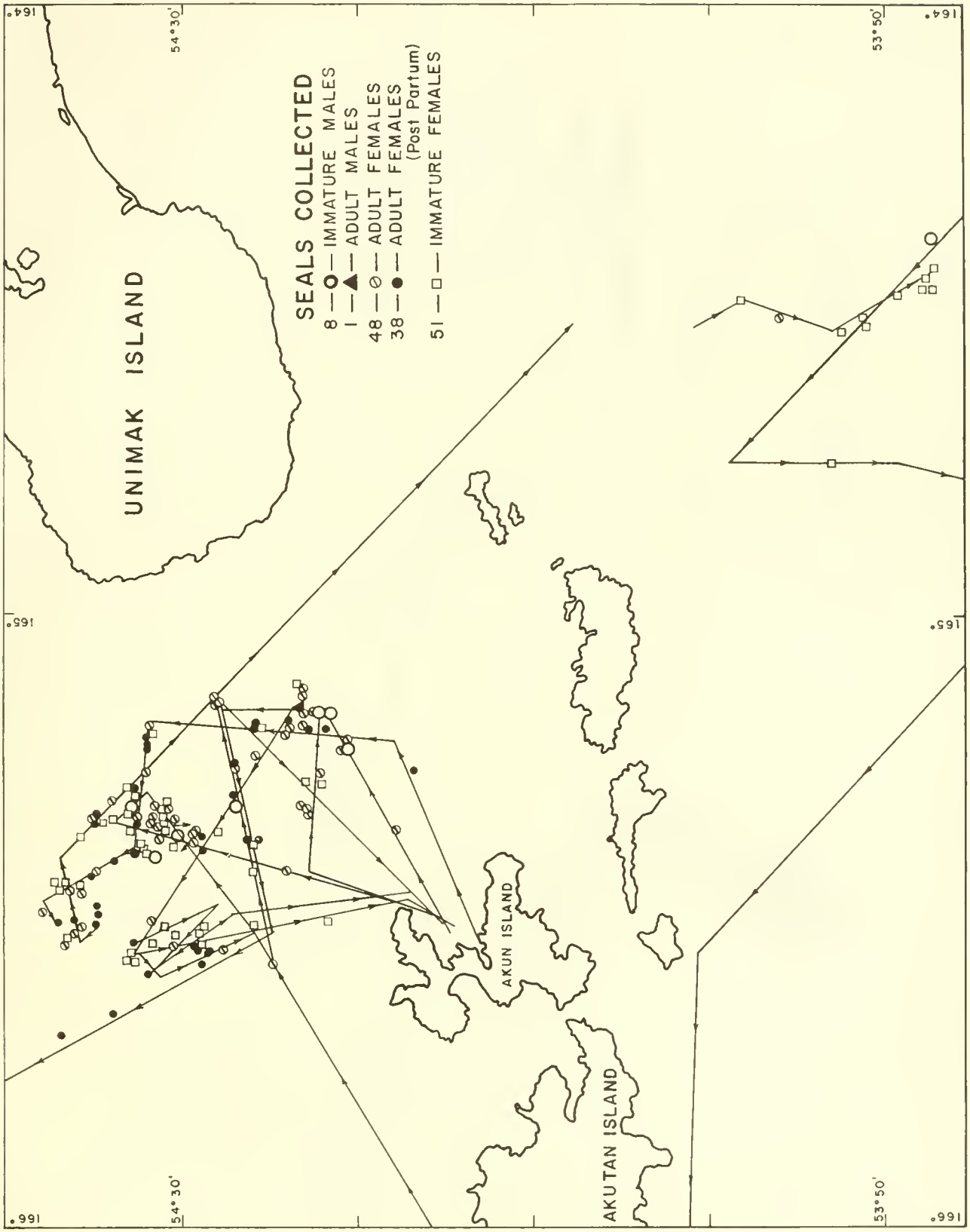

Figure 6.--Fur seals collected during the period 11-20 July 1962 in the Unimak Pass area.

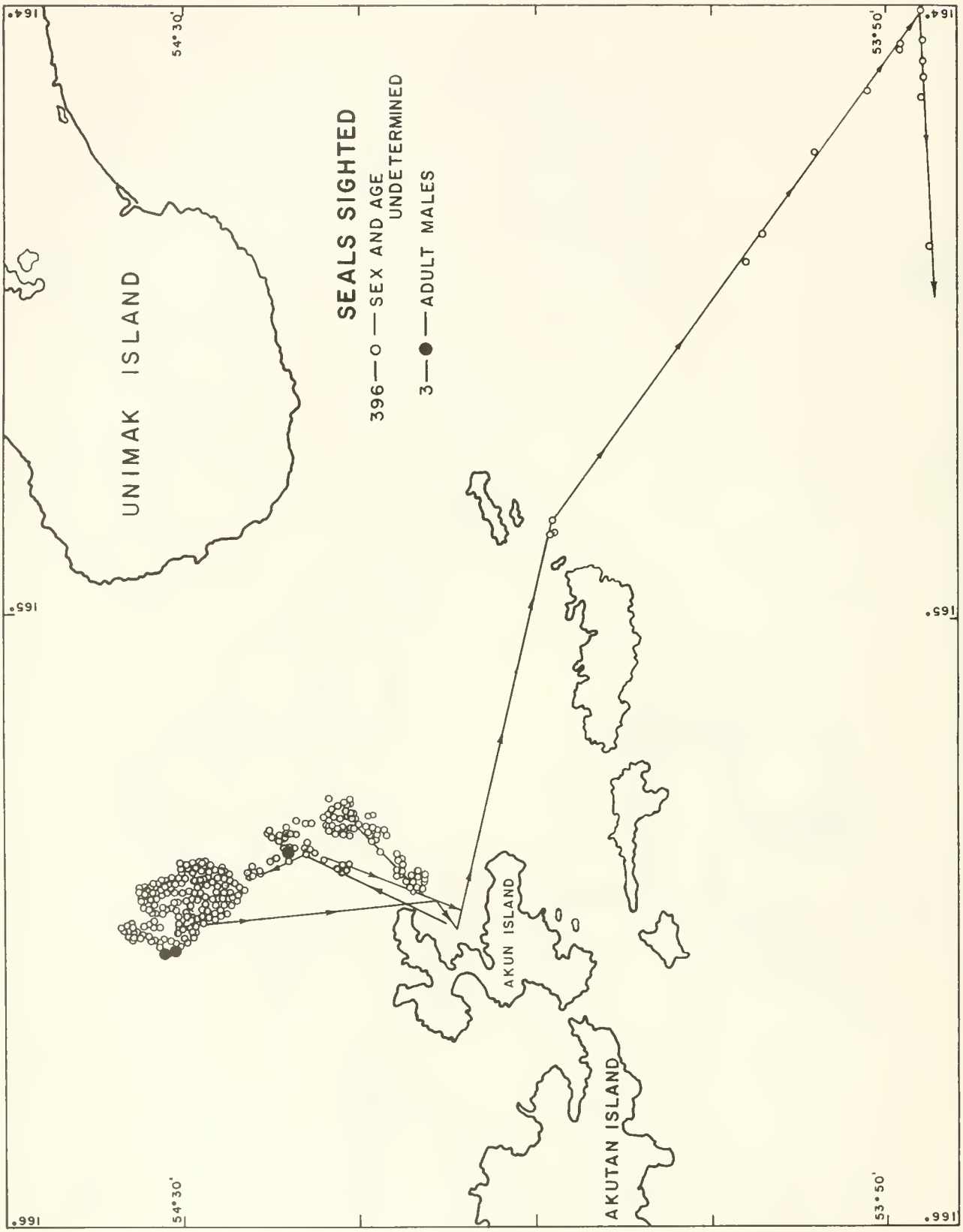

Figure 7.--Fur seals sighted during the period 11-20 August 1962 in the Unimak Pass area.

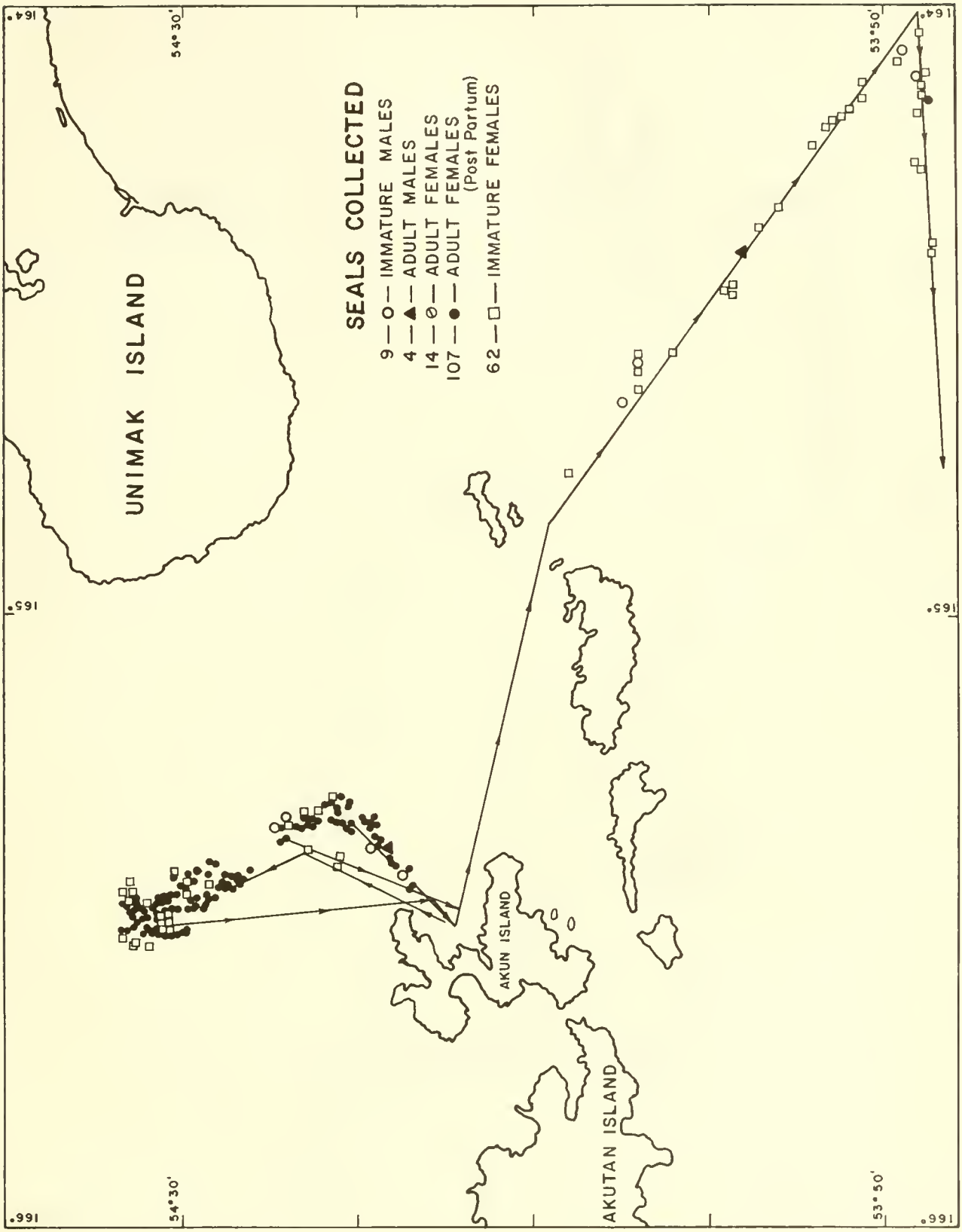

Figure 8.--Fur seals collected during the period 11-20 August 1962 in the Unimak Pass area.

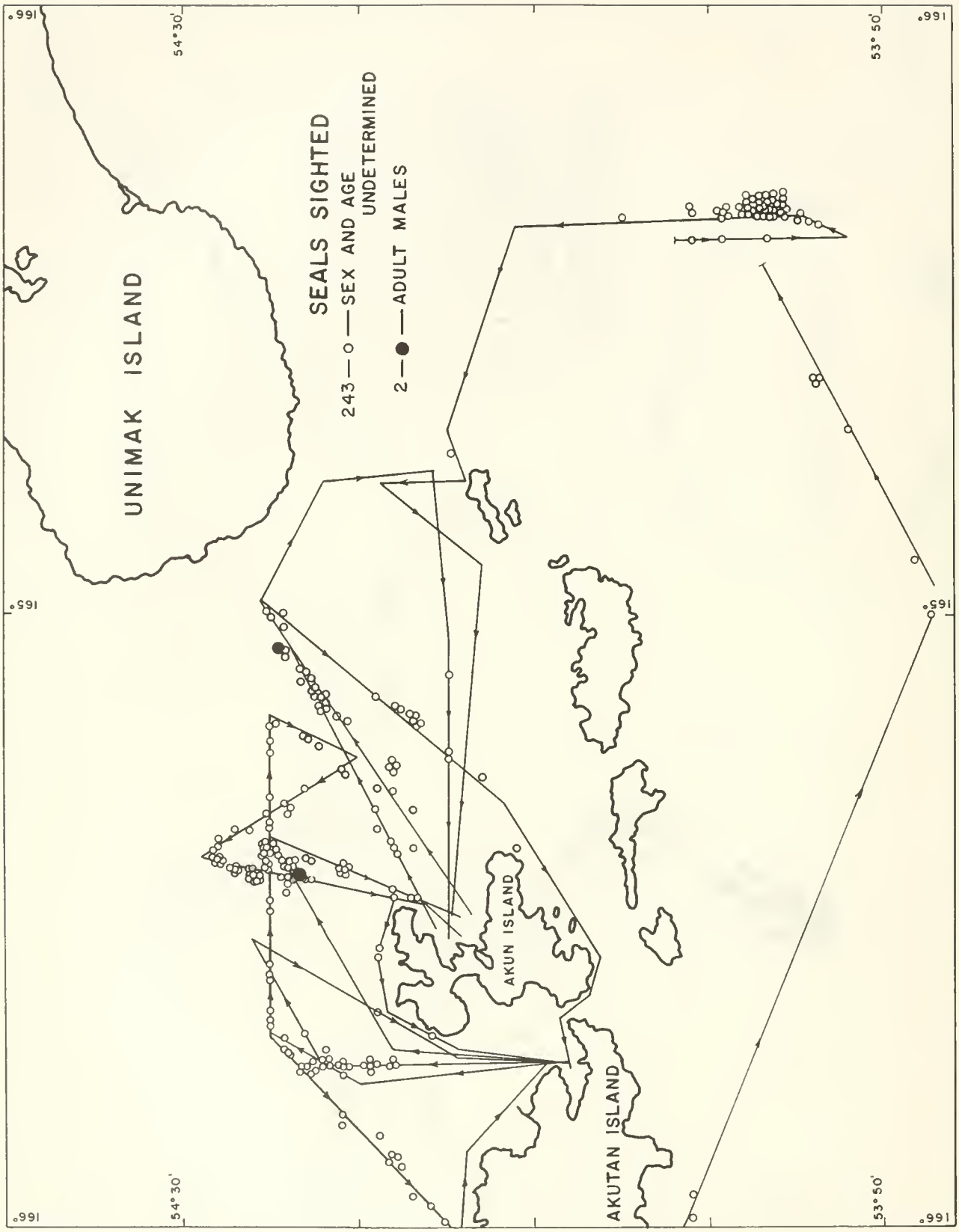

Figure 9.--Fur seals sighted during the period 1-10 September 1962 in the Unimak Pass area.

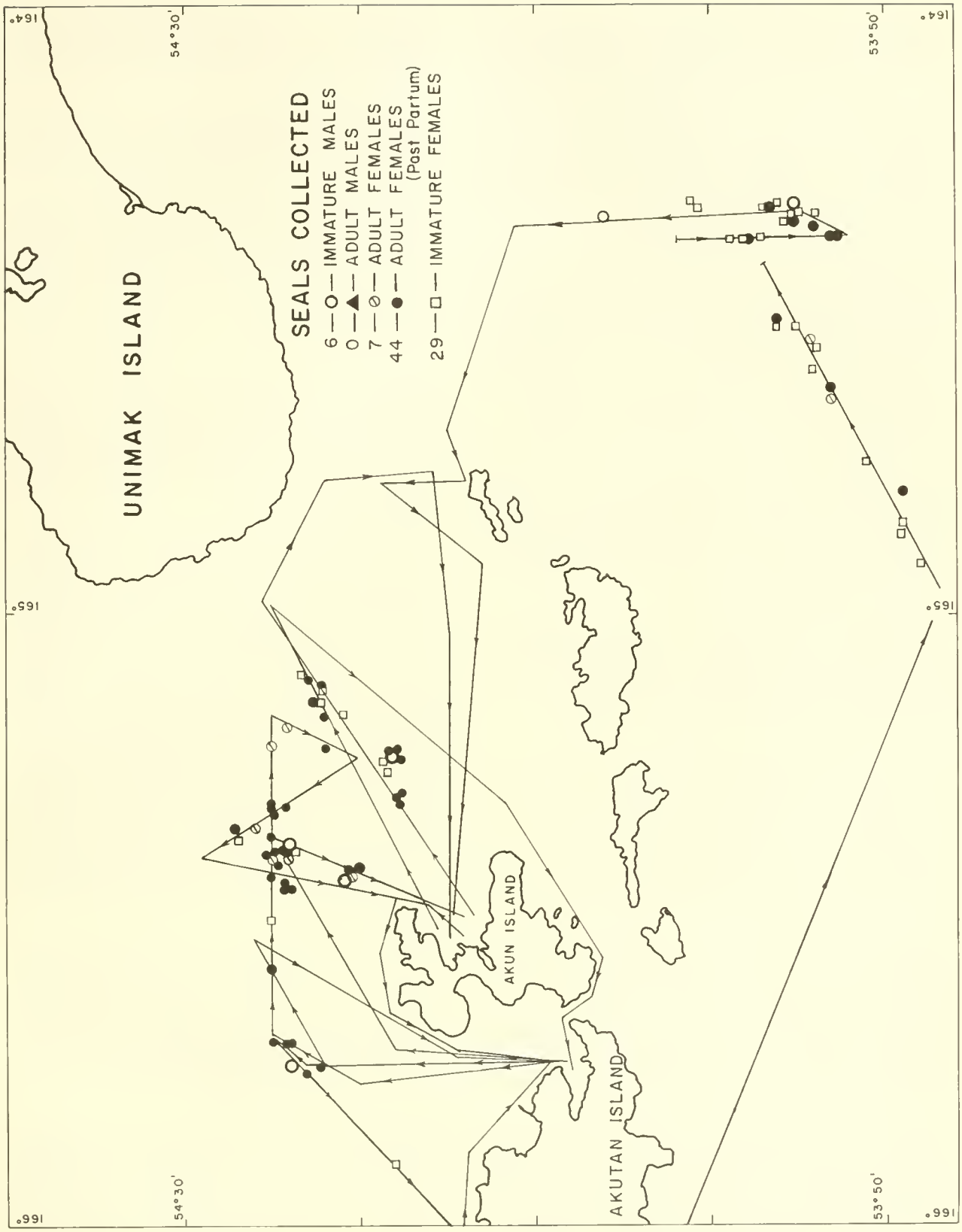

Figure 10.--Fur seals collected during the period 1-10 September 1962 in the Unimak Pass area.

In the first 10 days of September more than half of the seals collected were post partum females. Immature females were five times as abundant as immature males. Two bulls were seen. Seals were again found feeding and resting north and east of Akun Island and southeast of Tigalda Island. Of 33 collected southeast of Tigalda Island, 21 were immature. No seals considered to be traveling were observed in Unimak Pass.

Three of the five seals collected in the vicinity of Unimak Pass from 11 to 20 September were post partum females; the others were immature females. One large bull was seen but not collected. Most of the collecting was done west of Unimak Pass, and the majority of seals collected were immature.

Only two post partum females were taken in Unimak Pass and vicinity from 21 to 30 September. Weather was poor during most of this period. In 1 day of hunting northwest of Unalaska Island, 15 seals were collected, of which 6 were immature.

From 1 to 10 October female seals, both post partum and immature, were still abundant north and northeast of Akun Island. Very few seals were seen in Unimak Pass.

The first pregnant females were collected on the feeding grounds southeast of Tigalda Island in the latter part of May. During June large numbers of pregnant females were found in the two feeding areas and in Unimak Pass. They comprised 63 percent of the seals collected.

In July, diminishing numbers of pregnant females moved through the pass. Forty-four percent of the seals collected during the first 10 days of July were pregnant. From 11 to 20 July, pregnant females comprised only 15 percent of the seals collected. The last pregnant seal was taken 11 August.

The first post partum female from the vicinity of Unimak Pass was taken 7 July. They appeared in increasing numbers until August. From August until collecting ended in October, post partum females comprised approximately 50 percent of the seals taken. The majority were taken on the feeding grounds northeast of Akun Island. A few were found southeast of Tigalda Island.

Immature females amounted to approximately 25 percent of the seals collected during May and June, 30 percent during July, and 34 percent in August, September, and the first part of October. On the feeding grounds southeast of Tigalda Island, 70 percent of the seals collected from July through September were immature females and a similar high percentage was found north of Unalaska Island in September.

Nonpregnant mature females were found throughout the season in all collecting areas. No distinct periods of high or low numbers were found. They comprised approximately 10 percent of the total seals collected in the Unimak Pass area.

The first two bulls seen in the Unimak Pass area were found on 25 May about 20 miles southeast of the pass. During the first 20 days of June, nine bulls were seen in Unimak Pass and one, a 9-year-old, was collected. None was seen during the last 10 days of June and the first 10 days of July; however, one 12-year-old bull was collected approximately 60 miles southeast of St. George Island on 4 July. In mid-July, two were seen in Unimak Pass; one, a 12-year-old, was collected. Seventeen bulls were seen in Unimak Pass and vicinity in August. Seven that were collected ranged in age from 9 to 14 years. Three bulls were seen in September but none was seen after 13 September.

