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NATIONAL MARINE FISHERIES SERVICE

FUR SEAL INVESTIGATIONS, 1971

by

Marine Mammal Biological Laboratory

National Marine Fisheries Service

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MARINE MAMMAL BIOLOGICAL LABORATORY  
Seattle, Washington 98115

## ABSTRACT

Field investigations were conducted on the Pribilof Islands and at sea from March to October 1971.

The kill of fur seals was 31,795 males and 103 females.

Total counts of living adult males were 8,659 in June and 7,869 in July.

Dead fur seals counted consisted of 51,659 pups and 172 animals older than pups. Post-mortem examinations show apparent malnutrition and hookworm disease as the principal causes of death among 486 pups examined in 1971.

The average weights of 800 pups were 9.4 kg. for males and 8.1 for females.

We marked 24,995 pups of both sexes and 3,992 males selected as 1- and 2-year olds, and 2,554 marked males were recovered.

Pup population estimates at the time of tagging for year classes 1966-68, from mark recoveries in 1971, were 323,999, 437,866, and 550,808, respectively. The estimates for year classes 1967-68 are much higher than would be expected from estimates based on shearing and sampling in 1966, 1969, and 1970. Estimates based on tag recoveries are inflated for several reasons, with tag-caused mortality and unidentified tag losses probably the most important.

Of 1,323 seals sighted off Washington, 353 were collected, 44 were wounded and lost, and 63 were killed and lost.

Single seals were sighted more frequently than were groups of two or more.

Forty-one yearling seals from the 1970 year class were taken and 68 percent of female seals killed were from 1 to 7 years old. The oldest seal taken was a 22-year-old pregnant female. Twenty marked female seals were collected, including two tagged by the U. S. S. R.

Forty-six percent of the nonpregnant female seals in ages 5 to 22 years apparently had ovulated.

Northern anchovy was the leading food species found in the stomachs of 204 fur seals that contained food. Coho, sockeye, and chinook salmon, and Pacific hake, capelin, and Pacific herring followed in importance. Salmon were the most valuable commercial fish eaten by fur seals off Washington.

Part I. FUR SEAL INVESTIGATIONS, PRIBILOF ISLANDS,  
ALASKA, 1971

The objective of fur seal research on the Pribilof Islands is to determine the level at which the herd will produce maximum sustained yield. The investigations satisfy obligations to the "Interim Convention for Protection of North Pacific Fur Seals" and produce the information needed to manage the resource. This report summarizes the data collected in 1971.

Figures 1 and 2 show the locations of breeding grounds on the Pribilof Islands, and terms having special meanings in fur seal research are described in the glossary. In this report, "Pribilof Islands" includes St. Paul and St. George Islands and, occasionally, Sea Lion Rock. Two of the five Pribilof Islands, Otter and Walrus, do not have fur seal rookeries.

Alton Y. Roppel

AGE CLASSIFICATION AND NUMBER OF SEALS  
KILLED, BY SEX

In 1971 only hauling ground males without manes were purposely killed from 23 June to 31 July beginning at 6 a.m. Monday through Saturday of each week on St. Paul Island, and at 9 a.m. Mondays, Wednesdays, and Fridays on St. George Island.

Fifty-four females were killed unintentionally during the male kill. The ages of these and 49 females collected for research were not determined.

The kill of males in ages 2 to 6 years on St. Paul Island and St. George Island was 27,242 and 4,553, respectively (tables A-1 to A-4). Right upper canine teeth collected from 20 percent of the males killed were used to determine the age composition daily by rookery.

We sampled 20 percent of the males killed 22-26 July to determine age and body length for continuing studies of correlations between abundance of a year class on land at age 2 years and the number available for harvest the following year at age 3.