Young male seals were collected regularly throughout the season. There were no periods of unusual abundance or scarcity. None was collected after 10 September in the Unimak Pass; however, some were taken west of the pass later in September.

Seals were found in the pass throughout the day regardless of the direction of the 3-knot average tidal currents. Seals with stomachs ranging from full to empty were collected in the pass at all hours of the day. In June when all seals seen in the pass appeared to be

moving steadily northwestward, observers assumed that they were not feeding in Unimak Pass. Freshly caught, undigested fish, however, were found in stomachs of those taken. They were also found feeding in areas southeast and northwest of the pass.

Bering Sea.--Little collecting was done in the Bering Sea in May or June. A vessel sailed from Unimak Pass to the Pribilof Islands in late June, returning to Unalaska in early July. In late July and early August the trip was repeated, and in addition a short trip to the northward of St. Paul Island was made. On both of these trips seals were found over the whole distance between the Aleutian Islands and the Pribilof Islands with the greatest numbers in the immediate vicinity of the Pribilof Islands. In late August and early September the vessel *Tacoma* sailed from Bogoslof Island to the Pribilof Islands and returned to Unalaska. This cruise was made in deep water west of routes followed on two previous trips. Seal distribution appeared to be uneven, compared with observations made in June and July east of the 100-fathom depth curve. Some seals were seen, although no large concentrations were observed during several days spent 20-50 miles west and southwest of St. George Island in late August. Seals were found north of the Aleutian Islands between Unimak Pass and Bogoslof Island, along the 100-fathom curve. Their occurrence in deep or shallow water varied from day to day. The number of seals increased in August and remained stable through September. The numbers of animals in the locality may have remained about the same with a continuous flow of seals to and from the Pribilof Islands.

Distribution by Age and Sex

In Alaskan waters 1,486 seals were collected in 1962; 1,354 (91.1 percent) females, and 132 (8.9 percent) males. The ages of six females could not be determined, and the reproductive conditon of five other females was not obtained. These seals have been omitted from tables as footnoted.

Table 5 gives the age and sex of seals collected in western Alaska, Unimak Pass, and the Bering Sea. Age groups 3 through 11 had the largest numbers of seals. This finding agrees with the results of Bering Sea and Unimak Pass collections made in 1960.

The predominant age class of females was 4 years. From 1958 through 1961 the predominant age class varied from 8 to 12 years. This difference can be explained by the intensive collecting in 1962 in the Unimak Pass area where young females were present in large numbers throughout the collection period. Off California, Oregon, Washington, British Columbia, and in Alaska east of Unimak Pass young females are usually widely dispersed.

The predominant male age class in 1958, 1960, and 1962 was 3 years. In each of these years all or most of the collections were made in Alaska waters. In 1959 and 1961 when collecting was done from British Columbia south to California 1-year-old males formed the largest age class. The extent of southward migration of males appears to be inversely related, in a rough way, to age. Seals less than a year old would be expected to be most numerous, but it is possible that in years of heavy mortality among the young the year class may soon have fewer animals than remain from a year class having better survival.

In fact, yearlings have formed only a small proportion of collections made off the Pacific Coast States and Alaska. They comprised 0.5 percent of the seals collected in Unimak Pass and the Bering Sea in 1960. In 1958, 1959, and 1961 they made up 2.0, 1.7, and 4.0 percent, respectively, of the collections. The lower proportions for the Bering Sea and Unimak Pass are due to the lateness of the northward movement of yearlings. Also yearlings have not been found congregated in the pass area as were most other age groups.

Bulls are less abundant and more difficult to collect than other seals. The first bulls were observed in early May in the Gulf of Alaska. Through May and the first half of June, they were commonly observed in the study area and appeared to be moving northward. During the breeding season on the Pribilof Islands, the latter half of June and July,

Table 5 --Age and sex by month and area of fur seals collected by U.S. research vessels off Alaska in 1962[1/]

Age	Western Alaska				Unimak Pass				Bering Sea				Total			
	Male		Female		Male		Female		Male		Female		Male		Female	
Years	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
May																
1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	1	50.0	-	-	-	-	-	-	-	-	-	-	1	33.3	-	-
4	-	-	2	10.5	-	-	-	-	-	-	-	-	-	-	2	10.0
5	1	50.0	-	-	-	-	-	-	-	-	-	-	1	33.3	-	-
6	-	-	1	5.3	-	-	-	-	-	-	-	-	-	-	1	5.0
7	-	-	2	10.5	1	100.0	-	-	-	-	-	-	1	33.3	2	10.0
8	-	-	3	15.8	-	-	-	-	-	-	-	-	-	-	3	15.0
9	-	-	1	5.3	-	-	-	-	-	-	-	-	-	-	1	5.0
10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
12	-	-	2	10.5	-	-	-	-	-	-	-	-	-	-	2	10.0
13	-	-	2	10.5	-	-	-	-	-	-	-	-	-	-	2	10.0
14	-	-	2	10.5	-	-	-	-	-	-	-	-	-	-	2	10.0
15	-	-	1	5.3	-	-	-	-	-	-	1	100.0	-	-	2	10.0
16	-	-	2	10.5	-	-	-	-	-	-	-	-	-	-	2	10.0
20	-	-	1	5.3	-	-	-	-	-	-	-	-	-	-	1	5.0
Total	2		19		1				-		1		3		20	
June																
1	1	5.6	-	-	-	-	-	-	-	-	-	-	1	2.9	-	-
2	2	11.1	-	-	2	16.7	-	-	-	-	-	-	4	11.8	-	-
3	10	55.6	12	5.6	4	33.3	-	-	1	25.0	1	5.3	15	44.1	13	4.5
4	3	16.7	23	10.7	4	33.3	2	3.4	1	25.0	1	5.3	8	23.5	26	9.0
5	2	11.1	21	9.8	-	-	7	12.1	-	-	-	-	2	5.9	28	9.7
6	-	-	13	6.1	-	-	4	6.9	2	50.0	1	5.3	2	5.9	18	6.2
7	-	-	26	12.1	1	8.3	3	5.2	-	-	3	15.8	1	2.9	32	11.0
8	-	-	29	13.6	-	-	2	3.4	-	-	1	5.3	-	-	32	11.0
9	-	-	21	9.8	1	8.3	2	3.4	-	-	1	5.3	1	2.9	24	8.3
10	-	-	15	7.0	-	-	4	6.9	-	-	4	21.0	-	-	23	7.9
11	-	-	11	5.1	-	-	7	12.1	-	-	-	-	-	-	18	6.2
12	-	-	14	6.5	-	-	7	12.1	-	-	1	5.3	-	-	22	7.6
13	-	-	7	3.3	-	-	2	3.4	-	-	-	-	-	-	9	3.1
14	-	-	4	1.9	-	-	4	6.9	-	-	2	10.5	-	-	10	3.4
15	-	-	6	2.8	-	-	3	5.2	-	-	-	-	-	-	9	3.1
16	-	-	6	2.8	-	-	3	5.2	-	-	-	-	-	-	9	3.1
17	-	-	3	1.4	-	-	2	3.4	-	-	1	5.3	-	-	6	2.1
18	-	-	2	0.9	-	-	4	6.9	-	-	2	10.5	-	-	6	2.0
19	-	-	-	-	-	-	1	1.7	-	-	1	5.3	-	-	2	0.7
20	-	-	-	-	-	-	1	1.7	-	-	-	-	-	-	1	0.3
Total	18		213		12		58		4		19		34		290	
July																
1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	1	10.0	-	-	-	-	-	-	1	2.7	-	-
3	1	100.0	1	7.7	4	40.0	5	4.6	8	30.8	2	1.3	13	35.1	8	2.9
4	-	-	7	53.9	2	20.0	12	11.1	6	23.1	7	4.6	8	21.6	26	9.6
5	-	-	1	7.7	1	10.0	13	12.0	1	3.8	15	9.9	2	5.4	29	10.7
6	-	-	1	7.7	1	10.0	11	10.2	-	-	17	11.3	1	2.7	29	10.7
7	-	-	1	7.7	-	-	10	9.3	4	15.4	13	8.6	4	10.8	24	8.9
8	-	-	1	7.7	-	-	7	6.5	2	7.7	16	10.6	2	5.4	24	8.8
9	-	-	-	-	-	-	3	2.8	1	3.8	13	8.6	1	2.7	16	5.9
10	-	-	-	-	-	-	5	4.6	2	7.7	10	6.6	2	5.4	15	5.5
11	-	-	-	-	-	-	7	6.5	1	3.8	12	7.9	1	2.7	19	7.0
12	-	-	-	-	1	10.0	8	7.4	1	3.8	9	6.0	2	5.4	17	6.2
13	-	-	-	-	-	-	4	3.7	-	-	7	4.6	-	-	11	4.0
14	-	-	1	7.7	-	-	3	2.8	-	-	14	9.3	-	-	18	6.6
15	-	-	-	-	-	-	4	3.7	-	-	5	3.3	-	-	9	3.3
16	-	-	-	-	-	-	4	3.7	-	-	5	3.3	-	-	9	3.3
17	-	-	-	-	-	-	7	6.5	-	-	3	2.0	-	-	10	3.7
18	-	-	-	-	-	-	1	0.9	-	-	1	0.7	-	-	2	0.7
19	-	-	-	-	-	-	2	1.9	-	-	1	0.7	-	-	3	1.1
20	-	-	-	-	-	-	-	-	-	-	1	0.7	-	-	1	0.4
22	-	-	-	-	-	-	2	1.9	-	-	-	-	-	-	2	0.7
Total	1		13		10		108		26		151		37		272	
August																
1	1	16.7	1	1.5	-	-	-	-	-	-	-	-	1	2.5	1	0.2
2	2	33.3	9	13.2	4	26.7	6	4.3	6	31.6	5	1.6	12	30.0	20	3.9
3	1	16.7	24	35.3	-	-	8	5.7	5	26.3	16	5.2	6	15.0	48	9.3
4	-	-	15	22.1	2	13.3	13	9.3	-	-	28	9.0	2	5.0	56	10.8
5	-	-	6	8.8	-	-	9	6.4	-	-	26	8.4	-	-	41	7.9
6	-	-	1	1.5	1	6.7	3	2.1	-	-	12	3.9	1	2.5	16	3.1
7	-	-	5	7.4	1	6.7	4	2.9	2	10.5	16	5.2	3	7.5	25	4.8
8	-	-	1	1.5	2	13.3	4	2.9	2	10.5	17	5.5	4	10.0	22	4.2
9	-	-	1	1.5	2	13.3	8	5.7	-	-	18	5.8	2	5.0	27	5.2
10	1	16.7	-	-	1	6.7	15	10.7	-	-	24	7.7	2	5.0	39	7.5
11	-	-	2	2.9	1	6.7	12	8.6	1	5.3	22	7.1	2	5.0	36	6.9
12	1	16.7	1	1.5	-	-	11	7.9	1	5.3	27	8.7	2	5.0	39	7.5
13	-	-	-	-	-	-	9	6.4	2	10.5	18	5.8	2	5.0	27	5.2
14	-	-	-	-	1	6.7	4	2.9	-	-	16	5.2	1	2.5	20	3.9
15	-	-	1	1.5	-	-	8	5.7	-	-	16	5.2	-	-	25	4.8
16	-	-	-	-	-	-	7	5.0	-	-	18	5.8	-	-	25	4.8
17	-	-	1	1.5	-	-	8	5.7	-	-	12	3.9	-	-	21	4.1
18	-	-	-	-	-	-	4	2.9	-	-	9	2.9	-	-	13	2.5
19	-	-	-	-	-	-	2	1.4	-	-	6	1.9	-	-	8	1.5
20	-	-	-	-	-	-	3	2.1	-	-	2	0.6	-	-	5	1.0
21	-	-	-	-	-	-	1	0.7	-	-	1	0.3	-	-	2	0.4
22	-	-	-	-	-	-	1	0.7	-	-	-	-	-	-	1	0.2
24	-	-	-	-	-	-	-	-	-	-	1	0.3	-	-	1	0.2
Total	6		68		15		140		19		310		40		518	

See footnote at end of table.

Table 5.--Age and sex by month and area of fur seals collected by U.S. research vessels off Alaska in 1962[1/]--Continued

Age	Western Alaska				Unimak Pass				Bering Sea				Total			
	Male		Female		Male		Female		Male		Female		Male		Female	
Years	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
								September								
1	-	-	-	-	-	-	-	-	1	9.1	1	0.9	1	5.9	1	0.5
2	2	100.0	6	19.4	-	-	-	-	9	81.8	6	5.2	11	64.7	12	6.1
-	-	-	5	16.1	1	25.0	1	2.0	-	-	14	12.2	1	5.9	20	10.2
4	-	-	6	19.4	-	-	4	8.0	-	-	13	11.3	-	-	23	11.7
5	-	-	2	6.5	-	-	4	8.0	1	9.1	14	12.2	1	5.9	20	10.2
6	-	-	-	-	1	25.0	2	4.0	-	-	6	5.2	1	5.9	8	4.1
7	-	-	-	-	1	25.0	2	4.0	-	-	7	6.1	1	5.9	9	4.6
8	-	-	-	-	1	25.0	2	4.0	-	-	11	9.6	1	5.9	13	6.6
9	-	-	1	3.2	-	-	2	4.0	-	-	2	1.7	-	-	5	2.6
10	-	-	3	9.7	-	-	5	10.0	-	-	12	10.4	-	-	20	10.2
11	-	-	-	-	-	-	6	12.0	-	-	7	6.1	-	-	13	6.6
12	-	-	2	6.5	-	-	4	8.0	-	-	6	5.2	-	-	12	6.1
13	-	-	1	3.2	-	-	3	6.0	-	-	2	1.7	-	-	6	3.1
14	-	-	1	3.2	-	-	6	12.0	-	-	4	3.5	-	-	11	5.6
15	-	-	-	-	-	-	4	8.0	-	-	3	2.6	-	-	7	3.6
16	-	-	-	-	-	-	2	4.0	-	-	1	0.9	-	-	3	1.5
17	-	-	2	6.5	-	-	2	4.0	-	-	2	1.7	-	-	6	3.1
18	-	-	1	3.2	-	-	-	-	-	-	1	0.9	-	-	2	1.0
19	-	-	-	-	-	-	-	-	-	-	1	0.9	-	-	1	0.5
20	-	-	1	3.2	-	-	-	-	-	-	2	1.7	-	-	3	1.5
21	-	-	-	-	-	-	1	2.0	-	-	-	-	-	-	1	0.5
Total	2		31		4		50		11		115		17		196	
								October								
1	-	-	-	-	-	-	1	2.7	-	-	-	-	-	-	1	2.1
2	-	-	-	-	-	-	2	5.4	-	-	-	-	-	-	2	4.3
3	-	-	-	-	-	-	1	2.7	-	-	3	30.0	-	-	4	8.5
4	-	-	-	-	-	-	6	16.2	-	-	1	10.0	-	-	7	14.9
5	-	-	-	-	-	-	4	10.8	-	-	1	10.0	-	-	5	10.6
6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7	-	-	-	-	-	-	1	2.7	-	-	-	-	-	-	1	2.1
8	-	-	-	-	-	-	4	10.8	-	-	-	-	-	-	4	8.5
9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	2	5.4	-	-	1	10.0	-	-	3	6.4
11	-	-	-	-	-	-	4	10.8	-	-	1	10.0	-	-	5	10.6
12	-	-	-	-	-	-	1	2.7	-	-	2	20.0	-	-	3	6.4
13	-	-	-	-	-	-	3	8.1	-	-	-	-	-	-	3	6.4
14	-	-	-	-	-	-	4	10.8	-	-	-	-	-	-	4	8.5
15	-	-	-	-	-	-	1	2.7	-	-	-	-	-	-	1	2.1
16	-	-	-	-	-	-	1	2.7	-	-	1	10.0	-	-	2	4.3
17	-	-	-	-	-	-	1	2.7	-	-	-	-	-	-	1	2.1
18	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
19	-	-	-	-	-	-	1	2.7	-	-	-	-	-	-	1	2.1
Totals	-		-		-		37		-		10		-		47	
								Combined totals								
1	2	6.9	1	0.3	-	-	1	0.3	1	1.7	1	0.2	3	2.3	3	0.2
2	6	20.7	15	4.4	7	16.7	8	2.0	15	25.0	11	1.8	28	21.4	34	2.5
3	13	44.8	42	12.2	9	21.4	15	3.8	14	23.3	36	5.9	36	27.5	93	6.9
4	3	10.3	53	15.4	8	19.0	37	9.4	7	11.7	50	8.3	18	13.7	140	10.4
5	3	10.3	30	8.7	1	2.4	37	9.4	2	3.3	56	9.2	6	4.6	123	9.2
6	-	-	16	4.7	3	7.1	20	5.1	2	3.3	36	5.9	5	3.8	72	5.4
7	-	-	34	9.9	4	9.5	20	5.1	6	10.0	39	6.4	10	7.6	93	6.9
8	-	-	34	9.9	3	7.1	19	4.8	4	6.7	45	7.4	7	5.3	98	7.3
9	-	-	24	7.0	3	7.1	15	3.8	1	1.7	34	5.6	4	3.1	73	5.4
10	1	3.5	18	5.2	1	2.4	31	7.9	2	3.3	51	8.4	4	3.1	100	7.5
11	-	-	13	3.8	1	2.4	36	9.2	2	3.3	42	6.9	3	2.3	91	6.8
12	1	3.5	19	5.5	1	2.4	31	7.9	2	3.3	45	7.4	4	3.1	95	7.1
13	-	-	10	2.9	-	-	21	5.3	2	3.3	27	4.5	2	1.5	58	4.3
14	-	-	8	2.3	1	2.4	21	5.3	-	-	36	5.9	1	0.8	65	4.8
15	-	-	8	2.3	-	-	20	5.1	-	-	25	4.1	-	-	53	4.0
16	-	-	8	2.3	-	-	17	4.3	-	-	25	4.1	-	-	50	3.7
17	-	-	6	1.7	-	-	20	5.1	-	-	18	3.0	-	-	44	3.3
18	-	-	3	0.9	-	-	9	2.3	-	-	13	2.2	-	-	25	1.9
19	-	-	-	-	-	-	6	1.5	-	-	9	1.5	-	-	15	1.1
20	-	-	2	0.6	-	-	4	1.0	-	-	5	0.8	-	-	11	0.8
21	-	-	-	-	-	-	2	0.5	-	-	1	0.2	-	-	3	0.2
22	-	-	-	-	-	-	3	0.8	-	-	-	-	-	-	3	0.2
24	-	-	-	-	-	-	-	-	-	-	1	0.2	-	-	1	0.1
Totals	29	7.8	344	92.2	42	9.7	393	90.3	60	9.0	606	91.0	131	8.9	1,343	91.1
Combined totals		373				435				666				1,474		

1/ One male and two females from the Yakutat area and nine females with incomplete data are not included in this table.

only three bulls were seen. They were commonly seen again during August and into early September, but none were seen after 13 September. In early October a vessel sailed across the Gulf of Alaska on a course similar to that sailed in May. No bulls were sighted although weather conditions were favorable.

Tag Recoveries

Fifty seals (3.4 percent of all seals collected in 1962) bore tags (table 6).

A female seal tagged in the U.S.S.R. in 1960 and collected on 4 October in Unimak Pass is the first seal with a Soviet tag collected in waters off the American coast.

Size and Reproductive Condition

Size.--Lengths and weights of the seals collected are given in tables 7 through 14. Taylor, Fujinaga, and Wilke (1955) first recorded that pregnant fur seals are slightly longer than nonpregnant seals of the same age. This difference, which is most noticeable in seals under 10 years of age, has been observed in the pelagic collections from 1958 through 1962. In 1962, the mean lengths of 548 post partum females were compared with mean lengths of 282 pregnant and 513 nonpregnant females (fig. 11). The plotted lengths show the difference between the pregnant and nonpregnant females. The growth curve for post partum females closely agrees with the curve for nonpregnant females, rather than with that for pregnant females as would be expected. Measurement errors may account for this result, otherwise no valid explanation can be given.

Tables 15 and 16 give the lengths and weights of fetuses collected from 1958 through 1962. The average weight and length of fetuses by 10-day periods are plotted in figures 12 and 13. Of 285 fetuses collected in 1962, 15 were taken in May, 204 in June, 65 in July, and 1 in August. The last, a normal full-term female fetus weighing 5.3 kg. was collected on 11 August from a 21-year-old female.

Pregnancy rate.--The pregnancy rate of seals collected from 1958 through 1962 is shown in table 17. In 3- and 4-year-old females, the variation in pregnancy rate from year to year could be a result of sampling. In part this may be due to difference of population make up between the collection areas. It cannot be clearly shown where age of maturation of young females accounts for variation in the pregnancy rate. In the older year classes, variation in pregnancy rates in part may be caused by insufficient sample sizes and variation in the onset of senility.

By combining all females, ages 6 through 26, into one group (the sexually mature population) the pregnancy rate is found to be

Table 6.--Pelagic tag recoveries of fur seals collected by U.S. research vessels off Alaska in 1962

Age	Year tag attached	Tag series	Seals tagged	Number of tags recovered								Catch per year class		
				Western Alaska		Unimak Pass		Bering Sea		Combined				
				♂	♀	♂	♀	♂	♀	♂	♀	♂	♀	♂ and ♀
Years			Number											
1	1961	N	49,921	-	-	-	-	1	-	1	-	3	3	6
2	1960	M	59,981	3	1	-	2[1/]	2	1	5	4	28	34	62
3	1959	L	49,881	-	2	-	1	1	2	1	5	37	93	130
4	1958	K	49,917	-	4	-	1	1	2	1	7	18	140	158
5	1957	J	49,842	-	-	-	4	-	2	-	6	6	123	129
6	1956	I	49,900	-	-	-	2	-	2	-	4	5	73	78
7	1955	H[2/]	49,870	-	4	-	1	-	3	-	8	10	93	103
8	1954	G	10,000	-	-	-	-	-	2	-	2	7	98	105
9	1953	F	10,388	-	-	-	1	-	-	-	1	4	73	77
10	1952	E	19,979	-	1	-	2	-	2	-	5	4	100	104
	Total			3	12	-	14	5	16	8	42	122	830	952

1/ Includes one Soviet tagged seal (MOSCOW "BHNPO"-C 29850).