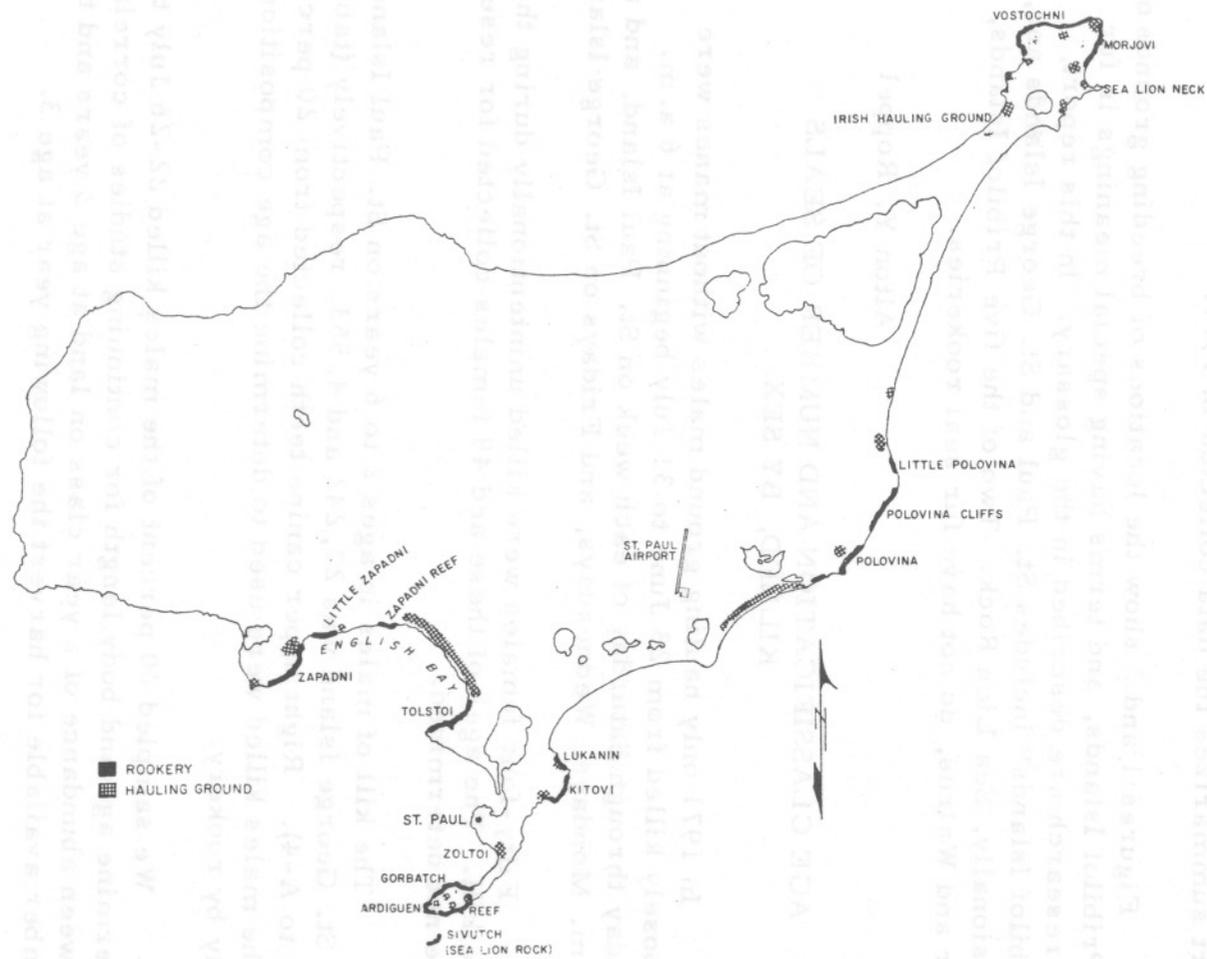


Figure 1. --Location of rookeries and hauling grounds, St. Paul Island.

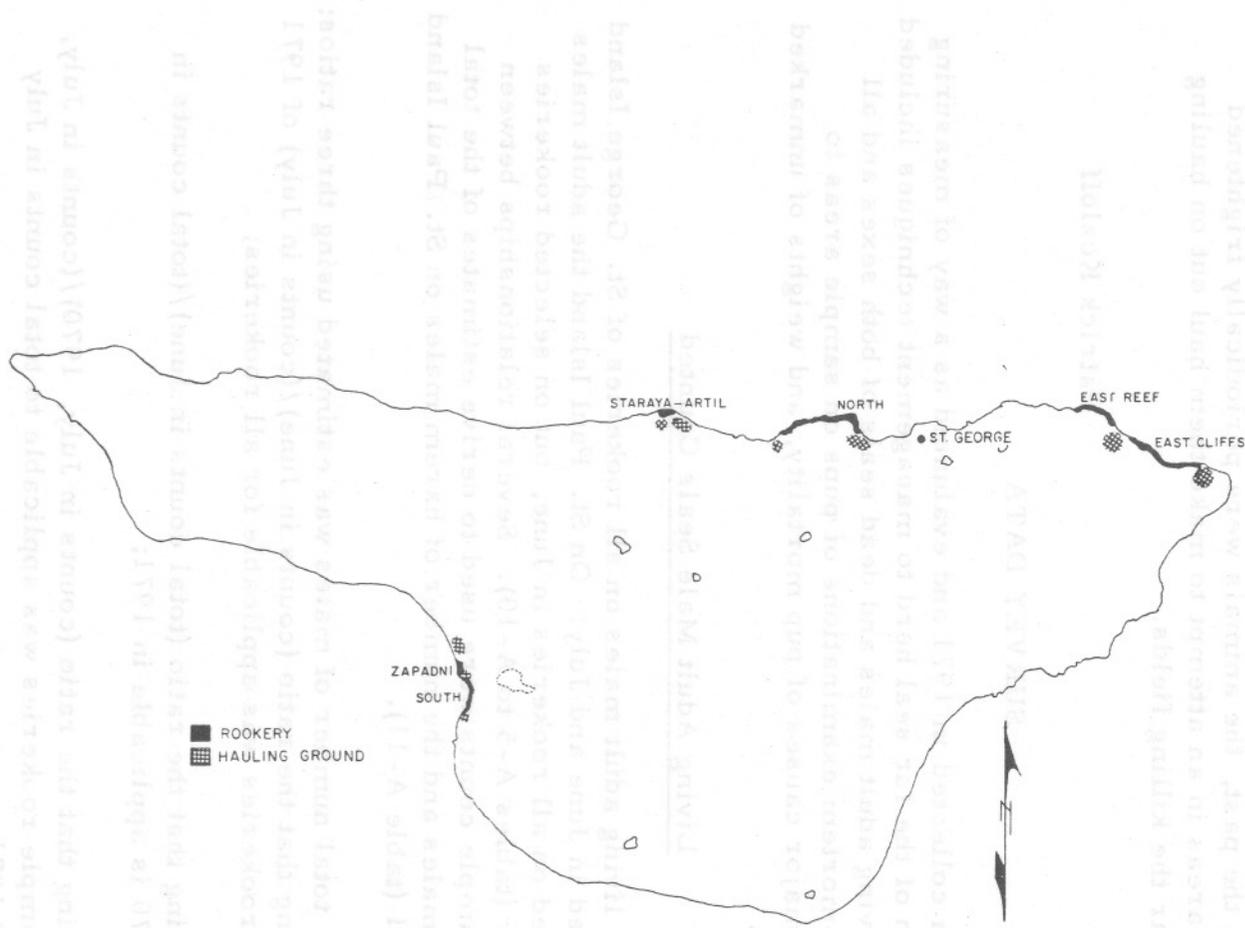


Figure 2. --Location of rookeries and hauling grounds, St. George Island.

Trends in the number of available 3- and 4-year-old males harvested on St. Paul and St. George Islands are given in figures 3 and 4, respectively. Males killed on the Pribilof Islands from year classes 1947 to 1969 are given in figure 5, and from year classes 1954 to 1969 in table 1.

Seals on inaccessible hauling grounds were not disturbed in 1971. In the past, the animals were periodically frightened from these areas in an attempt to make them haul out on hauling grounds near the killing fields.

Patrick Kozloff

#### SURVEY DATA

Data collected in 1971 and evaluated as a way of measuring the reaction of the fur seal herd to management techniques included counts of living adult males and dead seals of both sexes and all ages, post-mortem examinations of pups on sample areas to determine major causes of pup mortality, and weights of unmarked living pups.

##### Living Adult Male Seals Counted

The living adult males on all rookeries of St. George Island were counted in June and July. On St. Paul Island the adult males were counted on all rookeries in June, but on selected rookeries only in July (tables A-5 to A-10). Several relationships between total and sample counts were used to derive estimates of the total number of males and the number of harem males on St. Paul Island in July 1971 (table A-11).