2/ Includes H numbers 1-10,000, no series letter numbers 10,001-50,000.

Table 7. --Monthly mean lengths of pregnant fur seals collected by U.S. research vessels off Alaska in 1962

Age	May		June		July		August		Combined Length		
	Seals	Mean length	Seals	Mean length	Seals	Mean length	Seals	Mean length	Mean	Standard deviation	Seals
Years	Number	Cm.	Number	Cm.	Number	Cm.	Number	Cm.	Cm.	Cm.	Number
4	-	-	1	115.0	-	-	-	-	115.0	0.0	1
5	-	-	7	117.3	2	125.0	-	-	119.0	4.1	9
6	1	128.0	11	122.2	6	120.0	-	-	121.8	4.4	18
7	1	125.0	29	124.3	8	128.5	-	-	125.2	4.2	38
8	2	123.5	29	125.3	10	126.2	-	-	125.4	5.2	41
9	-	-	19	125.3	6	127.7	-	-	125.9	4.3	25
10	-	-	19	128.8	8	129.2	-	-	129.0	5.2	27
11	-	-	16	128.7	6	129.7	-	-	129.0	5.2	22
12	3	131.3	21	128.8	7	132.7	-	-	129.9	7.0	31
13	2	130.0	9	126.0	-	-	-	-	126.7	8.1	11
14	1	128.0	9	129.6	2	131.0	-	-	129.7	4.2	12
15	2	130.5	9	131.6	3	130.7	-	-	131.2	3.3	14
16	2	132.0	8	128.9	1	132.0	-	-	129.7	5.5	11
17	-	-	4	133.0	3	129.3	-	-	131.4	4.9	7
18	-	-	7	134.7	1	131.0	-	-	134.2	4.7	8
19	-	-	2	133.5	1	124.0	-	-	130.3	5.5	3
20	1	134.0	1	129.0	1	142.0	1	126.0	132.7	7.0	4
Total	15		201		65		1				282[1/]

1/ Two pregnant females have been omitted since their ages are unknown.

Table 8. --Monthly mean weights of pregnant fur seals collected by U.S. research vessels off Alaska in 1962

Age	May		June		July		August		Combined Weight		
	Seals	Mean weight	Seals	Mean weight	Seals	Mean weight	Seals	Mean weight	Mean	Standard deviation	Seals
Years	Number	Kg.	Number	Kg.	Number	Kg.	Number	Kg.	Kg.	Kg.	Number
4	-	-	1	37.0	-	-	-	-	37.0	0.0	1
5	-	-	7	37.6	2	42.5	-	-	38.7	2.8	9
6	1	42.0	11	42.2	6	39.8	-	-	41.4	4.3	18
7	1	40.5	29	43.7	8	45.4	-	-	44.0	4.4	38
8	2	40.0	29	45.7	10	47.6	-	-	45.9	4.9	41
9	-	-	19	44.9	6	51.6	-	-	46.5	5.9	25
10	-	-	19	47.1	8	49.7	-	-	47.9	3.7	27
11	-	-	16	49.1	6	51.4	-	-	49.7	4.8	22
12	3	51.0	21	48.5	7	54.3	-	-	50.1	5.6	31
13	2	47.0	9	46.9	-	-	-	-	46.9	7.3	11
14	1	48.0	9	50.8	2	54.0	-	-	51.1	3.0	12
15	2	45.5	9	52.2	3	53.2	-	-	51.4	5.4	14
16	2	46.5	8	51.2	1	52.0	-	-	50.5	4.4	11
17	-	-	4	60.0	3	51.2	-	-	56.2	7.4	7
18	-	-	7	57.9	1	54.0	-	-	57.4	5.5	8
19	-	-	2	54.7	1	50.0	-	-	53.2	3.9	3
20	1	51.0	1	51.0	1	59.0	1	51.0	53.0	4.0	4
Total	15		201		65		1				282[1/]

1/ Two pregnant females have been omitted since their ages are unknown.

Table 9.--Monthly mean lengths of post partum fur seals collected by U.S. research vessels off Alaska in 1962

Age	July		August		September		October		Combined Length		
	Seals	Mean length	Seals	Mean length	Seals	Mean length	Seals	Mean length	Mean	Standard deviation	Seals
Years	Number	Cm.	Number	Cm.	Number	Cm.	Number	Cm.	Cm.	Cm.	Number
3	-	-	1	111.0	-	-	-	-	111.0	0.0	1
4	1	116.0	-	-	2	110.5	-	-	112.3	4.7	3
5	10	116.5	6	117.5	7	117.4	-	-	117.0	3.6	23
6	7	114.0	8	116.7	6	118.2	-	-	116.2	4.2	21
7	11	119.5	20	122.1	9	122.6	1	118.0	121.4	4.2	41
8	11	122.8	22	122.4	11	122.1	3	125.0	122.6	4.7	47
9	8	124.5	25	123.3	4	122.5	-	-	123.5	5.5	37
10	6	122.2	36	121.3	18	124.2	2	126.0	122.4	5.4	62
11	12	123.7	30	124.0	13	126.5	4	124.7	124.6	5.4	59
12	9	124.6	33	123.3	11	123.4	3	125.7	123.7	5.3	56
13	10	125.1	27	125.7	5	125.6	2	126.5	125.6	4.6	44
14	14	127.8	18	124.1	10	129.9	3	130.7	127.0	5.3	45
15	3	130.3	20	126.0	5	128.2	1	117.0	126.6	4.8	29
16	5	121.2	22	124.5	2	125.5	1	122.0	123.9	4.6	30
17	2	123.5	18	127.3	4	127.7	1	133.0	127.3	5.9	25
18	1	124.0	9	124.8	-	-	-	-	124.7	4.9	10
19	-	-	5	129.2	1	130.0	-	-	129.3	4.9	6
20	-	-	3	126.3	1	129.0	-	-	127.0	2.4	4
21	-	-	2	128.0	1	141.0	-	-	132.3	7.6	3
22	1	128.0	1	131.0	-	-	-	-	129.5	2.1	2
Total	111		306		110		21				548 1/

1/ One seal of unknown age and two seals with undetermined reproductive condition are omitted.

Table 10.--Monthly mean weights of post partum fur seals collected by U.S. research vessels off Alaska in 1962

Age	July		August		September		October		Combined Weights		
	Seals	Mean weight	Seals	Mean weight	Seals	Mean weight	Seals	Mean weight	Mean	Standard deviation	Seals
Years	Number	Kg.	Number	Kg.	Number	Kg.	Number	Kg.	Kg.	Kg.	Number
3	-	-	1	21.0	-	-	-	-	21.0	0.0	1
4	1	21.0	-	-	2	24.7	-	-	23.5	3.5	3
5	10	29.5	6	26.8	7	29.1	-	-	28.7	3.2	23
6	7	27.1	8	29.8	6	30.6	-	-	29.1	4.2	21
7	11	30.1	20	32.4	9	31.2	1	32.0	31.5	3.5	41
8	11	33.5	22	33.3	11	34.5	3	36.0	33.8	3.9	47
9	8	33.8	25	35.3	4	33.5	-	-	34.8	4.1	37
10	6	32.4	36	33.9	18	35.1	2	38.7	34.3	3.9	62
11	12	36.6	30	35.5	13	37.5	4	36.0	36.2	4.2	59
12	9	36.9	33	35.5	11	36.9	3	39.8	36.3	4.7	56
13	10	36.2	27	37.8	5	36.6	2	40.0	37.4	4.0	44
14	14	39.3	18	37.9	10	41.2	3	44.7	39.5	5.2	45
15	3	45.5	20	38.1	5	38.9	1	36.0	38.9	4.5	29
16	5	36.3	22	37.7	2	35.0	1	36.5	37.2	2.8	30
17	2	31.5	18	39.8	4	39.5	1	46.5	39.3	4.9	25
18	1	32.5	9	37.6	-	-	-	-	37.1	6.0	10
19	-	-	5	40.1	1	38.5	-	-	39.8	5.3	6
20	-	-	3	40.3	1	45.0	-	-	41.5	3.9	4
21	-	-	2	42.5	1	48.0	-	-	44.3	3.2	3
22	1	39.0	1	37.0	-	-	-	-	38.0	1.4	2
Total	111		306		110		21				548 1/

1/ One seal of unknown age and two seals with undetermined reproductive condition are omitted.

Table 11.--Monthly mean lengths of nonpregnant fur seals collected by U.S. research vessels off Alaska in 1962

Age	May		June		July		August		September		October		Combined Length		
	Seals	Mean length	Seals	Mean length	Seals	Mean length	Seals	Mean length	Seals	Mean length	Seals	Mean length	Mean	Standard deviation	Seals
Years	Number	Cm.	Number	Cm.	Number	Cm.	Number	Cm.	Number	Cm.	Number	Cm.	Cm.	Cm.	Number
1	-	-	-	-	-	-	1	85.0	1	91.0	1	90.0	88.7	-	3
2	-	-	-	-	-	-	20	99.1	12	100.0	2	95.5	99.2	4.0	34
3	-	-	13	102.9	8	105.2	47	104.9	20	107.6	4	110.7	105.5	4.7	92
4	2	106.0	25	106.9	25	112.4	56	111.6	22	113.9	7	113.0	111.2	5.0	137
5	-	-	21	110.6	17	114.0	35	114.5	13	118.9	5	120.2	114.4	5.9	91
6	-	-	7	114.3	16	116.5	8	120.6	2	119.0	-	-	117.2	4.9	33
7	1	122.0	3	117.7	5	118.4	4	120.5	-	-	-	-	119.2	4.6	13
8	1	126.0	3	125.7	3	120.0	-	-	2	123.0	1	129.0	123.8	5.4	10
9	1	118.0	5	123.4	2	120.5	2	123.0	1	125.0	-	-	122.4	5.7	11
10	-	-	4	121.5	1	127.0	3	124.0	2	124.5	1	123.0	123.4	3 0	11
11	-	-	2	131.0	1	126.0	5	125.0	-	-	1	128.0	126.7	5.6	9
12	1	134.0	1	128.0	1	130.0	6	127.7	-	-	-	-	128.7	4.7	9
13	-	-	-	-	1	125.0	-	-	1	119.0	1	123.0	122.3	-	3
14	1	119.0	1	119.0	2	125.0	2	130.0	1	124.0	1	122.0	124.2	7.3	8
15	-	-	-	-	3	128.7	5	124.6	2	120.5	-	-	125.0	6.3	10
16	-	-	1	131.0	3	129.3	3	130.7	1	131.0	1	128.0	130.0	3.3	9
17	-	-	2	130.5	5	129.4	3	123.0	2	132.5	-	-	128.5	5.0	12
18	-	-	1	121.0	-	-	4	127.5	2	131.5	-	-	127.7	6.4	7
19	-	-	-	-	2	125.5	3	129.3	-	-	1	134.0	128.8	6.4	6
20	-	-	-	-	-	-	1	132.0	2	132.0	-	-	132.0	-	3
21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
22	-	-	-	-	1	124.0	-	-	-	-	-	-	124.0	-	1
23	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
24	-	-	-	-	-	-	1	120.0	-	-	-	-	120.0	-	1
Total	7		89		96		209		86		26				513

Table 12.--Monthly mean weights of nonpregnant fur seals collected by U.S. research vessels off Alaska in 1962

Age	May		June		July		August		September		October		Combined Weight		
	Seals	Mean weight	Seals	Mean weight	Seals	Mean weight	Seals	Mean weight	Seals	Mean weight	Seals	Mean weight	Mean	Standard deviation	Seals
Years	Number	Kg.	Number	Kg.	Number	Kg.	Number	Kg.	Number	Kg.	Number	Kg.	Kg.	Kg.	Number
1	-	-	-	-	-	-	1	11.0	1	13.0	1	12.5	12.2	-	3
2	-	-	-	-	-	-	20	17.5	12	17.9	2	16.5	16.5	2.0	34
3	-	-	13	19.0	8	20.2	47	21.1	20	21.3	4	22.2	20.8	2.7	92
4	2	20.5	25	21.4	25	25.3	56	26.4	22	25.3	7	24.9	24.9	4.4	137
5	-	-	21	25.2	17	28.2	35	28.9	13	28.5	5	30.2	27.9	4.0	91
6	-	-	7	28.4	16	28.2	8	33.7	2	28.0	-	-	29.6	3.4	33
7	1	30.0	3	31.7	5	30.4	4	32.8	-	-	-	-	31.4	3.2	13
8	1	34.0	3	36.3	3	33.0	-	-	2	31.5	1	36.5	34.1	3.7	10
9	1	31.0	5	35.1	2	33.5	2	32.0	1	32.0	-	-	33.6	2.2	11
10	-	-	4	34.5	1	33.0	3	34.0	2	35.5	1	33.0	34.3	2.9	11
11	-	-	2	37.5	1	39.5	5	36.8	-	-	1	37.5	37.3	3.8	9
12	1	38.0	1	33.0	1	40.0	6	36.1	-	-	-	-	36.4	5.0	9
13	-	-	-	-	1	34.0	-	-	1	35.5	1	37.5	35.7	-	3
14	1	26.0	1	30.5	2	41.5	2	43.0	1	36.0	1	35.0	37.1	7.6	8
15	-	-	-	-	3	44.5	5	34.6	2	33.0	-	-	37.2	5.9	10
16	-	-	1	43.0	3	41.7	3	40.0	1	37.0	1	40.0	40.6	4.7	9
17	-	-	2	43.5	5	43.0	3	42.3	2	39.0	-	-	42.2	6.7	12
18	-	-	1	36.0	-	-	4	41.6	2	41.0	-	-	40.6	5.8	7
19	-	-	-	-	2	37.0	3	43.3	-	-	1	48.0	42.0	7.8	6
20	-	-	-	-	-	-	1	45.0	2	43.0	-	-	43.7	-	3
21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
22	-	-	-	-	1	40.0	-	-	-	-	-	-	40.0	-	1
23	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
24	-	-	-	-	-	-	1	38.0	-	-	-	-	38.0	-	1
Total	7		89		96		209		86		26				513

Table 13.--Monthly mean lengths of male fur seals collected by U.S. research vessels off Alaska in 1962

Age	May		June		July		August		September		Combined Length		
	Seals	Mean length	Seals	Mean length	Seals	Mean length	Seals	Mean length	Seals	Mean length	Mean	Standard deviation	Seals
Years	Number	Cm.	Number	Cm.	Number	Cm.	Number	Cm.	Number	Cm.	Cm.	Cm.	Number
1	-	-	1	80.0	-	-	1	100.0	1	98.0	92.7	11.0	3
2	-	-	4	98.5	1	101.0	12	103.2	11	105.8	103.5	4.8	28
3	2	99.5	15	106.8	13	113.2	5 1/	113.0	1	111.0	109.7	6.0	36
4	-	-	8	116.0	8	121.1	2	122.5	-	-	119.0	6.0	18
5	1	107.0	2	134.0	2	129.5	-	-	1	150.0	130.7	15.0	6
6	-	-	2	157.5	1	138.0	1	141.0	1	145.0	147.8	9.4	5
7	1	143.0	1	141.0	4	163.2	3	152.7	1	150.0	154.5	12.4	10
8	-	-	-	-	2	165.5	4	154.2	1	162.0	158.6	9.3	7
9	-	-	1	174.0	1	178.0	2	178.5	-	-	177.2	3.0	4
10	-	-	-	-	2	180.5	2	166.5	-	-	173.5	9.5	4
11	-	-	-	-	1	184.0	2	179.5	-	-	181.0	2.6	3
12	-	-	-	-	2	190.0	2	181.0	-	-	185.5	8.7	4
13	-	-	-	-	-	-	2	185.0	-	-	185.0	2.8	2
14	-	-	-	-	-	-	1	176.0	-	-	176.0	0.0	1
Total	4		34		37		39		17				131

1/ Six 3-year-old male seals were collected but the length was not obtained for one.

Table 14.--Monthly mean weights of male fur seals collected by U.S. research vessels off Alaska in 1962

Age	May		June		July		August		September		Combined Weight		
	Seals	Mean weight	Seals	Mean weight	Seals	Mean weight	Seals	Mean weight	Seals	Mean weight	Mean	Standard deviation	Seals
Years	Number	Kg.	Number	Kg.	Number	Kg.	Number	Kg.	Number	Kg.	Kg.	Kg.	Number
1	-	-	1	11.0	-	-	1	20.5	1	16.0	15.8	4.8	3
2	-	-	4	17.0	1	17.5	12	20.4	11	21.5	20.2	3.6	28
3	2	20.2	15	23.0	13	30.4	6	26.8	1	23.0	26.1	4.6	37
4	-	-	8	28.5	8	36.0	2	33.5	-	-	32.4	5.5	18
5	1	23.0	2	48.5	2	41.0	-	-	1	70.0	45.3	16.2	6
6	-	-	2	76.5	1	51.0	1	60.0	1	52.5	63.3	12.8	5
7	1	55.0	1	66.0	4	93.5	3	62.5	1	55.0	73.7	20.1	10
8	-	-	-	-	2	91.0	4	76.6	1	64.0	78.9	13.2	7
9	-	-	1	120.0	1	98.5	2	107.5	-	-	108.4	9.1	4
10	-	-	-	-	2	118.7	2	86.5	-	-	102.6	25.5	4
11	-	-	-	-	1	126.0	2	100.5	-	-	109.0	15.4	3
12	-	-	-	-	2	179.2	2	111.2	-	-	145.2	52.8	4
13	-	-	-	-	-	-	2	115.0	-	-	115.0	4.2	2
14	-	-	-	-	-	-	1	92.0	-	-	92.0	0.0	1
Total	4		34		37		40		17				132

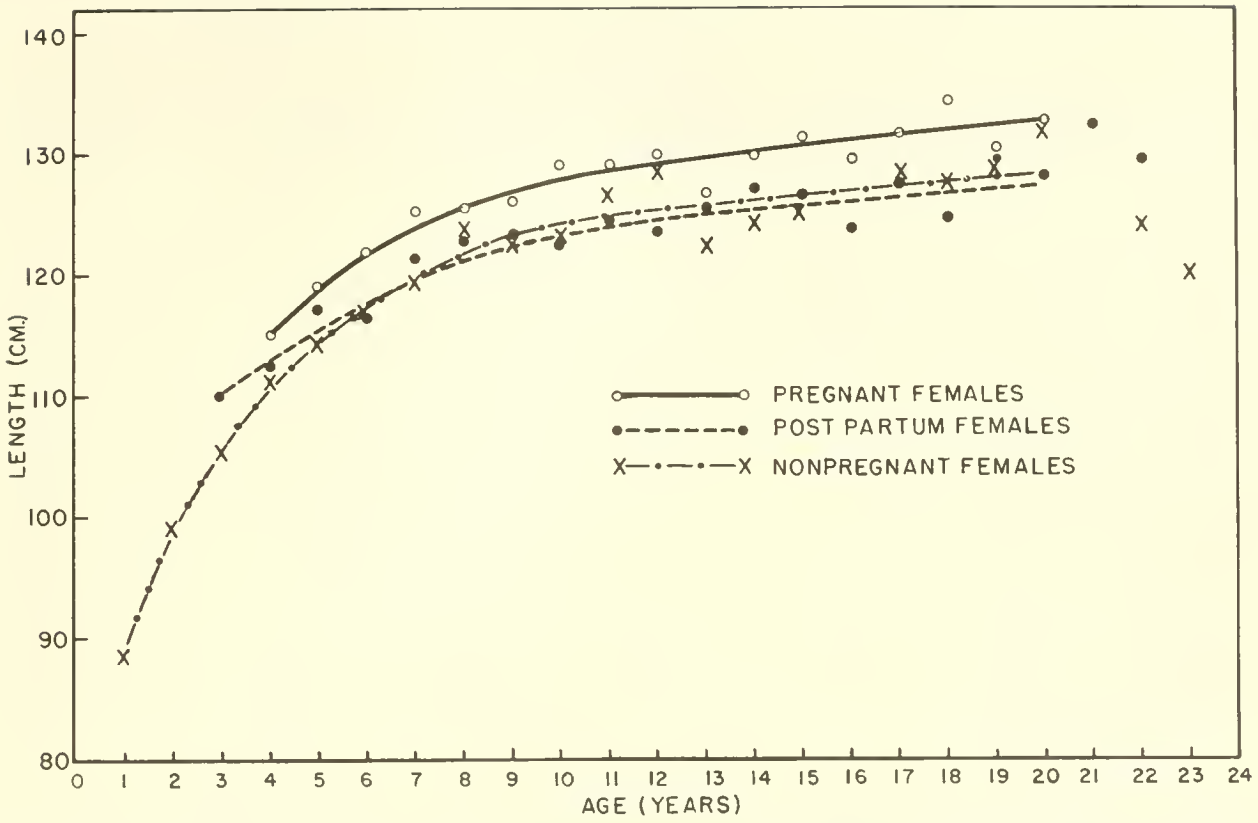

Figure 11.--Comparison of length by age of pregnant, nonpregnant, and post partum female fur seals collected in 1962.

remarkably uniform for all 5 years, with a 5-year average of 83.8 percent. The pregnancy rate of all females, age 3 and over for the 5-year period ranged from about 63 to 79 percent. The 5-year average pregnancy rate is 72.3 percent.

Reproductive condition.--Tables 18, 19, and 20 give the reproductive condition by age, area, and month of females collected in western Alaska, Unimak Pass, and the Bering Sea. The data for 11 females are incomplete and are omitted.

A higher percentage of nulliparous females were collected in western Alaska than Unimak Pass or the Bering Sea. In May and June when pregnant females were moving northward they dominated the western Alaska collection. From July through September, however, nulliparous females were predominant. In Unimak Pass and the Bering Sea, nulliparous females were not as abundant relatively as in western Alaska.