The total number of males was estimated using three ratios:

- (1) Assuming that the ratio (counts in June)/(counts in July) of 1971 on sample rookeries was applicable for all rookeries;

- (2) Assuming that the ratio (total counts in June)/(total counts in July) of 1970 is applicable in 1971;

- (3) Assuming that the ratio (counts in July, 1970)/(counts in July, 1971) on sample rookeries was applicable to total counts in July of 1970 and 1971.

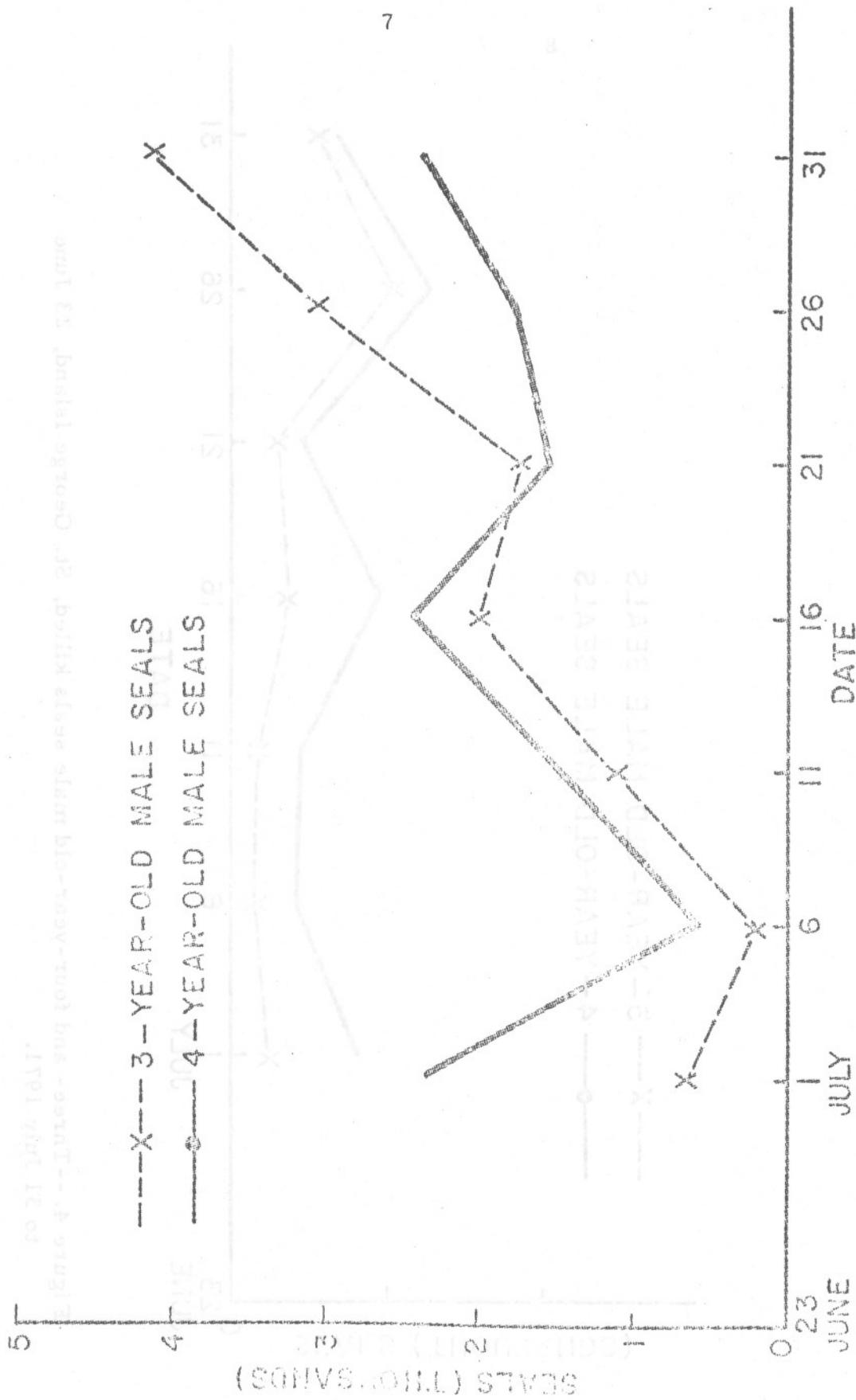


Figure 3. -- Three- and four-year-old male seals killed, St. Paul Island, 23 June to 31 July 1971.

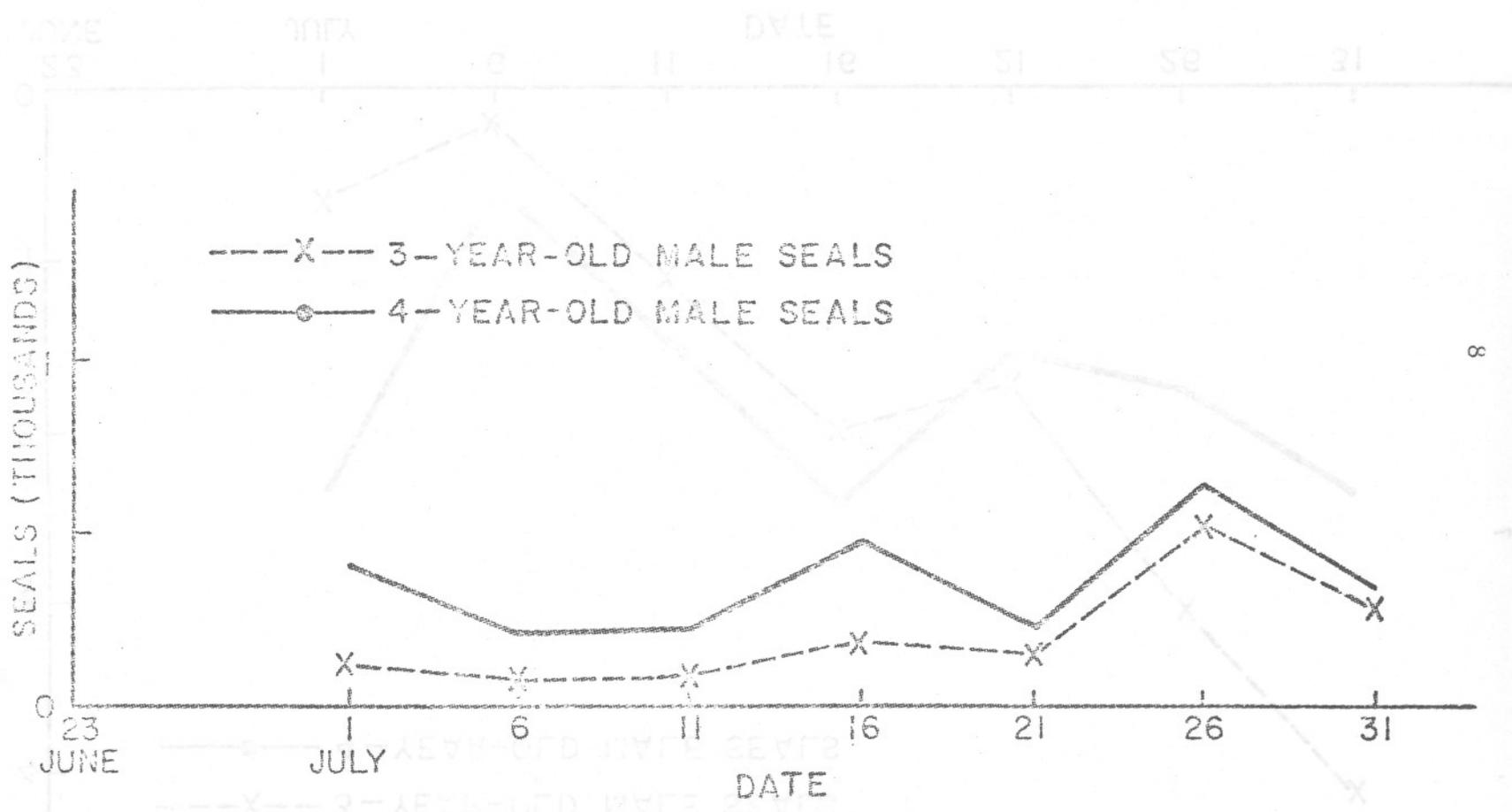


Figure 4. --Three- and four-year-old male seals killed, St. George Island, 23 June to 31 July 1971.