The majority of primiparous females were taken in the Bering Sea during July, August, and September. Primiparous females were taken in a lesser proportion during the period when pregnant females were numerous than later when post partum females predominated. This suggests that the sampling accuracy was not the same during these periods. The youngest pregnant females were three primiparous 4-year-olds.

Nonpregnant multiparous females were found consistently throughout the collection period in all areas. They averaged a few years older than the multiparous pregnant females. Multiparous pregnant females were mainly between the ages of 6 and 17. The most numerous age classes were 8 through 12. This is consistent for the findings reported in pelagic sealing reports for 1958 through 1961.

Table 15.--Mean lengths of fur seal fetuses collected by U.S. research vessels in eastern Pacific, 1958-62

[1958-60]

Period	1958				1959				1960			
	Male		Female		Male		Female		Male		Female	
	Mean lengths	Fetuses	Mean lengths	Fetuses	Mean lengths	Fetuses	Mean lengths	Fetuses	Mean lengths	Fetuses	Mean lengths	Fetuses
	Cm.	Number	Cm.	Number	Cm.	Number	Cm.	Number	Cm.	Number	Cm.	Number
1-10 January	-	-	-	-	-	-	-	-	-	-	-	-
11-20 "	-	-	-	-	-	-	-	-	-	-	-	-
21-31 "	-	-	-	-	18.2	36	18.9	36	-	-	-	-
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 (29) "	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	35.1	14	34.5	17
11-20 "	36.6	58	33.8	60	36.5	34	35.4	43	38.9	15	37.2	25
21-31 "	39.5	46	37.9	42	39.0	17	37.4	22	42.3	22	40.4	16
1-10 April	43.0	4	40.7	4	43.5	74	41.1	71	-	-	43.8	5
11-20 "	46.7	25	44.6	30	47.0	36	46.1	29	47.9	17	45.8	19
21-30 "	49.6	25	48.0	26	49.1	18	47.1	23	49.0	76	46.8	93
1-10 May	54.1	35	52.2	45	-	-	-	-	51.6	60	49.6	59
11-20 "	54.4	56	53.0	37	-	-	-	-	53.3	43	51.6	51
21-31 "	58.0	81	53.8	65	-	-	-	-	56.9	44	53.2	64
1-10 June	58.7	13	57.6	18	-	-	-	-	60.4	17	58.2	10
11-20 "	59.6	33	57.4	26	-	-	-	-	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 August	-	-	-	-	-	-	-	-	-	-	-	-
11-20 "	-	-	-	-	-	-	-	-	-	-	-	-
1-10 December	-	-	-	-	-	-	-	-	4.0 1/	2 2/	-	-
Total		506		467		526		550		390		440
Grand total			973				1,076				830	

Table 15.--Mean lengths of fur seal fetuses collected by U.S. research vessels in eastern Pacific, 1958-62--Continued

[1961-62]

Period	1961				1962				Combined			
	Male		Female		Male		Female		Male		Female	
	Mean lengths	Fetuses	Mean lengths	Fetuses	Mean lengths	Fetuses	Mean lengths	Fetuses	Mean lengths	Fetuses	Mean lengths	Fetuses
	Cm.	Number	Cm.	Number	Cm.	Number	Cm.	Number	Cm.	Number	Cm.	Number
1-10 January	15.3	24	13.3	24	-	-	-	-	15.3	24	13.3	24
11-20 "	17.2	40	16.3	58	-	-	-	-	17.2	40	16.3	58
21-31 "	20.3	76	18.9	89	-	-	-	-	19.6	112	18.9	145
1-10 February	25.1	75	24.2	81	-	-	-	-	23.9	231	22.8	222
11-20 "	26.9	27	26.9	39	-	-	-	-	27.0	139	26.2	152
21-28(29) "	29.9	18	30.8	12	-	-	-	-	30.0	122	28.2	111
1-10 March	33.9	10	33.2	9	-	-	-	-	34.0	93	33.0	93
11-20 "	38.2	10	35.5	15	-	-	-	-	37.0	117	34.9	143
21-31 "	41.4	23	39.6	18	-	-	-	-	40.4	108	38.5	98
1-10 April	41.8	5	43.0	3	-	-	-	-	43.4	83	39.9	83
11-20 "	46.5	52	43.6	46	-	-	-	-	46.9	130	44.8	124
21-30	48.2	28	46.2	26	-	-	-	-	49.0	147	46.9	168
1-10 May	-	-	-	-	59.0	1	54.5	1	52.6	96	50.8	105
11-20 "	-	-	-	-	56.0	2	53.0	2	54.0	101	52.2	90
21-31 "	-	-	-	-	60.3	5	58.2	4	57.7	130	53.6	133
1-10 June	-	-	-	-	61.4	11	58.2	10	60.1	41	57.9	38
11-20 "	-	-	-	-	60.8	58	57.6	88	60.4	102	57.8	136
21-30 "	-	-	-	-	63.4	17	60.1	20	60.8	65	57.9	62
1-10 July	-	-	-	-	64.2	23	60.8	17	63.9	33	60.0	31
11-20 "	-	-	-	-	61.7	9	60.5	15	62.9	18	61.1	17
21-31 "	-	-	-	-	63.0	1	-	-	63.0	3	59.0	1
1-10 August	-	-	-	-	-	-	-	-	-	-	-	-
11-20 "	-	-	-	-	-	-	54.0	1	-	-	54.0	1
1-10 December	-	-	-	-	-	-	-	-	4.0	2	-	-
Total		388		420		127		158		1,937		2,035
Grand total			808				285				3,972	

1/ Crown-rump measurement.

2/ Taken during 1961 pelagic season starting in 1960.

Table 16. --Mean weights of fur seal fetuses collected by U.S. research vessels in eastern Pacific, 1958-62

[1958-60]

Period	1958				1959				1960			
	Male		Female		Male		Female		Male		Female	
	Mean weights	Fetuses	Mean weights	Fetuses	Mean weights	Fetuses	Mean weights	Fetuses	Mean weights	Fetuses	Mean weights	Fetuses
	Kg.	Number	Kg.	Number	Kg.	Number	Kg.	Number	Kg.	Number	Kg.	Number
1-10 January	-	-	-	-	-	-	-	-	-	-	-	-
11-20 "	-	-	-	-	-	-	-	-	-	-	-	-
21-31 "	-	-	-	-	0.2	36	0.2	56	-	-	-	-
1-10 February	0.4	14	0.4	7	0.4	144	0.3	133	-	-	-	-
11-20 "	0.5	24	0.4	30	0.6	89	0.5	85	-	-	-	-
21-28(29) "	0.7	43	0.5	37	0.7	61	0.6	63	-	-	-	-
1-10 March	1.1	53	0.9	45	0.9	17	0.9	23	1.2	14	1.1	17
11-20 "	1.3	59	1.1	62	1.2	35	1.1	42	1.6	15	1.4	25
21-31 "	1.5	46	1.3	42	1.4	17	1.2	22	1.8	22	1.6	15
1-10 April	2.2	4	1.6	4	1.9	74	1.6	71	2.4	2	2.0	5
11-20 "	2.4	26	2.0	30	2.3	36	2.2	29	2.9	15	2.4	19
21-30 "	2.9	25	2.5	26	2.6	18	2.3	23	3.1	76	2.7	93
1-10 May	3.9	35	3.4	44	-	-	-	-	3.6	60	3.2	59
11-20 "	4.1	56	3.6	37	-	-	-	-	4.0	43	3.5	51
21-31 "	4.8	81	4.4	67	-	-	-	-	4.5	44	3.9	64
1-10 June	5.3	13	4.8	18	-	-	-	-	5.0	17	4.4	10
11-20 "	5.9	34	5.3	26	-	-	-	-	4.9	11	4.9	22
21-30 "	-	-	-	-	-	-	-	-	5.7	48	5.1	42
1-10 July	-	-	-	-	-	-	-	-	5.9	10	5.1	14
11-20 "	-	-	-	-	-	-	-	-	6.2	9	5.8	2
21-31 "	-	-	-	-	-	-	-	-	6.0	2	5.3	1
1-10 August	-	-	-	-	-	-	-	-	-	-	-	-
11-20 "	-	-	-	-	-	-	-	-	-	-	-	-
1-10 December	-	-	-	-	-	-	-	-	.003	2	-	-
Total		513		475		527		547		390		439
Grand total		988				1,074				829		

Table 16. --Mean weights of fur seal fetuses collected by U.S. research vessels in eastern Pacific, 1958-62 --Continued

[1961-62]

Period	1961				1962				Combined			
	Male		Female		Male		Female		Male		Female	
	Mean weights	Fetuses	Mean weights	Fetuses	Mean weights	Fetuses	Mean weights	Fetuses	Mean weights	Fetuses	Mean weights	Fetuses
	Kg.	Number	Kg.	Number	Kg.	Number	Kg.	Number	Kg.	Number	Kg.	Number
1-10 January	0.2	24	0.1	24	-	-	-	-	0.2	24	0.1	24
11-20 "	0.2	41	0.1	58	-	-	-	-	0.2	41	0.1	58
21-31 "	0.3	75	0.2	89	-	-	-	-	0.3	111	0.2	145
1-10 February	0.5	74	0.4	82	-	-	-	-	0.4	232	0.3	222
11-20 "	0.6	27	0.6	39	-	-	-	-	0.6	140	0.4	154
21-28(29) "	0.8	18	0.8	12	-	-	-	-	0.7	122	0.6	112
1-10 March	1.0	10	0.9	9	-	-	-	-	1.1	94	0.9	94
11-20 "	1.3	10	1.1	15	-	-	-	-	1.3	119	1.2	144
21-31 "	1.7	23	1.5	19	-	-	-	-	1.6	108	1.4	98
1-10 April	1.9	5	1.7	3	-	-	-	-	1.9	85	1.6	83
11-20 "	2.5	52	2.1	46	-	-	-	-	2.5	129	2.1	124
21-30 "	2.7	28	2.3	26	-	-	-	-	2.9	147	2.6	168
1-10 May	-	-	-	-	5.1	1	3.4	1	3.7	96	3.3	104
11-20 "	-	-	-	-	4.1	2	3.4	2	4.1	101	3.5	90
21-31 "	-	-	-	-	4.7	5	4.1	4	4.7	130	4.2	135
1-10 June	-	-	-	-	5.2	11	4.4	10	5.2	41	4.6	38
11-20 "	-	-	-	-	5.6	58	5.0	88	5.6	103	5.0	136
21-30 "	-	-	-	-	6.0	17	5.5	20	5.8	65	5.2	62
1-10 July	-	-	-	-	6.4	23	5.7	17	6.3	33	5.4	31
11-20 "	-	-	-	-	6.2	9	5.8	15	6.2	18	5.8	17
21-31 "	-	-	-	-	5.6	1	-	-	5.9	3	5.3	1
1-10 August	-	-	-	-	-	-	-	-	-	-	-	-
11-20 "	-	-	-	-	-	-	5.3	1	-	-	5.3	1
1-10 December	-	-	-	-	-	-	-	-	.003	2	-	-
Total		387		422		127		158		1,944		2,041
Grand total		809				285				3,985		

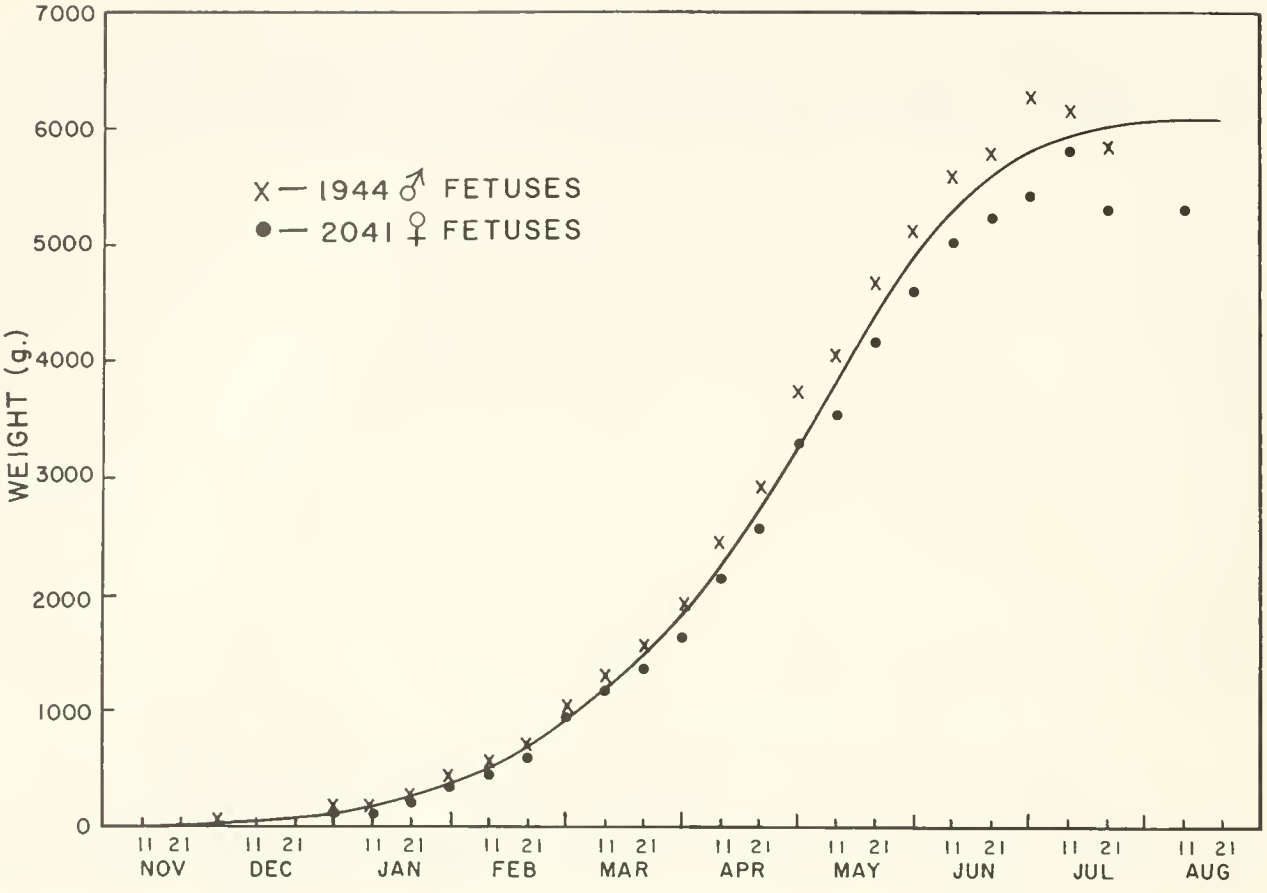

Figure 12.--Weights of 3,985 fur seal fetuses plotted by 10-day periods for 1958-62.

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

Year	Number of seals carrying twins	Uterine horn of pregnancy	Sex of fetuses
1958	1	L and R	F, F
1959	2	L	M, F
		L	M, F
1960	1	L and R	M, F
1961	1	L	M, F
1962	1	L	M, F

In 1962, twins were found on 11 June in a 16-year-old female. The ovary of the pregnant horn (figs. 14-17) contained two corpora lutea. The male fetus was larger (55.0 cm. long and weighed 4.6 kg.) than the female fetus (53.0 cm. long and weighed 4.3 kg.). The average male fetus collected during this same 10-day period was 60.4 cm. and 5.6 kg. The average female was 57.8 cm. and 5.0 kg.

The last pregnant seal was taken on 11 August. A 21-year-old female carried a normal sized female fetus. None was taken between 26 July and 11 August.

Pedunculate barnacles are occasionally found attached to fur seals (Scheffer, 1962). In 1962, two fur seals were collected with barnacles attached to their fur. *Lepas pectinata* was found attached to the individual guard hairs of the neck and back of an adult female collected in Unimak Pass on 28 June. *Lepas anatifera* was found attached to guard hairs behind each ear pinna of a young male fur seal collected about 18 miles northeast of St. Paul Island on 27 July. Individual barnacles of both species of *Lepas* were small; the capitulum of the largest did not exceed 5 mm. The barnacles were identified by Dora P.

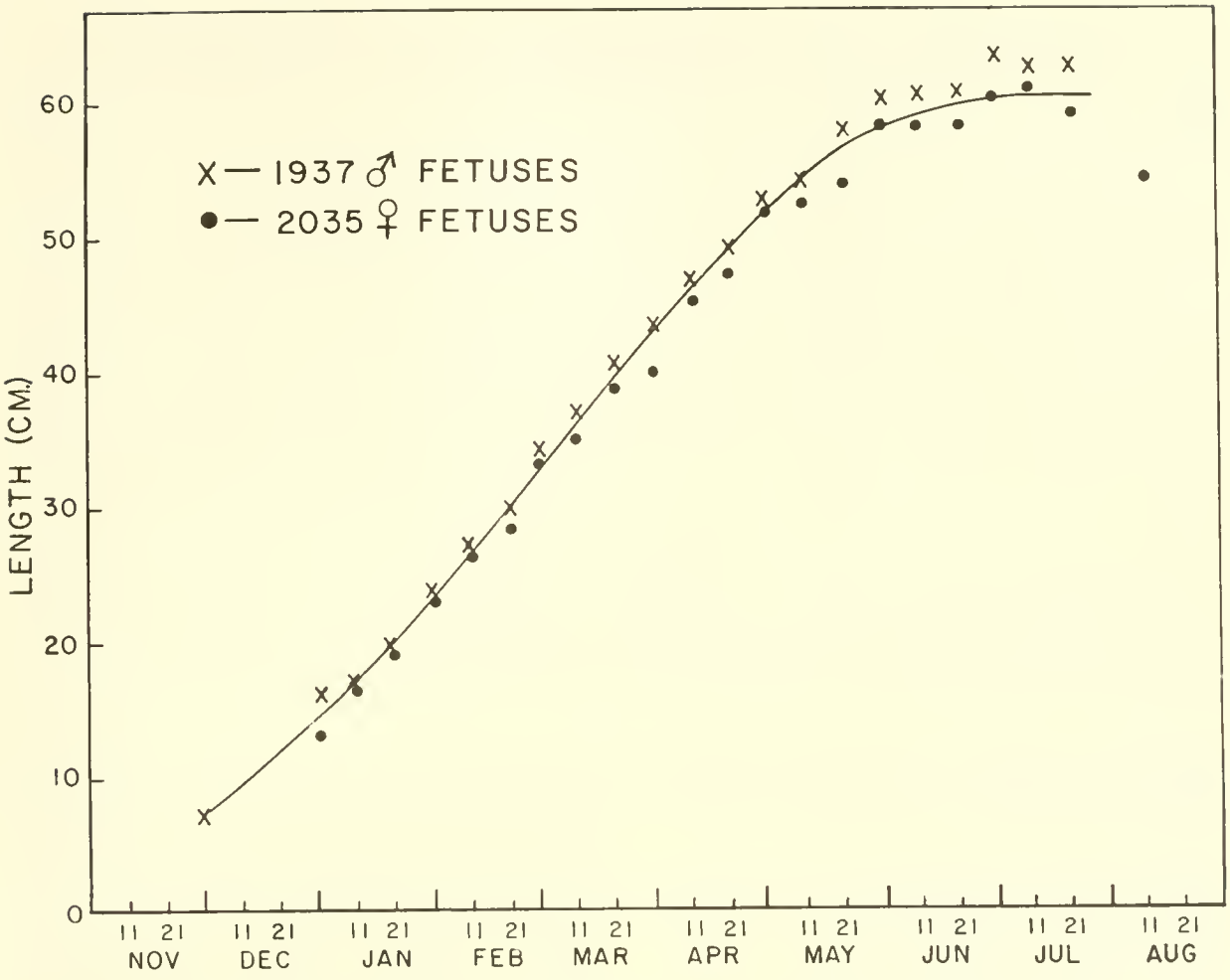

Figure 13.--Lengths of 3,972 fur seal fetuses plotted by 10-day periods for 1958-62.

Henry (Oceanography Department, University of Washington, Seattle, Wash.).

Fetal sex ratio and uterine horn of pregnancy.--In the samples collected during 5 years, pregnancies occur most often in the left horn, as shown below:

Year	Percent of pregnancies		Percent of fetus sex	
	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
1962	50.2	49.8	44.6	55.4

The sex ratio has progressively changed towards a greater proportion of female fetuses. The apparent change may be real or a result of sampling variation.

Food Habits

Throughout its range, the fur seal feeds upon a wide variety of fish and squids. In the past 4 years, 53 different food organisms from the eastern Pacific and 28 from the western Pacific have been identified.[5] The collection made by the United States in 1962

[5]North Pacific Fur Seal Commission, Report of Investigations from 1958 to 1961 (in press).

Table 17 --Pregnancy rate of seals taken by U.S. research vessels in eastern Pacific from 1958 through 1962

Age	Number of females						Number pregnant						Percent pregnant					
	1958	1959	1960	1961	1962	Combined	1958	1959	1960	1961	1962	Combined	1958	1959	1960	1961	1962	Combined
Years																		
3	39	43	18	84	93	277	1	-	-	-	1	2	2.6	-	-	-	1.1	0.7
4	42	93	36	96	140	407	1	6	1	1	4	13	2.4	6.4	2.8	1.0	2.9	3.2
5	70	114	55	68	123	430	32	64	27	14	32	169	45.7	56.1	49.1	20.6	26.0	39.3
6	99	118	45	62	72	396	80	91	36	47	39	293	80.8	77.1	80.0	75.8	54.2	74.0
7	103	143	66	95	93	500	92	109	52	72	79	404	89.3	76.2	78.8	75.8	84.9	80.8
8	102	164	105	107	98	576	91	142	90	85	88	496	89.2	86.6	85.7	79.4	89.8	86.1
9	81	108	144	114	73	520	78	96	133	107	61	475	96.3	88.9	92.4	93.9	83.6	91.3
10	97	96	129	112	100	534	85	82	118	105	89	479	87.6	85.4	91.5	93.8	89.0	89.7
11	113	98	136	82	91	520	104	88	124	73	81	470	92.0	89.8	91.2	89.0	89.0	90.4
12	134	76	106	71	97	484	110	67	96	66	87	426	82.0	88.2	90.6	93.0	89.7	88.0
13	110	56	120	76	58	420	91	50	105	63	55	364	82.7	89.3	87.5	82.9	94.8	86.7
14	92	70	107	67	65	401	75	59	86	62	57	339	81.5	84.3	80.4	92.5	87.7	84.5
15	71	87	67	68	53	346	56	77	56	54	43	286	78.9	88.5	83.6	79.4	81.1	82.7
16	56	69	53	55	50	283	44	52	38	47	41	222	78.6	75.4	71.7	85.5	82.0	78.4
17	36	36	46	24	44	186	20	29	31	15	32	127	55.6	80.6	67.4	62.5	72.7	68.3
18	22	27	23	25	25	122	13	23	19	16	18	89	59.1	85.2	82.6	64.0	72.0	73.0
19	14	16	19	10	15	74	4	13	11	5	9	42	28.6	81.3	57.9	50.0	60.0	56.8
20	3	5	6	7	11	32	1	2	1	7	8	19	33.3	40.0	16.7	100.0	72.7	59.4
21	1	7	6	2	3	19	1	6	3	1	3	14	100.0	85.7	50.0	50.0	100.0	73.7
22	1	5	-	-	3	9	-	2	-	-	2	4	-	40.0	-	-	66.7	44.4
23	-	1	1	1	-	3	-	-	-	-	-	-	-	-	-	-	-	-
24	-	1	1	1	1	4	-	-	-	-	-	-	-	-	-	-	-	-
25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
26	-	1	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-
Total	1,286	1,434	1,289	1,227	1,308 1/	6,544	979	1,058	1,027	840	829	4,733 2/	76.1	73.8	79.7	68.5	63.4	72.3
6-26	1,135	1,184	1,180	979	952	5,430	945	988	999	825	792	4,549	83.3	83.4	84.4	84.3	83.2	83.8

1/ Six seals have been omitted because age is not known; three seals are omitted because reproductive condition is not known

2/ Post partum cows are treated as pregnant cows in this table.

added no new species. The following 11 species of fish and squids were identified:

Clupea harengus pallasi (herring)
Oncorhynchus sp. (salmon)
Mallotus villosus (capelin)
Thaleichthys pacificus (eulachon)
Theragra chalcogrammus (walleye pollock)
Pleurogrammus monopterygius (Atka mackerel)
Ammodytes hexapterus (sand lance)
Bathymasteridae (searchers)
Gonatus fabricii (squid)
Gonatus magister (squid)
Gonatopsis sp. (squid)

Excluding cephalopods, few invertebrates have been found in fur seal stomachs. Occasional specimens are thought to have been taken accidentally, or to have been consumed by fish that were later eaten by seals. A few were known ectoparasites of fish. However, several pup stomachs collected late in the fall of 1961 at St. Paul Island contained invertebrates, and it is possible that pups in their postweaning period feed to some degree upon invertebrates.

The fur seal commonly swallows small fish and squids without coming to the surface, but usually eats large fish at the surface. The seal kills large fish by biting the head, or by shaking the fish vigorously. Occasionally the head may be bitten off and the body torn into smaller pieces before it is swallowed. Most of the fish found in stomachs in 1962 were small, whole fish. *Theragra* specimens smaller than 30 to 35 cm. long were usually found intact, but *Oncorhynchus*, the only other large fish in the collection in 1962, were usually broken into pieces and the heads frequently were missing.

The fur seal feeds primarily at night and in the early morning over much of its range, since squids and other species are more readily available during darkness. Figure 18 shows the percent stomachs with food in relation to the time of collection. More than 65 percent of the seals collected before 0900 had food in the stomach. The proportion decreased to 27.7 percent at 1500, when it began to increase. The low of 27.7 percent is higher than was found in previous years off the California coast and is the result of seals feeding on *Mallotus* throughout the day.

Water temperature ranged from 5° to 13° C. during the 1962 field season. It had no

Table 18.--Monthly reproductive condition of female fur seals collected by U.S. research vessels in western Alaska waters in 1962[1/]

	Age in years																				
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	Total	
May																						
Nulliparous																						
Number	-	-	-	2	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	3	
Primiparous																						
Nonpregnant																						
Number	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	1	
Pregnant																						
Number	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	1	
Percent	-	-	-	-	-	-	-	50	-	-	-	-	-	-	-	-	-	-	-	-		50
Multiparous																						
Nonpregnant																						
Number	-	-	-	-	-	-	-	-	1	-	-	1	-	1	-	-	-	-	-	-	3	
Pregnant																						
Number	-	-	-	-	-	1	1	1	-	-	-	1	2	1	1	2	-	-	-	1	11	
Percent	-	-	-	-	-	100	100	100	-	-	-	50	100	50	100	100	-	-	-	100		78.6
June																						
Nulliparous																						
Number	-	-	12	22	16	4	2	-	1	-	-	-	-	-	-	-	-	-	-	-	57[2/]	
Primiparous																						
Nonpregnant																						
Number	-	-	-	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	
Pregnant																						
Number	-	-	-	1	2	1	5	1	-	-	-	-	-	-	-	-	-	-	-	-	10	
Percent	-	-	-	100	66.7	50	100	100	-	-	-	-	-	-	-	-	-	-	-	-		83.3
Multiparous																						
Nonpregnant																						
Number	-	-	-	-	-	-	1	3	4	3	1	1	-	-	-	1	-	1	-	-	15	
Pregnant																						
Number	-	-	-	-	2	7	18	25	16	12	10	13	7	4	6	5	3	1	-	-	129	
Percent	-	-	-	-	100	100	94.7	89.3	80	80	91	92.9	100	100	100	83.3	100	50	-	-		89.6
July																						
Nulliparous																						
Number	-	-	1	7	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	10	
Primiparous																						
Nonpregnant																						
Number	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	1	
Multiparous																						
Nonpregnant																						
Number	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	1	
Pregnant																						
Number	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	1	
Percent	-	-	-	-	-	-	-	100	-	-	-	-	-	-	-	-	-	-	-	-		50
August																						
Nulliparous																						
Number	1	9	24	15	5	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	56	
Primiparous																						
Pregnant																						
Number	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	
Percent	-	-	-	-	100	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		100
Multiparous																						
Nonpregnant																						
Number	-	-	-	-	-	-	-	-	-	-	1	1	-	-	1	-	-	-	-	-	3	
Pregnant																						
Number	-	-	-	-	-	-	3	1	1	-	1	-	-	-	-	-	1	-	-	-	7	
Percent	-	-	-	-	-	-	100[3/]	100	100	-	50	-	-	-	-	-	100	-	-	-		70
September																						
Nulliparous																						
Number	-	6	5	6	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	19	
Multiparous																						
Nonpregnant																						
Number	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	1	3	
Pregnant																						
Number	-	-	-	-	-	-	-	-	1	3	-	2	1	1	-	-	1	-	-	-	9	
Percent	-	-	-	-	-	-	-	-	100	100	-	100	100	100	-	-	50	-	-	-		75
Total	1	15	42	53	30	16	33	34	24	18	13	19	10	8	8	8	6	3	-	2	343	

1/ Pregnant class includes post partum females.
2/ One seal of unknown age has been excluded from the total.
3/ One seal of unknown reproductive condition excluded.

Table 19.--Montly reproductive condition of female fur seals collected by U.S. research vessels in Unimak Pass in 1962[1/]

	Age in years																					
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	Total
June																							
Nulliparous																							
Number	-	-	-	2	4	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7
Primiparous																							
Pregnant																							
Number	-	-	-	-	3	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4
Percent	-	-	-	-	100	100	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	100
Multiparous																							
Nonpregnant																							
Number	-	-	-	-	-	1	-	-	-	-	1	-	-	1	-	-	1	-	-	-	-	-	4
Pregnant																							
Number	-	-	-	-	-	1	3	2	2	4	6	7	2	3	3	3	1	4	1	1	-	-	43[2/]
Percent	-	-	-	-	-	50	100	100	100	100	85.7	100	100	75	100	100	50	100	100	100	-	-	91.5
July																							
Nulliparous																							
Number	-	-	5	12	10	6	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	35
Primiparous																							
Nonpregnant																							
Number	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	1
Pregnant																							
Number	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
Percent	-	-	-	-	100	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	50
Multiparous																							
Nonpregnant																							
Number	-	-	-	-	-	1	1	-	-	-	1	-	1	1	2	2	5	-	1	-	-	1	16
Pregnant																							
Number	-	-	-	-	2	4	8	6	3	4	6	8	3	2	2	2	2	1	1	-	-	1	55
Percent	-	-	-	-	100	80[3/]	88.9	100	100	100	85.7	100	75	66.7	50	50[3/]	28.6	100	50	-	-	50	77.5
August																							
Nulliparous																							
Number	-	6	8	13	9	2	1	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	40
Primiparous																							
Pregnant																							
Number	-	-	-	-	-	1	-	1	2	2	3	-	-	-	-	-	-	-	-	-	-	-	9
Percent	-	-	-	-	-	100	-	100	100	100	100	-	-	-	-	-	-	-	-	-	-	-	100
Multiparous																							
Nonpregnant																							
Number	-	-	-	-	-	-	-	-	-	1	1	4	-	-	-	1	2	-	1	1	-	-	11
Pregnant																							
Number	-	-	-	-	-	-	3	3	6	12	8	7	9	4	8	6	6	3	1	2	1	1	80[4/]
Percent	-	-	-	-	-	-	100	100	100	92.3	88.9	63.6	100	100	100	85.7	75	100	50	66.7	100	100	87.9
September																							
Nulliparous																							
Number	-	-	1	4	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	9
Multiparous																							
Nonpregnant																							
Number	-	-	-	-	-	-	-	-	-	1	-	-	-	1	2	-	1	-	-	-	-	-	5
Pregnant																							
Number	-	-	-	-	-	2	2	2	2	4	6	4	3	5	2	2	1	-	-	-	1	-	36
Percent	-	-	-	-	-	100	100	100	100	80	100	100	100	83.3	50	100	50	-	-	-	100	-	87.8
October																							
Nulliparous																							
Number	1	2	1	6	4	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	15
Primiparous																							
Pregnant																							
Number	-	-	-	-	-	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
Percent	-	-	-	-	-	-	100	100	-	-	-	-	-	-	-	-	-	-	-	-	-	-	100
Multiparous																							
Nonpregnant																							
Number	-	-	-	-	-	-	-	-	-	1	1	-	1	1	-	1	-	-	1	-	-	-	6
Pregnant																							
Number	-	-	-	-	-	-	-	2	-	1	3	1	2	3	1	-	1	-	-	-	-	-	14
Percent	-	-	-	-	-	-	-	100	-	50	75	100	66.7	75	100	-	100	-	-	-	-	-	70
Total	1	8	15	37	37	20	20	19	15	31	36	31	21	21	20	17	20	9	6	4	2	3	393

1/ Pregnant class includes post partum females.
2/ One seal of unknown age has been excluded from the total.
3/ One seal of unknown reproductive condition excluded from the 6- and 16-year-old classes.
4/ Two seals of unknown age excluded from the total.

Table 20.--Monthly reproductive condition of female fur seals collected by U.S. research vessels in the Bering Sea in 1962[1/]

	Age in years																					
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	24	Total
May																							
Multiparous																							
Pregnant																							
Number	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	1
Percent	-	-	-	-	-	-	-	-	-	-	-	-	-	-	100	-	-	-	-	-	-	-	100
June																							
Nulliparous																							
Number	-	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
Multiparous																							
Nonpregnant																							
Number	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	1	-	-	-	-	-	2
Pregnant																							
Number	-	-	-	-	-	1	3	1	1	3	-	1	-	2	-	-	-	2	1	-	-	-	15[2/]
Percent	-	-	-	-	-	100	100	100	100	75	-	100	-	100	-	-	-	100	100	-	-	-	88.2
July																							
Nulliparous																							
Number	-	-	2	6	4	7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	19
Primiparous																							
Nonpregnant																							
Number	-	-	-	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
Pregnant																							
Number	-	-	-	1	5	5	1	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	14
Percent	-	-	-	100	83.3	83.3	100	100	-	-	-	-	-	-	-	-	-	-	-	-	-	-	87.5
Multiparous																							
Nonpregnant																							
Number	-	-	-	-	1	-	2	2	2	-	-	1	-	-	1	1	-	-	1	-	-	-	11
Pregnant																							
Number	-	-	-	-	4	4	10	12	11	10	12	8	7	14	4	4	3	1	-	1	-	-	105
Percent	-	-	-	-	80	100	83.3	85.7	84.6	100	100	88.9	100	100	80	80	100	100	-	100	-	-	83.3
August																							
Nulliparous																							
Number	-	5	16	28	21	3	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	74
Primiparous																							
Pregnant																							
Number	-	-	-	-	5	3	1	1	2	1	1	3	2	-	-	-	-	-	-	-	-	-	19
Percent	-	-	-	-	100	100	100	100	100	100	100	100	100	-	-	-	-	-	-	-	-	-	100
Multiparous																							
Nonpregnant																							
Number	-	-	-	-	-	2	2	-	1	2	3	1	-	2	4	2	1	3	2	-	-	1	26[3/]
Pregnant																							
Number	-	-	-	-	-	4	13	16	14	21	17[4/]	23	16	14	12	16	11	6	4	2	1	-	190
Percent	-	-	-	-	-	66.7	86.7	100	93.3	91.3	85[4/]	95.8	100	87.5	75	88.9	91.7	66.7	66.7	100	100	-	88
September																							
Nulliparous																							
Number	1	6	14	12	7	2	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	44
Primiparous																							
Pregnant																							
Number	-	-	-	1	6	1	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	13
Percent	-	-	-	100	100	100	100	100	-	-	-	-	-	-	-	-	-	-	-	-	-	-	100
Multiparous																							
Nonpregnant																							
Number	-	-	-	-	-	-	-	1	-	1	-	-	1	-	-	1	-	1	-	1	-	-	6
Pregnant																							
Number	-	-	-	-	1	3	4	7	1	11	7	6	1	4	3	-	2	-	1	1	-	-	52
Percent	-	-	-	-	100	100	100	87.5	100	91.3	100	100	50	100	100	-	100	-	100	50	-	-	87.7
October																							
Nulliparous																							
Number	-	-	3	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5
Multiparous																							
Pregnant																							
Number	-	-	-	-	-	-	-	-	-	1	1	2	-	-	-	1	-	-	-	-	-	-	5
Percent	-	-	-	-	-	-	-	-	-	100	100	100	-	-	-	100	-	-	-	-	-	-	100
Total	1	11	36	50	56	36	39	45	34	51	41	45	27	36	25	25	18	13	9	5	1	1	605

1/ Pregnant class includes post partum females.
2/ One seal of unknown age has been excluded from the total.
3/ One seal of unknown age has been excluded from the total.
4/ One seal of unknown reproductive condition excluded from the 11- and 12-year-old classes

Figure 14.--Opened body cavity of 16-year-old female fur seal showing position of uterus and twin fetuses.

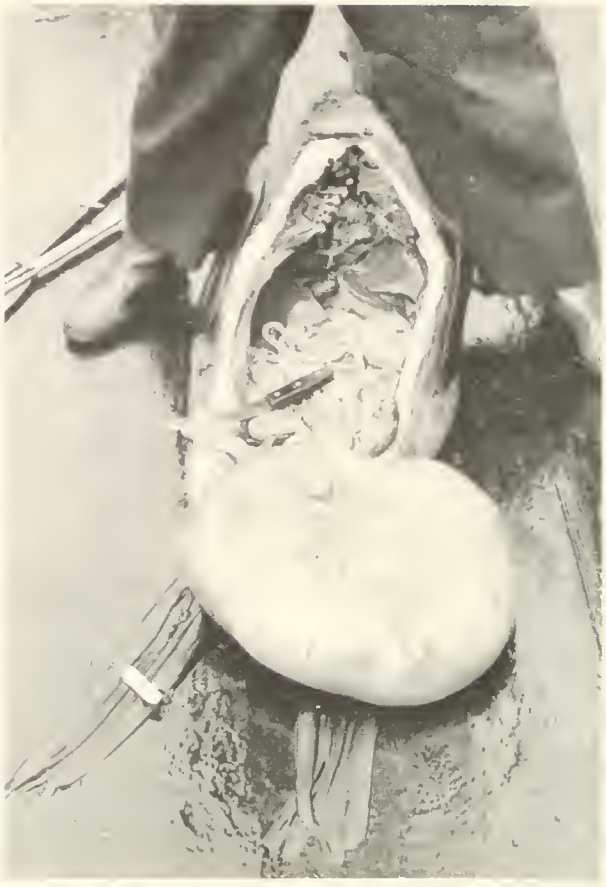

Figure 15.--Reproductive tract partially removed. The nonpregnant horn and its ovary are visible on the knife blade.

apparent direct effect on the fur seals but presumably influenced the distribution of their prey.

The area north of the Aleutian Islands between Unimak Pass and Bogoslof Island in the vicinity of the 100-fathom curve, Unimak Pass, and the western Alaska feeding grounds south of Unimak Pass, form what is probably one of the major summer and fall feeding areas for Pribilof seals. Seals travel about 180 miles from St. George Island or 220 miles from St. Paul Island to reach the feeding area north of the Aleutians. The western Alaska grounds are about 250 miles from St. George Island or 290 miles from St. Paul Island. The presence of post partum nursing females in these areas is proof that seals travel from the Pribilof Islands to feed. Nursing females can be recognized by the milk in the mammary glands, placental scar in the uterus, and corpus albicans in the ovary. They can be expected to return to the islands to nurse their pups.

Few seals collected near the Pribilof Islands had food in their stomachs. Kenyon (1956) found that the number of seals on St. Paul Island with appreciable stomach contents was less than 0.1 percent of those examined. Figure 19 illustrates a series of zones 30 miles wide, concentric at a point midway between St. Paul and St. George Islands and numbered from this point. These make possible a comparison of the volume of stomach contents in relation to distance from the islands. The percent of stomachs containing food, a trace of food,[6] or empty is shown for each zone. Stomachs from zones 1 to 3 were largely

[6] Less than 5 cc. of food in a stomach is considered a trace.

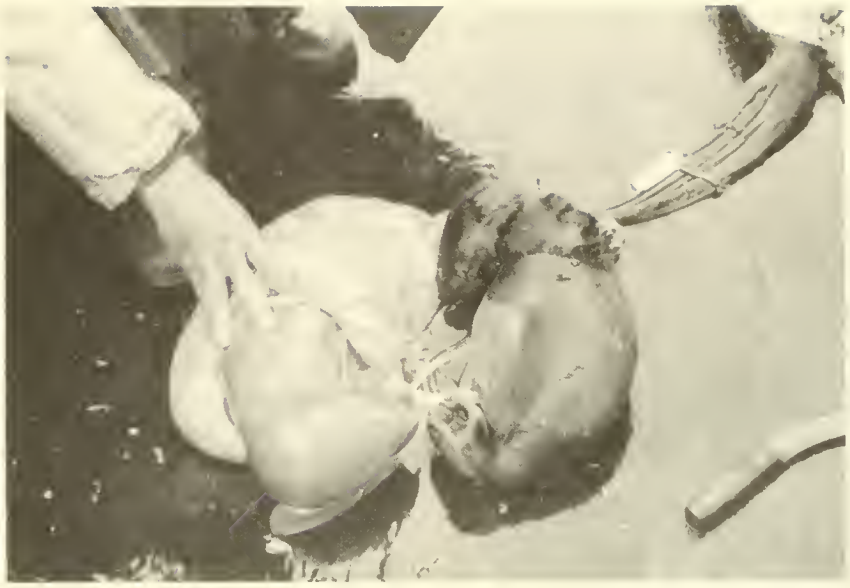

Figure 16.--Reproductive tract removed. One fetus still in embryonic sac.

Figure 17.--Both fetuses removed from embryonic sacs, umbilicus still attached, nonpregnant horn and ovary visible in lower left of photo.

empty or contained only traces. Those from zones 7 to 9, the heavily sampled areas of Unimak Pass, western Alaska, and the area in the Bering Sea immediately north of the Aleutians, contained more food than did stomachs from seals collected in other zones except zone 4.

General account of stomach contents.--The area surveyed in 1962 was small compared to the areas examined in the previous 4 years. (The three 1962 subareas were described in the section on distribution.) Intensive collecting from May to October gave a clear picture of the food species taken by seals.

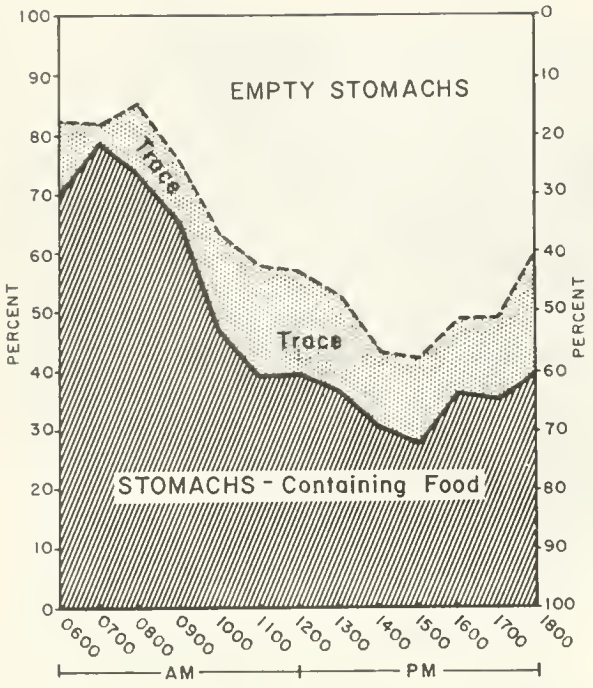

Figure 18.--The proportion of stomachs containing food in relation to the time of collection.