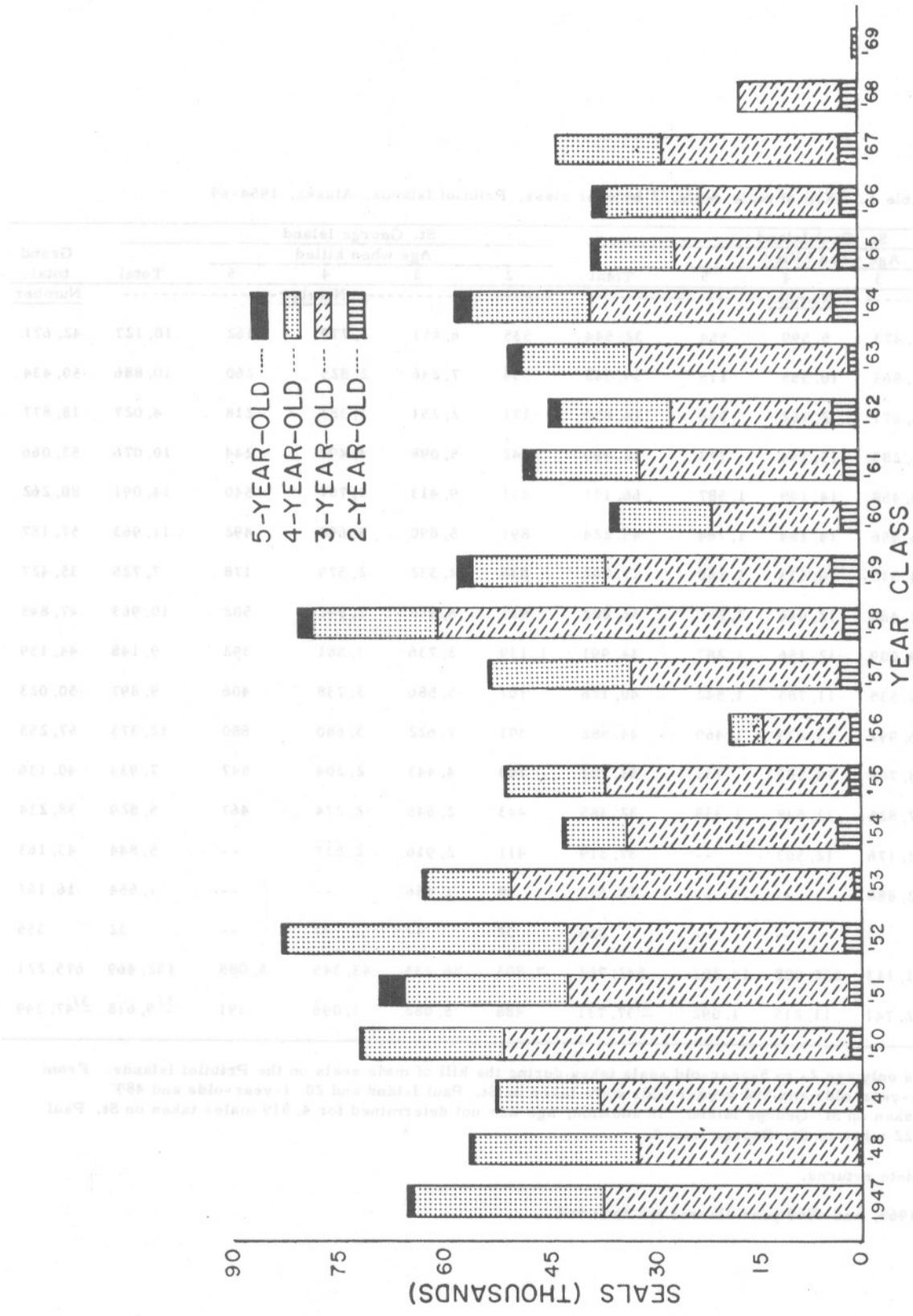


Figure 5.--Kill of male seals, by year class, Pribilof Islands, Alaska, 1947-69.