Figure 20 presents the major food items by percent of volume of stomach contents and percent of frequency. All food species contributing more than 2 percent of the total volume are shown. In western Alaska, squids, *Mallotus*, and *Ammodytes* accounted for 94 percent of the total food consumed in the area. In Unimak Pass, *Mallotus* and *Pleurogrammus* accounted for 97.1 percent of the total food. In the Bering Sea, *Theragra*, squids, and *Mallotus* accounted for 87.1 percent of the total food. Combined area totals show that for the seals collected in the three areas during 1962, *Mallotus*, squids, and *Theragra* accounted for 88.2 percent of the food.

The locations where food species occurred in seal stomachs are shown in figures 21-28.

The food of seals in the Bering Sea is better known than for other areas in Alaska. Lucas (1899) and Wilke and Kenyon (1954; 1957) reported on food habits of fur seals in the Bering Sea. The present pelagic research program began in 1958, but only two seals were collected in the Bering Sea that year (Wilke, Niggol, and Fiscus, 1958).[7] In 1960, a vessel operating in Unimak Pass and the Bering Sea from 25 June to 21 August collected 427 seals (Niggol, Fiscus, O'Brien, and Wilke, 1960).[8] In 1962, 1,482 seals were collected in the western Alaska, Unimak Pass, and Bering Sea areas from 16 May to 8 October. The results of stomach examinations are shown in tables 21 to 24 by area, season, volume, and frequency.

Theragra, *Mallotus*, and squids have consistently been the principal food of seals in the Bering Sea. Lucas (1899) listed *Theragra* and squids as major food items. Wilke and Kenyon (1954) noted that bones and otoliths of gadids are the most common material disgorged on the Pribilof Islands. From 17 June to 20 July 1955, they collected 204 fur seals between Unimak Pass and the Pribilof Islands. In stomachs from seals collected near Unimak Pass and the Aleutian Islands, *Mallotus* was the dominant food item, being replaced offshore by *Theragra* and squids. In 1960, the same food items were important in the inshore and offshore areas.

In 1962, *Mallotus*, *Theragra*, and squids again were leading food items. A discussion of individual food items is given below. (Not included are three seals collected 6 May in the Gulf of Alaska about 110 miles west of Cape Ommaney, containing the squid *Gonatus magister*, and a fourth seal collected on 12 May about 25 miles south of Sitkinak Island containing *Theragra* and a trace of *Mallotus*.)

Food items.--

Clupea harengus pallasi (herring)

Clupea were found in nine seals collected in or near Unimak Pass. Seven were collected

[7] Ford Wilke, Karl Niggol, and Clifford H. Fiscus. 1958. Pelagic fur seal investigations, California, Oregon, Washington, and Alaska, 1958. Bureau of Commercial Fisheries Marine Mammal Biological Laboratory, U.S. Fish and Wildlife Service, Seattle, Wash. [Processed.]

[8] Karl Niggol, Clifford H. Fiscus, Thomas P. O'Brien, and Ford Wilke. 1960. Pelagic fur seal investigations, Alaska, 1960. Bureau of Commercial Fisheries Marine Mammal Biological Laboratory, U.S. Fish and Wildlife Service, Seattle, Wash. [Processed.]

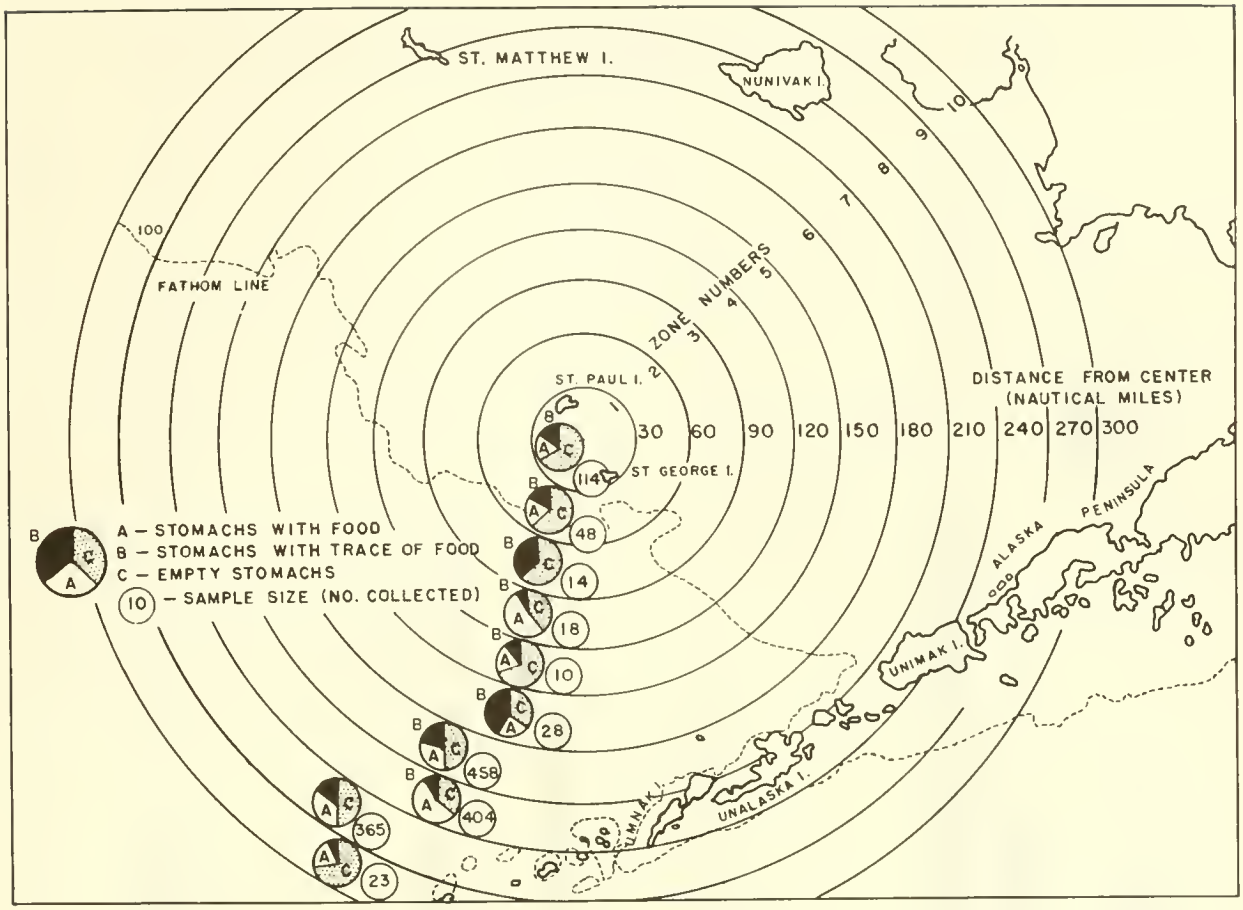

Figure 19.--Proportion of fur seal stomachs collected in 1962 that contained food, a trace of food, or nothing.

between 9 and 14 August and two on 2 and 10 October.

Oncorhynchus sp. (salmon)

Salmon, not identified to species, were found in 18 seals, or 1.2 percent of those examined. Nine stomachs from western Alaska contained salmon (3 percent of the total food by volume). Eight of the nine seals were taken 30 miles southeast of Unimak Pass, five on 20 June. Only 1 of 347 seals collected in Unimak Pass during June, July, and August had salmon in its stomach. Stomachs of eight seals from the Bering Sea contained salmon (6.2 percent of the total food by volume). Six of these seals were collected on the north side of Akutan Pass; four of the six were taken on 6 August. A seal collected 15 miles southwest of St. George Island on 28 August also had fed on salmon. Salmon appeared irregularly in stomachs from 18 June to 6 September and with one exception, all appeared to be mature. There was no evidence of predation by fur seals on salmon in Unimak Pass.

Mallotus villosus (capelin)

Mallotus comprised 56.8 percent of the total food by volume. They were taken by seals through the three subareas, and were found from May to October. *Mallotus* made up 34.2 percent of the total food in western Alaska, 90.6 percent in Unimak Pass, and 22.1 percent in the Bering Sea. The northern approach to the pass was a favorite feeding area for seals, particularly from July into October. *Mallotus* were present in large numbers in this locality throughout these months. In the Bering Sea, *Mallotus* ranked below *Theragra* and squid.

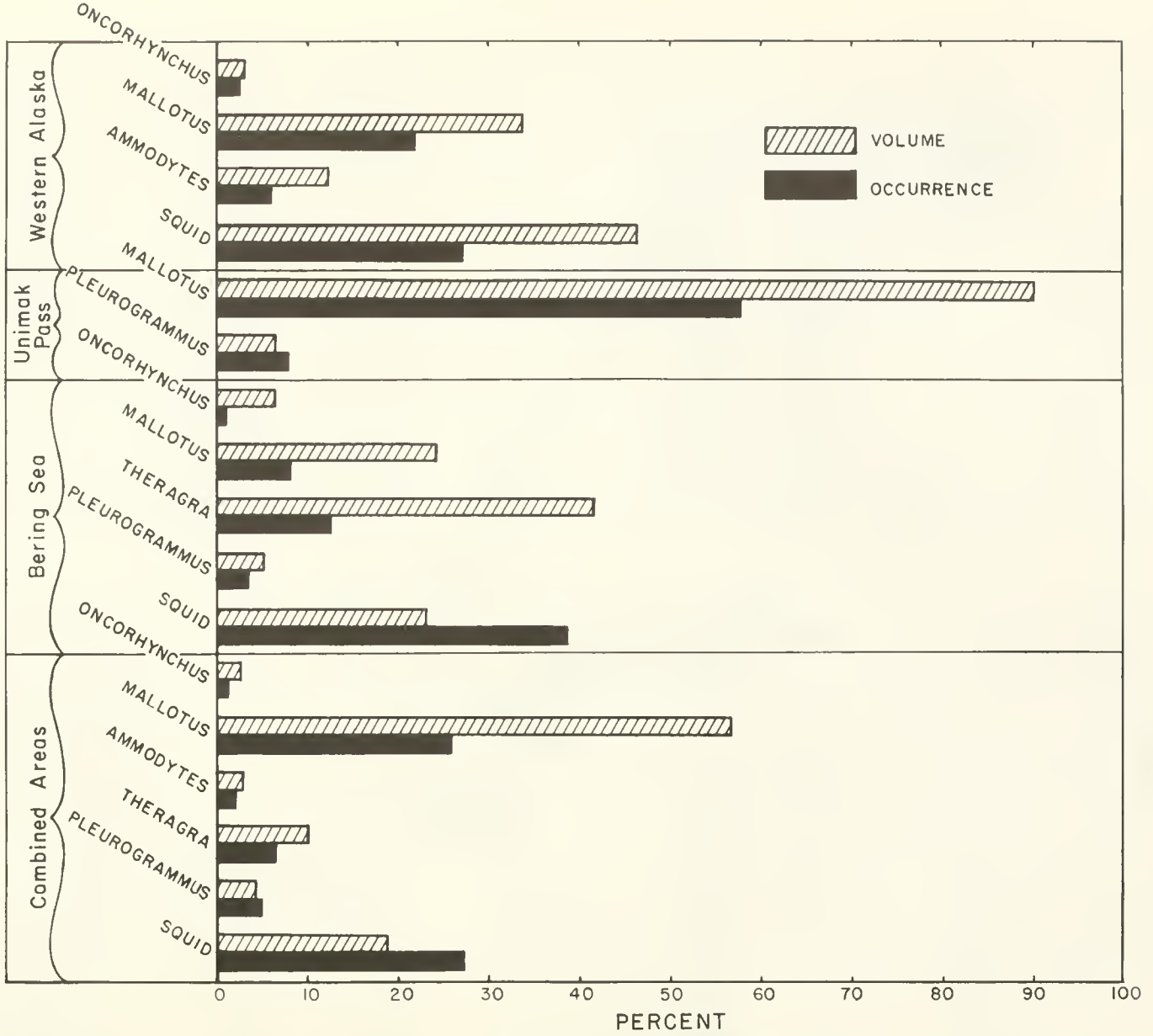

Figure 20.--Percent of stomach content volume and percent of stomachs containing principal food species found in 1962, by area.

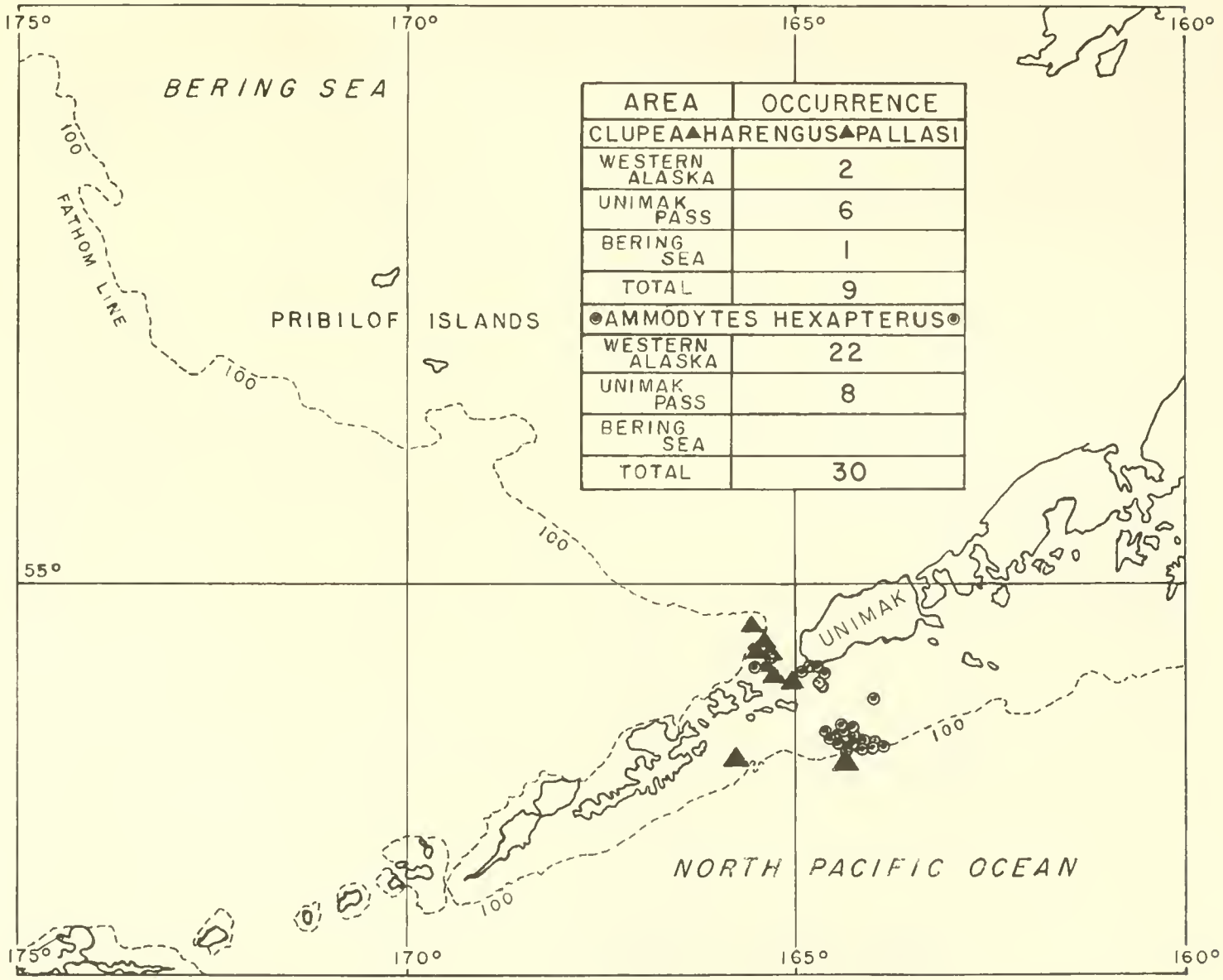

Figure 21.--Locations where fur seal stomachs collected in 1962 contained *Clupea harengus pallasi* (herring) and *Ammodytes hexapterus* (sand lance).

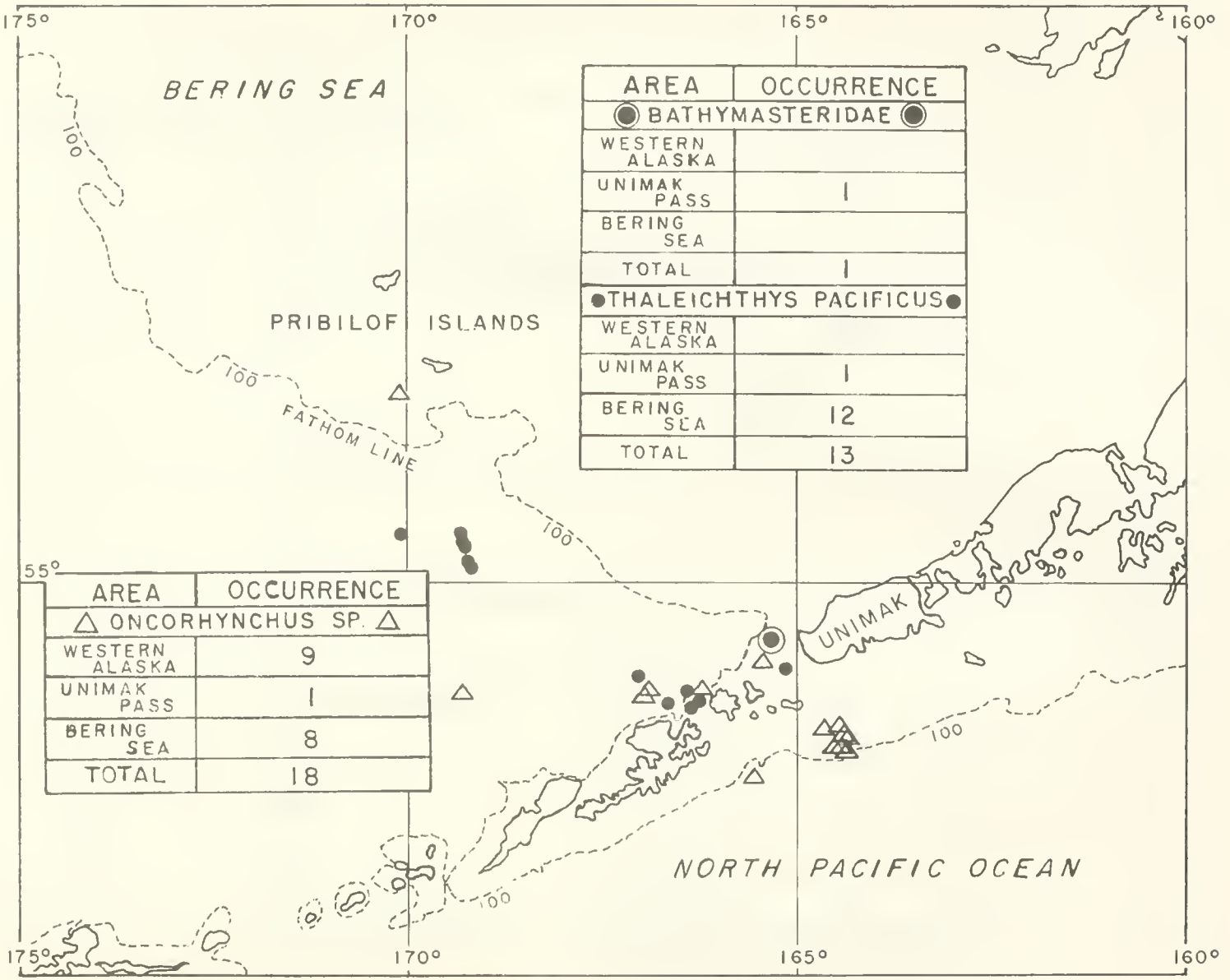

Figure 22.--Locations where fur seal stomachs collected in 1962 contained *Oncorhynchus* sp. (salmon), *Thaleichthys pacificus* (eulachon), and Bathymasteridae (searchers).

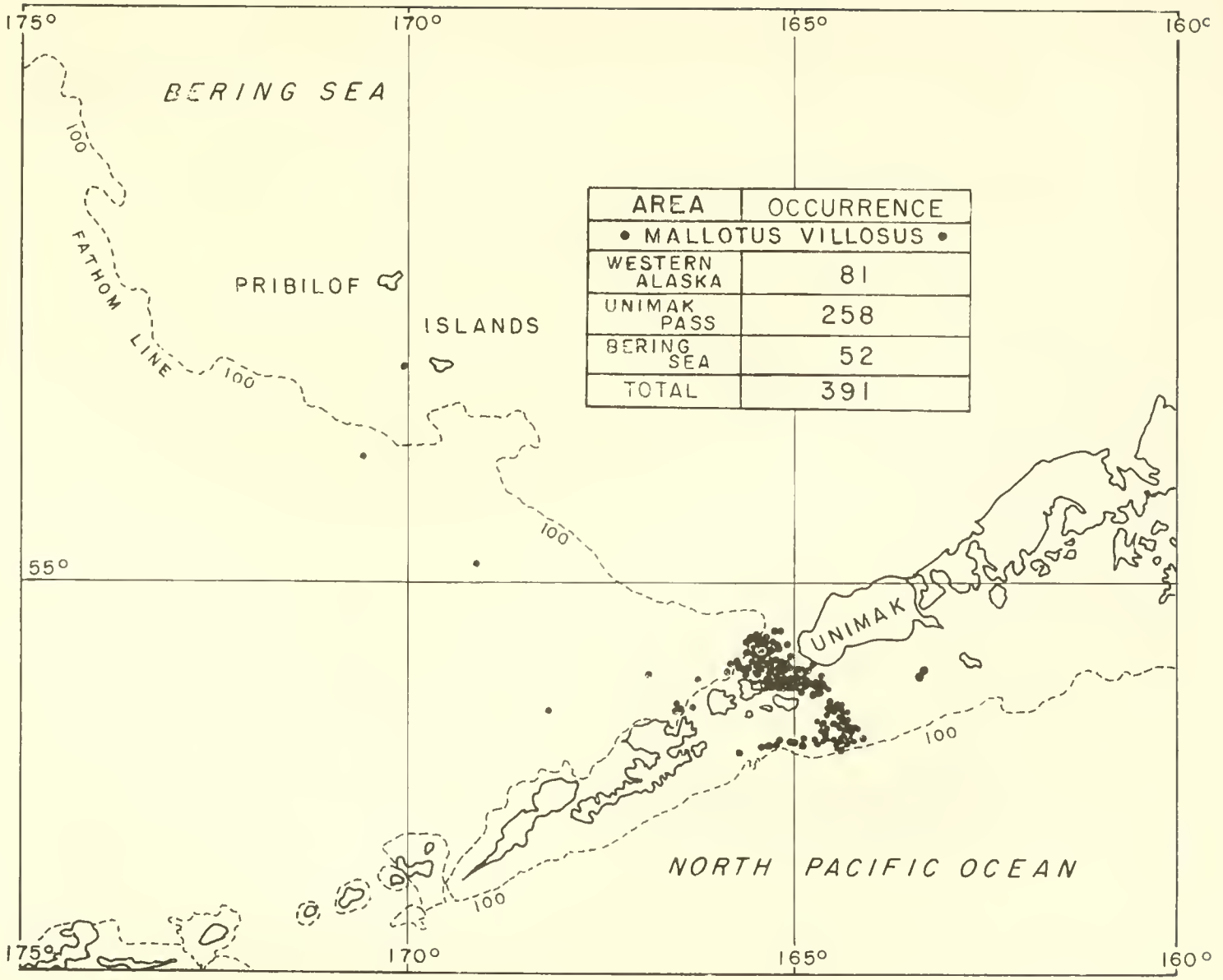

Figure 23.--Locations where fur seal stomachs collected in 1962 contained *Mallotus villosus* (capelin).

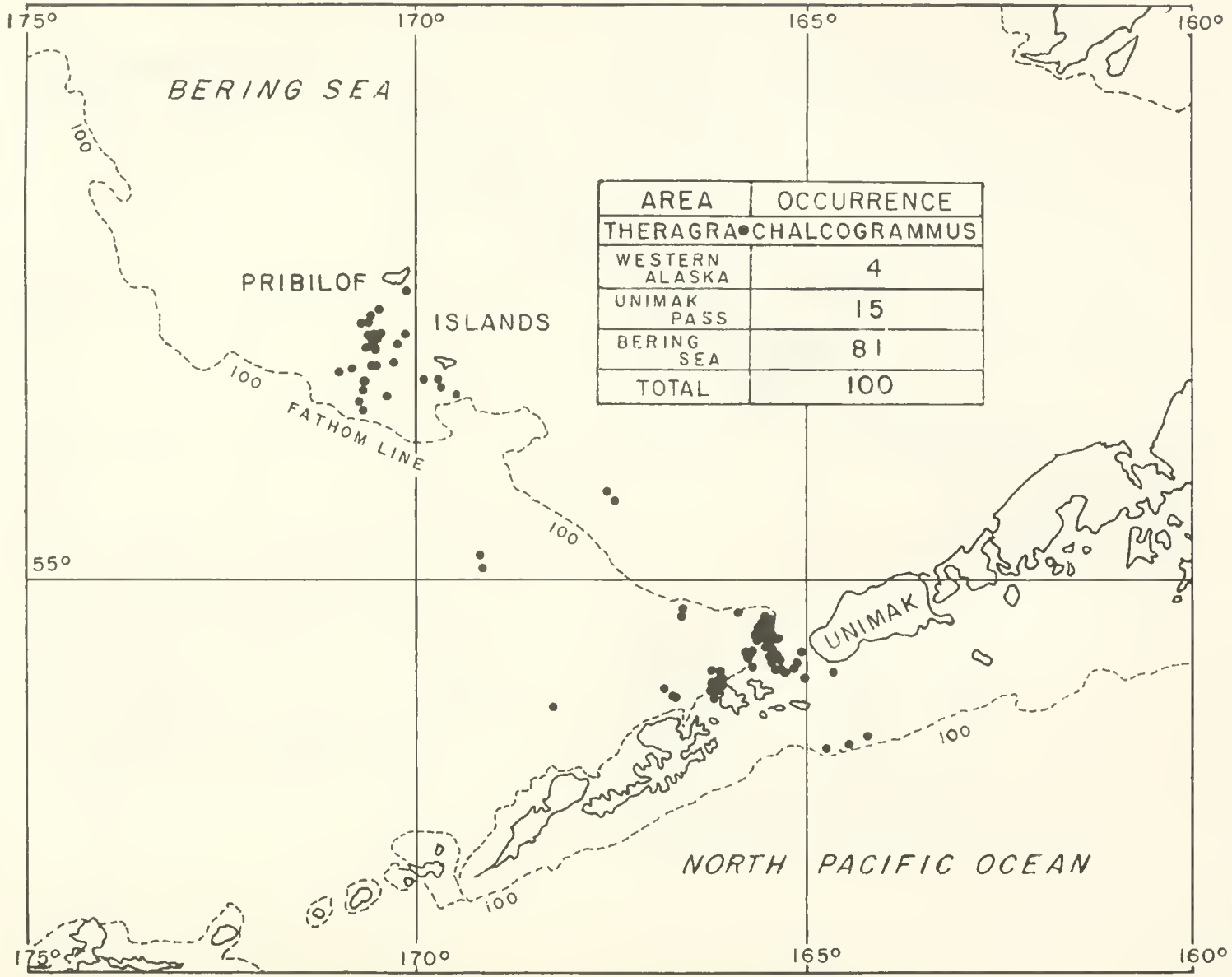

Figure 24.--Locations where fur seal stomachs collected in 1962 contained *Theragra chalcogrammus* (walleye pollock).

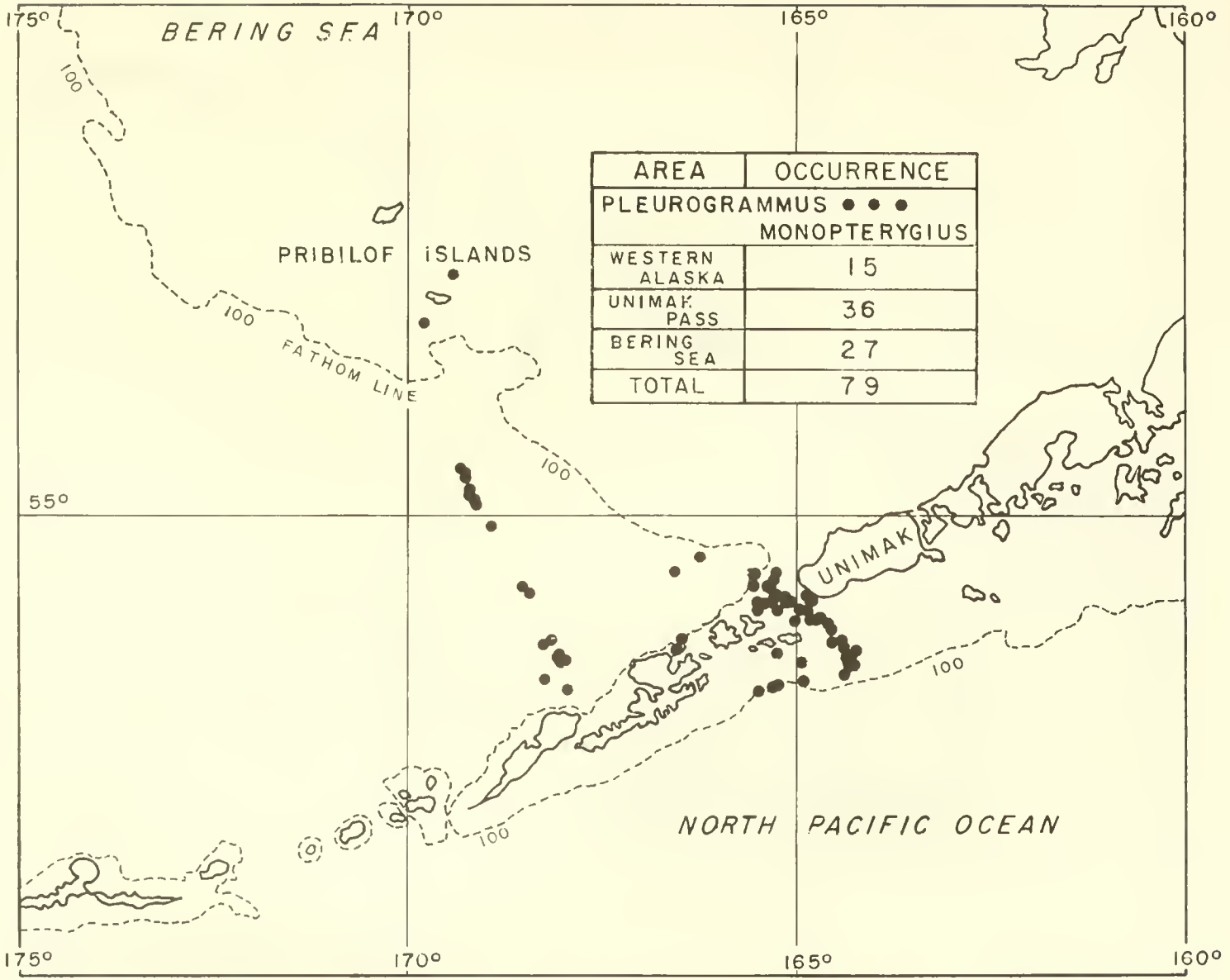

Figure 25.--Locations where fur seal stomachs collected in 1962 contained *Pleurogrammus monopterygius* (Atka mackerel).

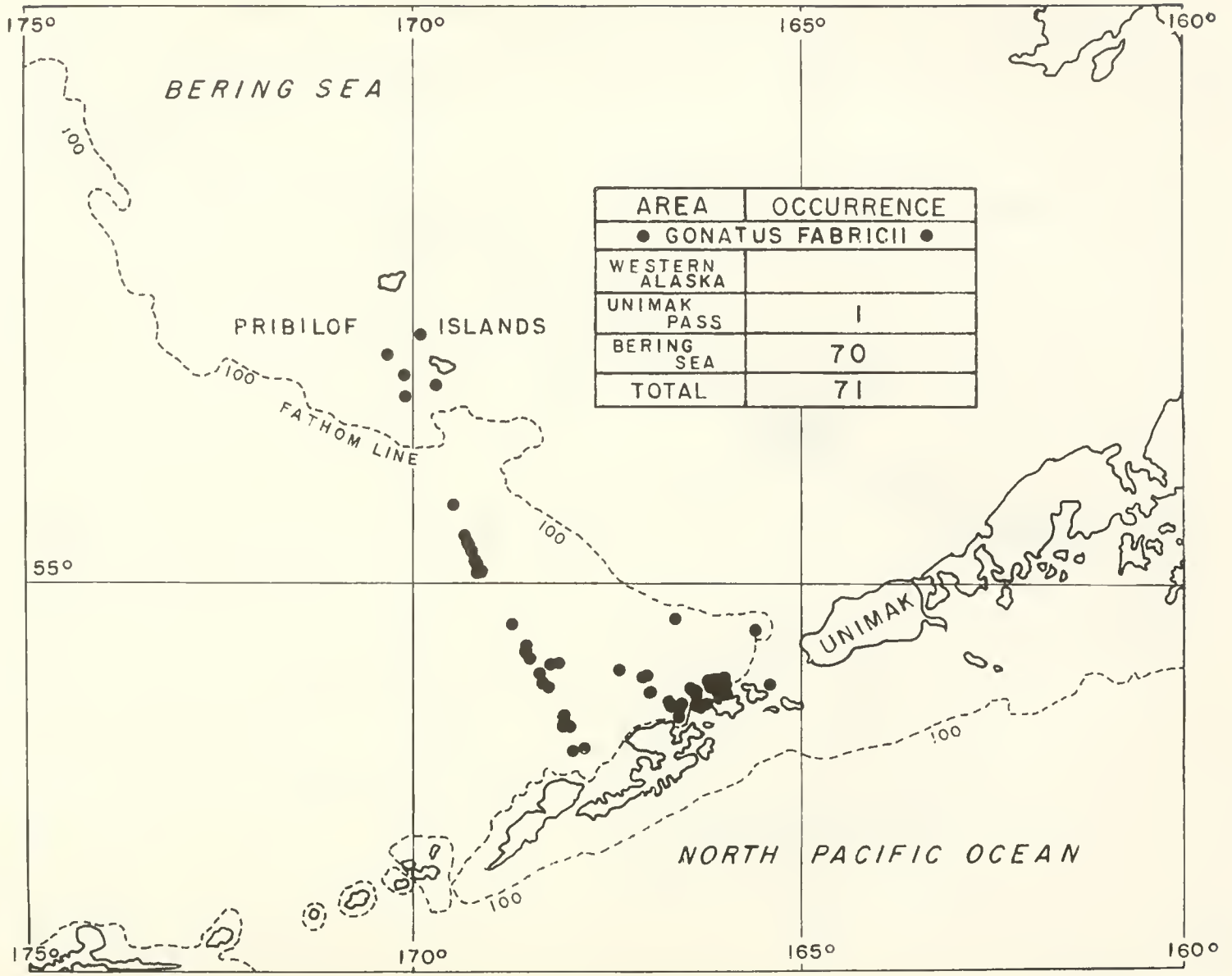

Figure 26.--Locations where fur seal stomachs collected in 1962 contained the squid *Gonatus fabricii*.

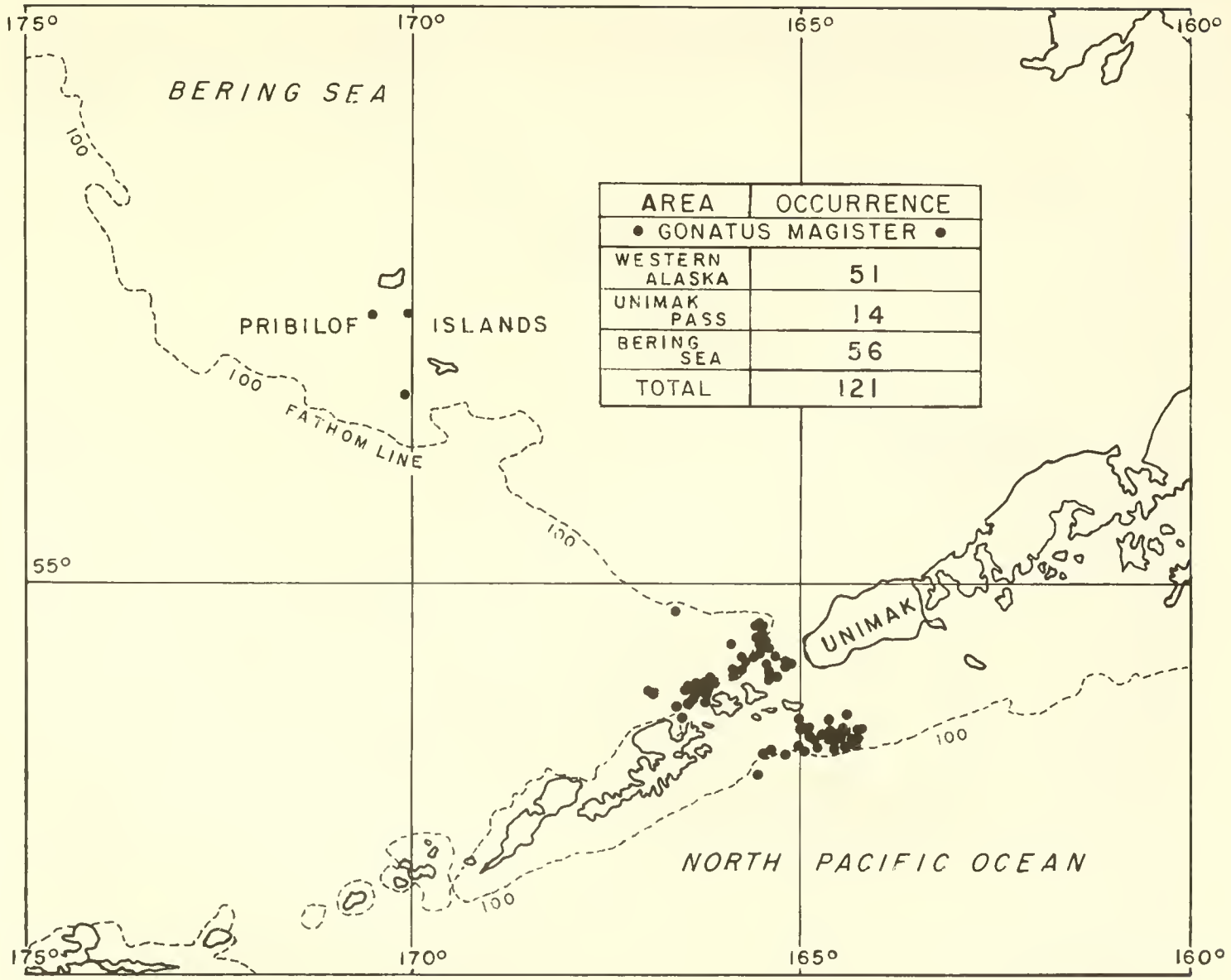

Figure 27.--Locations where fur seal stomachs collected in 1962 contained the squid *Gonatus magister*.

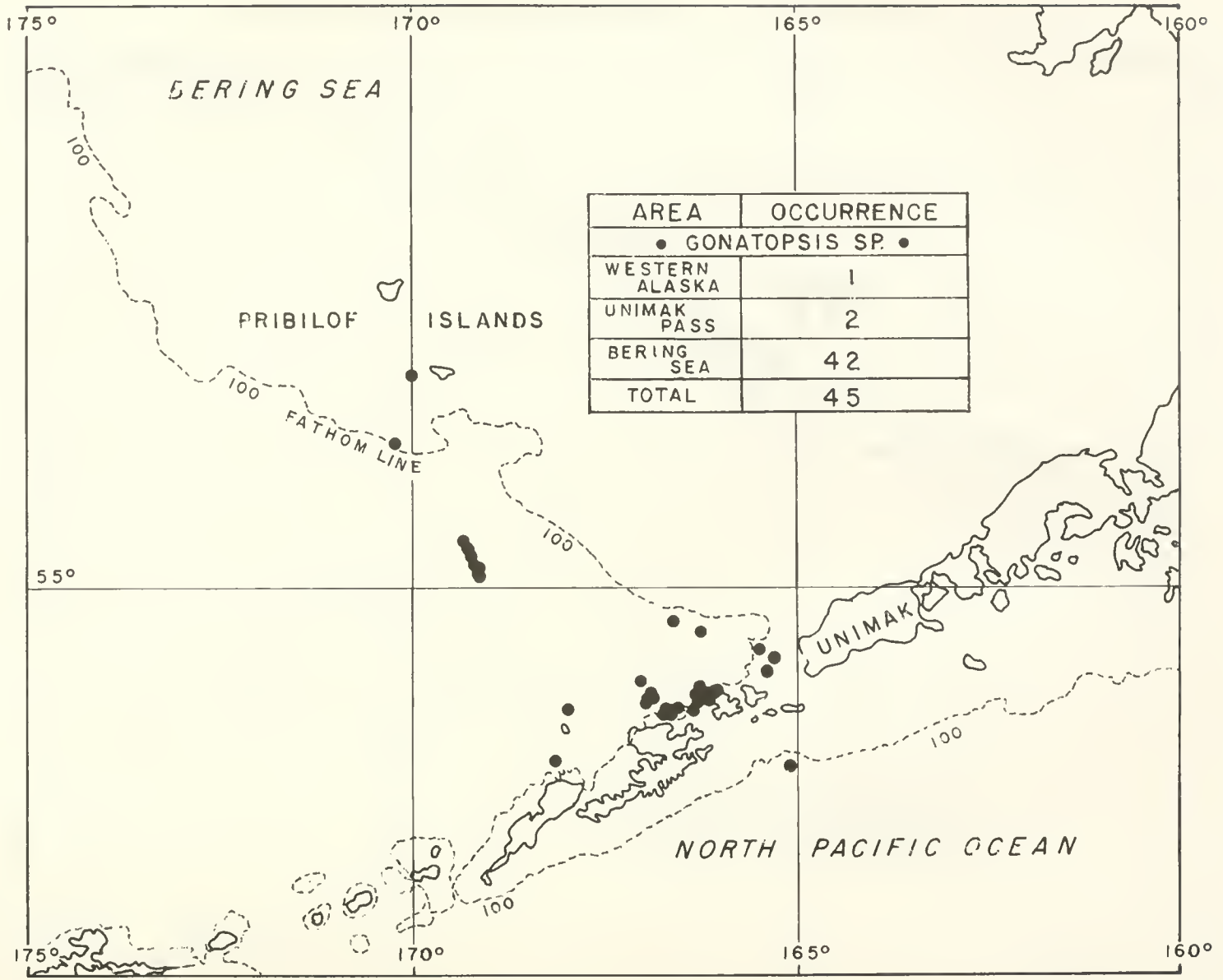

Figure 28.--Locations where fur seal stomachs collected in 1962 contained the squid *Gonatopsis* sp.

Table 21. --Stomach contents of fur seals from western Alaska, May to October 1962

Food items	Spring May				Summer June, July, August				Fall September, October				Combined Spring, Summer, Fall			
	Volume		Frequency	Frequency of trace 1/	Volume		Frequency	Frequency of trace	Volume		Frequency	Frequency of trace	Volume		Frequency	Frequency of trace
	Cc.	Percent	Number	Number	Cc.	Percent	Number	Number	Cc.	Percent	Number	Number	Cc.	Percent	Number	Number
Clupea harengus pallasi	-	-	-	-	497	0.8	2	-	-	-	-	-	497	0.7	2	-
Oncorhynchus sp	-	-	-	-	2,030	3.4	9	1	-	-	-	-	2,030	3.0	9	1
Mallotus villosus	1,450	34.9	3	-	18,798	31.2	64	11	2,858	90.9	14	-	23,106	34.2	81	12
Thaleichthys pacificus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Theragra chalcogrammus	55	1.3	1	-	214	0.4	3	2	-	-	-	-	269	0.4	4	2
Pleurogrammus monopterygius	-	-	-	-	666	1.1	11	1	287	9.1	4	-	953	1.4	15	1
Ammodytes hexapterus	2,160	51.9	1	-	6,016	10.0	21	2	-	-	-	-	8,176	12.1	22	2
Bathymasteridae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Unidentified fish	-	-	1	1	170	0.3	18	14	-	-	-	-	170	0.3	19	15
Decapoda (squid)																
Gonatidae	-	-	-	-	145	0.2	20	14	-	-	1	1	145	0.2	21	15
Gonatus fabricii	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Gonatus magister	495	11.9	3	1	31,764	52.6	48	20	-	-	-	-	32,259	47.7	51	21
Gonatopsis sp.	-	-	-	-	15	0.0	1	-	-	-	-	-	15	0.0	1	-
Unidentified	-	-	-	-	-	-	23	23	-	-	-	-	-	-	23	23
Birds	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Crustacea	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Isopoda	-	-	-	-	-	-	3	3	-	-	3	3	-	-	6	6
Mollusca	-	-	-	-	-	-	1	1	-	-	-	-	-	-	1	1
Pebbles	-	-	-	-	-	-	9	9	-	-	1	1	-	-	10	10
Total food	4,160	100.0			60,315	100.0			3,145	100.0			67,620	100.0		
Stomachs with food	7				157				15				179			
Stomachs empty	13				163				18				194			
Total stomachs collected	20				320				33				373			

1/ Trace counts are included in frequency counts (Trace = an occurrence in which there is no measurable amount of volume, usually only a few vertebrae or squid beaks.)

Table 22 --Stomach contents of fur seals from Unimak Pass, May to October 1962

Food items	Spring May				Summer June, July, August				Fall September, October				Combined Spring, Summer, Fall			
	Volume		Frequency	Frequency of trace 1/	Volume		Frequency	Frequency of trace	Volume		Frequency	Frequency of trace	Volume		Frequency	Frequency of trace
	Cc.	Percent	Number	Number	Cc.	Percent	Number	Number	Cc.	Percent	Number	Number	Cc.	Percent	Number	Number
Clupea harengus pallasi	-	-	-	-	951	1.1	4	-	196	0.6	2	1	1,147	1.0	6	1
Oncorhynchus sp.	-	-	-	-	172	0.2	1	-	-	-	-	-	172	0.1	1	-
Mallotus villosus	-	-	-	-	79,136	88.4	198	16	31,281	97.1	60	3	110,417	90.6	258	19
Thaleichthys pacificus	-	-	-	-	-	-	-	-	-	-	1	1	-	-	1	1
Theragra chalcogrammus	-	-	-	-	1,239	1.4	12	6	26	0.1	3	2	1,265	1.0	15	8
Pleurogrammus monopterygius	-	-	-	-	7,306	8.1	21	2	620	1.9	15	6	7,926	6.5	36	8
Ammodytes hexapterus	-	-	-	-	220	0.2	6	1	45	0.1	2	-	265	0.2	8	1
Bathymasteridae	-	-	-	-	108	0.1	1	-	-	-	-	-	108	0.1	1	-
Unidentified fish	-	-	-	-	157	0.2	9	7	28	0.1	3	2	185	0.2	12	9
Decapoda (squid)																
Gonatidae	-	-	-	-	87	0.1	16	12	-	-	6	6	87	0.1	22	18
Gonatus fabricii	-	-	-	-	-	-	1	1	-	-	-	-	-	-	1	1
Gonatus magister	-	-	-	-	162	0.2	9	5	39	0.1	5	3	201	0.2	14	8
Gonatopsis sp	-	-	-	-	15	0.0	1	-	-	-	1	1	15	0.0	2	1
Unidentified	-	-	-	-	-	-	5	5	-	-	3	3	-	-	8	8
Birds	-	-	-	-	-	-	1	1	-	-	1	1	-	-	2	2
Crustacea	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Isopoda	-	-	-	-	-	-	6	6	-	-	6	6	-	-	12	12
Mollusca	-	-	-	-	-	-	1	1	-	-	-	-	-	-	1	1
Pebbles	-	-	-	-	-	-	14	14	-	-	4	4	-	-	18	18
Total food	-	-			89,553	100.0			32,235	100.0			121,788	100.0		
Stomachs with food	-				221 2/				70				291			
Stomachs empty	1				127 2/				21				149			
Total stomachs collected	1				348				91				440			

1/ See footnote 1, table 21

2/ Including one missing stomach.

Table 23.--Stomach contents of fur seals from the Bering Sea, May to October 1962

Food items	Spring May				Summer June, July, August				Fall September, October				Combined Spring, Summer, Fall			
	Volume		Frequency	Frequency of trace 1/	Volume		Frequency	Frequency of trace	Volume		Frequency	Frequency of trace	Volume		Frequency	Frequency of trace
	Cc.	Percent	Number	Number	Cc.	Percent	Number	Number	Cc.	Percent	Number	Number	Cc.	Percent	Number	Number
Clupea harengus pallasi	-	-	-	-	19	0.0	1	-	-	-	-	-	19	0.0	1	-
Oncorhynchus sp.	-	-	-	-	4,351	7.9	7	-	247	1.3	1	-	4,598	6.2	8	-
Mallotus villosus	-	-	-	-	15,708	28.4	46	9	819	4.2	6	1	16,527	22.1	52	10
Thaleichthys pacificus	-	-	-	-	1,058	1.9	10	-	157	0.8	2	-	1,215	1.6	12	-
Theragra chalcogrammus	-	-	-	-	20,775	37.6	66	18	10,316	53.1	15	4	31,091	41.6	81	22
Pleurogrammus monopterygius	-	-	-	-	2,387	4.3	18	-	1,368	7.0	9	2	3,755	5.0	27	2
Ammodytes hexapterus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bathymasteridae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Unidentified fish	-	-	-	-	-	-	18	18	40	0.2	4	1	40	0.1	22	18
Decapoda (squid)																
Gonatidae	-	-	-	-	494	0.9	90	70	283	2.0	32	27	777	1.0	122	97
Gonatus fabricii	-	-	-	-	280	0.5	56	46	25	0.1	13	12	305	0.4	70	58
Gonatus magister	-	-	-	-	6,083	11.0	47	20	2,570	13.2	9	1	8,653	11.6	56	21
Gonatopsis sp	-	-	-	-	4,084	7.4	30	1	3,620	18.1	12	1	7,704	10.3	42	2
Unidentified	-	-	-	-	66	0.1	40	39	-	-	11	11	66	0.1	51	50
Birds	-	-	-	-	-	-	2	2	-	-	-	-	-	-	2	2
Crustacea	-	-	-	-	-	-	2	2	-	-	-	-	-	-	2	2
Isopoda	-	-	-	-	-	-	4	4	-	-	-	-	-	-	4	4
Mollusca	-	-	-	-	-	-	4	4	-	-	1	1	-	-	5	5
Pebbles	-	-	-	-	-	-	16	16	-	-	-	-	-	-	16	16
Total food	-	-			55,305	100.0			19,445	100.0			74,750	100.0		
Stomachs with food	-				254				71				325			
Stomachs empty	1				278 2/				65				344			
Total stomachs collected	1				532				136				669			

1/ See footnote 1, table 21
2/ Including one missing stomach.

Table 24 --Stomach contents of fur seals from the combined areas (western Alaska, Unimak Pass, and the Bering Sea), 1962

Food items	Volume		Frequency	Frequency of trace 1/
	Cc.	Percent	Number	Number
Clupea harengus pallasi	1,663	0.6	9	1
Oncorhynchus sp.	6,800	2.6	18	1
Mallotus villosus	150,050	56.8	391	41
Thaleichthys pacificus	1,215	0.5	13	-
Theragra chalcogrammus	32,625	12.4	100	32
Pleurogrammus monopterygius	12,634	4.8	78	11
Ammodytes hexapterus	8,441	3.2	30	3
Bathymasteridae	108	0.0	1	-
Unidentified fish	395	0.1	53	42
Decapoda (squid)				
Gonatidae	1,009	0.4	165	130
Gonatus fabricii	305	0.1	71	59
Gonatus magister	41,113	15.6	121	50
Gonatopsis sp	7,734	2.9	45	3
Unidentified	66	0.0	82	81
Birds	-	-	4	4
Crustacea	-	-	2	2
Isopoda	-	-	22	22
Mollusca	-	-	7	7
Pebbles	-	-	44	44
Total food	264,158	100.0		
Stomachs with food	795			
Stomachs empty	687 2/			
Total stomachs collected	1,482			

1/ See footnote 1, table 21
2/ Including two missing stomachs

Thaleichthys pacificus (eulachon)

Thaleichthys were found in stomachs of 12 out of 13 seals collected in the Bering Sea between 21 July and 10 October.

Theragra chalcogrammus (walleye pollock)

Theragra were of minor importance in western Alaska and Unimak Pass, but were the most important food item (41.6 percent of the total food by volume) in the Bering Sea. They were generally distributed and found regularly from May to October.

Pleurogrammus monopterygius (Atka mackerel)

Pleurogrammus were generally distributed in collections from June to October. They were second in importance as a food item in Unimak Pass and fifth in the Bering Sea (6.5 and 5.0 percent of the total food by volume, respectively).

Ammodytes hexapterus (sand lance)

Ammodytes were the third most important food item (12.1 percent of the total food by volume) in western Alaska, but were of minor importance in Unimak Pass. They were found in stomachs collected in May, June, and October. They were not found in the Bering Sea.

Bathymasteridae (searchers)

One member of this family was found in the stomach of a seal collected in Unimak Pass. The fish was nearly digested.

Decapoda (squids)

Squids were a major food in western Alaska and the Bering Sea. They ranked second in the combined areas by volume and first by frequency of occurrence. In Unimak Pass, they were of minor importance. Squids are listed under five categories: unidentified squids, Gonatidae, *Gonatus fabricii*, *Gonatus magister*, and *Gonatopsis* sp. All are probably members of the family Gonatidae, but where only beaks were available for identification, the specimens were listed as unidentified. Squids definitely known to be gonatids, but lacking specific distinguishing features are listed as Gonatidae. The squids in this category are almost certainly either *Gonatus magister* or *Gonatopsis* sp. *Gonatus fabricii* is easily separated from *Gonatus magister* and *Gonatopsis* sp. by beak characters alone.

Squids with distinguishing features intact were identified as *Gonatus fabricii*, *Gonatus magister*, or to genus in the case of *Gonatopsis* sp. The last may be *Gonatopsis borealis*. The distribution of the three identified squids in western Alaska, Unimak Pass, and the Bering Sea does not differ materially from that found in 1960.

Gonatus fabricii was next in importance to *Gonatus magister* in frequency of occurrence but was of minor importance by volume. It was identified only in seal stomachs from the Bering Sea, with one exception. It was found principally on the feeding ground north of Akutan and Unalaska Islands and in the deep water between Bogoslof Island and St. George Island. Only beaks remained in stomachs collected in the vicinity of the Pribilof Islands; fragments in various stages of digestion were found in stomachs collected in deep water.

Gonatus magister was found principally in western Alaska where it comprised 47.7 percent of the food found in seal stomachs. In the Bering Sea it occurred principally in the feeding area immediately north of Unalaska, Akutan, and Akun Islands. There it formed 11.6 percent of the food. It is probable that beaks found in three seals taken near the Pribilof Islands were from squid consumed on the Aleutian feeding grounds.

Gonatopsis sp. was found in seal stomachs collected principally in the Bering Sea north of Unalaska, Akutan, Akun Islands, and in deep water between Bogoslof Island and St. George Island. *Gonatopsis* comprised 10.3 percent of the food found in seal stomachs collected in the Bering Sea and was identified in two stomachs from Unimak Pass and one from western Alaska.

Miscellaneous

Four unidentified traces of birds were found. Gastropod or pelecypod fragments occurred in seven stomachs. There were 24 occurrences of crustaceans; 1 an unidentified fragment, 1 a hermit crab, *Pagurus* sp., which was in a broken gastropod shell, and 22 occurrences of the parasitic isopod, *Rocinela belliceps*.

R. belliceps, an ectoparasite of fishes in the families Gadidae and Cottidae, is found throughout the Aleutian area (Murie and Scheffer, 1959). This isopod was found only in seal stomachs taken in Unimak Pass and closely adjoining parts of western Alaska and the Bering Sea. It was probably attached to fish that were eaten by seals. With its hard exoskeleton it is relatively resistant to digestive juices. The hermit crab and the isopods were identified by Patsy A. McLaughlin, Oceanography Department, University of Washington, Seattle, Wash.

Pebbles ranging in size from 2 to 40 mm. were found in 44 stomachs. The number in a single stomach varied from 1 to over 100, although only 9 stomachs contained more than 25 pebbles. Pebbles were found throughout the collection period in stomachs collected in shallow water (less than 100 fathoms) feeding grounds. Pebbles have been recovered from fur seal stomachs during previous investigations, although in 1958, 1959, and 1961 when collections were made mostly in deep water off the coast of California, Oregon, and Washington, pebbles were seldom found (see below). Seal stomachs from Alaska waters contained pebbles more frequently, probably because large numbers of seals were collected in shallow water and because many of the seals taken had been landing on the Pribilof Islands.

	Number of fur seal stomachs containing pebbles	
Year	California, Oregon, Washington	Alaska
1958	-	14
1959	4	-
1960	-	14
1961	3	-
1962	-	44

Relation of fur seals to commercial fisheries.--In 1962, seal stomachs contained salmon, probably more than one species, and *Theragra* which are fishes that are fished commercially in this region. Salmon are apparently subject to some predation as they pass through the feeding grounds of seals in western Alaska and in the Bering Sea. However, salmon was found in only 1 seal stomach of a collection of 440 seals taken in Unimak Pass. They formed 2.6 percent of the total food by volume in 1962.

Theragra appear in the catch of the Japanese and Soviet trawl fleets. They are used principally to produce fish meal. They are a major food item of the fur seal in the Bering Sea. The effect of the fur seal upon this fishery is difficult to assess.

Predators

The only known predator of the fur seal in northern waters is *Orcinus orca* (killer whale). *Orcinus* was observed in Unimak Pass twice each in June, September, and October; in western Alaska it was seen once in August and once in October; and in the Bering Sea one observation was made in August. No predation by *Orcinus* was observed.

SUMMARY

The fifth year of pelagic fur seal research under the terms of the Interim Convention on Conservation of North Pacific Fur Seals was completed in 1962 in waters off Alaska.

One vessel carried on investigations from May through September in western Alaska, Unimak Pass, and the Bering Sea. A second vessel worked from August to October in the same area.

An intensive study of seal movements and food habits was made in Unimak Pass and vicinity. Two major feeding areas were found; one centered 10 to 15 miles north of Akun Island and the other about 20 miles southeast of Tigalda Island.

Unimak Pass is believed to be the route used by most eastern Pacific fur seals in moving between the Bering Sea and Pacific Ocean. Smaller passes in the same area are used, although strong tidal currents may affect their use.

Seals feeding, traveling, and apparently temporarily resident were observed. Seals apparently traveling were seen in May, June, and early July. The traveling seals during these months were predominantly pregnant females. From late July through early October large concentrations utilized the two main feeding areas. Post partum females predominated in the collection during this period. A resident population of young seals was observed throughout the season.

Data on sex and age of seals collected in Unimak Pass and vicinity are analyzed by 10-day periods to show changes in movements of the different classes of seals.

During June, pregnant females comprised 63 percent of the seals collected. In the first 10 days of July the percentage dropped to 44, and during the period 11-20 July to only 15.

Post partum (lactating) females from the Pribilof Islands were first taken in early July. They increased until they formed approximately 50 percent of the collection from August through the first part of October. Some post partum females traveled through Unimak Pass to feed in the area southeast of Tigalda Island.

Immature females were collected throughout the season. From July through September they composed 70 percent of the seals collected southeast of Tigalda Island.

Nonpregnant females were collected regularly throughout the season and comprised about 10 percent of the total.

Mature bulls were seen or collected throughout most of the season except for the last 10 days of June and the first 10 days of July. None was seen after 13 September. Young males were collected throughout the season with no marked changes in abundance.

No correlation was found between seal movements through the pass and stomach contents or tide direction. The majority of seals collected in the pass had food in the stomach regardless of the time of day or stage of the tide.

A total of 1,486 seals was collected in 1962; 1,354 (91.1 percent) females and 132 (8.9 percent) males. Age classes 3 through 11 years were best represented. The largest single age classes were those of 4-year females and 3-year males. Yearlings comprised 0.4 percent of the total collection.

Fifty seals (3.4 percent) of the total collection were found to be carrying tags. One Soviet tag attached in 1960 was recovered.

For a given age, the average length of pregnant females was greater than that of nonpregnant or post partum females.

Two hundred eighty-five fetuses were collected.

From 1958 through 1962 the average pregnancy rate of females 6 through 26 years of age was 83.8 percent. The average pregnancy rate for females taken in pelagic collections during these years was 72.3 percent.

The youngest pregnant females were 4 years old. Multiparous pregnant females were most numerous through age classes 8 to 12.

The twin seals collected in 1962 were each smaller than the average normal fetus collected at the same time of year.

The barnacles *Lepas pectinata* and *L. anatifera* were attached to guard hairs of two seals.

Over the past 5 years, more female than male fetuses and more fetuses in the left than in the right uterine horn have been recorded.

Eleven species of fish and squids were identified in seal stomachs. Excluding cephalopods, few invertebrates have been found in fur seal stomachs.

The fur seal commonly swallows whole small fish and squids without coming to the surface but eats large fish at the surface. It is primarily a night and early morning feeder.

The area immediately north of the Aleutian Islands between Unimak Pass and Bogoslof Island, Unimak Pass, and the western Alaska area south of Unimak Pass form what is probably one of the major summer and fall feeding areas of the Pribilof fur seal herd.

The stomachs of seals collected near the Pribilof Islands usually contained less food than those collected from the areas near the Aleutians. The stomachs of 1,486 seals were examined. Major food items by areas were as follows: western Alaska, squids, *Mallotus*, and *Ammodytes;* Unimak Pass, *Mallotus* and *Pleurogrammus;* Bering Sea, *Mallotus;* squids, and *Mallotus*, combined area totals, *Mallotus*, squids, and *Theragra*. *Mallotus*, *Theragra*, and squids are reported as major food items in these areas since 1896.

Salmon *(Oncorhynchus)* were found in 18 of the 1,486 stomachs examined. By frequency of occurrence it comprised 1.2 percent of the food, and by volume it comprised 2.6 percent of the food. Salmon were identified in seal stomachs from western Alaska and the Bering Sea; only one occurrence was noted in Unimak Pass.

Mallotus were the most important single food item, comprising over 50 percent of the total food by volume. They were found through the three subareas from May to October.

Theragra were of major importance in the Bering Sea and were found throughout the season.

Squids were a major food in western Alaska and the Bering Sea, and were the second most important food for the combined areas. The squids *Gonatus fabricii*, *G. magister*, and *Gonatopsis* sp. were identified.

Seal stomachs in 1962 contained salmon and walleye pollock *(Theragra)*, which are fished commercially in this region.

LITERATURE CITED

BERRY, S. S.
1912. A review of the cephalopods of western North America. Bulletin, [U.S.] Bureau of Fisheries, vol. 32, p. 257-362.

CLEMENS, W. A., and G. V. WILBY.
1961. Fishes of the Pacific coast of Canada. 2d ed. Fisheries Research Board of Canada, Bulletin No. 68, 368 p.

EVERMANN, BARTON WARREN, and EDMUND LEE GOLDSBOROUGH.
1906. The fishes of Alaska. [U.S.] Bureau of Fisheries Document No. 624, p. 219-360, pl. 23 to 42.

KENYON, KARL W.
1956. Food of fur seals taken on St. Paul Island, Alaska, 1954. Journal of Wildlife Management, vol. 20, no. 2, p. 214-215.

LUCAS, F. A.
1899. The food of the northern fur seals. *In* the fur seals and fur-seal islands of the North Pacific Ocean, part 3, p. 59-68. U.S. Treasury Department Document 2017.

MURIE, OLAUS J., and VICTOR B. SCHEFFER.
1959. Fauna of the Aleutian Islands and Alaska Peninsula. U.S. Fish and Wildlife Service, North American Fauna No. 61, 406 p.

SASAKI, MADOKA.
1929. A monograph of the dibranchiate cephalopods of the Japanese and adjacent waters. Jour. Faculty of Agriculture, Hokkaido Imperial University, Sapporo, vol. 20, suppl. 357 p., 30 pls.

SCHEFFER, VICTOR B.
1950. Growth layers on the teeth of Pinnipedia as an indication of age. Science,

vol. 112, no. 2907, p. 309-311, September 15.

SCHEFFER, VICTOR B.
1962. Pelage and surface topography of the northern fur seal. U.S. Fish and Wildlife Service, North American Fauna, No. 64, 206 p., 112 pls.

SCHULTZ, L. P.
1953. Keyes to the fishes of Washington, Oregon, and closely adjoining regions. 4th printing. University of Washington Publications in Biology, vol. 2, no. 4, p. 103-228.

TAYLOR, F. H. C., M. FUJINAGA, and FORD WILKE.
1955. Distribution and food habits of the fur seals of the North Pacific Ocean. U.S. Department of the Interior, Fish and Wildlife Service, Washington, 86 p.

WILKE, FORD, and KARL W. KENYON.
1954. Migration and food of the northern fur seal. Transactions of the Nineteenth North American Wildlife Conference, p. 430-440.

1957. The food of fur seals in the eastern Bering Sea. The Journal of Wildlife Management, vol. 21, no. 2, p. 237-238.

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