Table 1. --Kill of male seals, <sup>1/</sup> by year class, Pribilof Islands, Alaska, 1954-69

Year class	St. Paul Island					St. George Island					Grand total
	Age when killed				Total	Age when killed				Total	
	2	3	4	5		2	3	4	5		
-----Number-----					-----Number-----					Number	
1954	2,918	23,473	5,599	554	32,544	535	6,651	2,779	162	10,127	42,671
1955	1,015	27,863	10,555	115	39,548	555	7,246	2,825	260	10,886	50,434
1956	885	10,671	2,762	532	14,850	171	2,251	1,387	218	4,027	18,877
1957	2,590	24,283	15,344	773	42,990	242	5,098	4,492	244	10,076	53,066
1958	1,977	48,458	14,149	1,587	66,171	431	9,413	3,707	540	14,091	80,262
1959	2,820	26,456	14,184	1,764	45,224	891	5,890	4,690	492	11,963	57,187
1960	1,619	14,310	10,533	1,240	27,702	636	4,332	2,579	178	7,725	35,427
1961	1,098	22,468	12,046	1,270	36,882	921	6,948	2,592	502	10,963	47,845
1962	2,539	19,009	12,156	1,287	34,991	1,139	3,736	3,881	392	9,148	44,139
1963	1,264	25,535	11,785	1,542	40,126	167	5,586	3,738	406	9,897	50,023
1964	3,143	26,991	13,279	1,469	44,882	391	7,622	3,680	680	12,373	57,255
1965	2,200	18,706	10,565	731	32,202	740	4,443	2,204	547	7,934	40,136
1966	1,673	17,826	11,548	1,338	32,385	443	2,645	2,274	467	5,829	38,214
1967 <sup>2/</sup>	2,640	22,176	12,503	--	37,319	411	2,916	2,517	--	5,844	43,163
1968 <sup>2/</sup>	1,725	12,888	--	--	14,613	98	1,456	--	--	1,554	16,167
1969 <sup>2/</sup>	323	--	--	--	323	32	--	--	--	32	355
Total	30,429	341,113	157,008	14,202	542,752	7,803	76,233	43,345	5,088	132,469	675,221
Mean	1,902	22,741	11,215	1,092	<sup>3/</sup> 37,731	488	5,082	3,096	391	<sup>3/</sup> 9,618	<sup>3/</sup> 47,349

<sup>1/</sup> Includes only age 2- to 5-year-old seals taken during the kill of male seals on the Pribilof Islands. From 1956 to 1969, 131 1-year-olds and 892 6-year-olds were taken on St. Paul Island and 20 1-year-olds and 489 6-year-olds were taken on St. George Island. In addition, age was not determined for 4,919 males taken on St. Paul Island, nor for 1,522 taken on St. George Island.

<sup>2/</sup> Incomplete returns.

<sup>3/</sup> 1967, 1968, and 1969 year classes not included.

Estimates of the total number of males in July 1971 were 6,253, 6,375, and 5,713, respectively, for the three methods. The average to the nearest hundred was 6,100.

Two ratios were used to estimate the number of harem males:

(1) Assuming that the ratio (counts in July, 1970)/(counts in July, 1971) on sample rookeries was applicable to all rookeries;

(2) Assuming that the ratio (July counts of harem males)/(July counts of total males) on sample rookeries was applicable to all rookeries in 1971.

In this case the estimate of 6,100 obtained above was used for the value of total males. The average of the two estimates of harem males to the nearest hundred was 4,200.

Ratios used in the foregoing calculations utilize the most recent relationships among counts, therefore, they should be reasonably accurate. Estimates made in 1967 and 1968 using similar methods agreed with complete counts made in 1966, 1969, and 1970.

#### Dead Seals Counted That Were Older Than Pups

In 1971, counts of dead seals older than pups on the Pribilof Islands included 44 males and 128 females, the lowest number for either sex since the counts were begun in 1965. Canine teeth were collected from most of the animals and will be used for age distribution and death rate studies (some seals had lost their canines). The number of dead animals counted each year since 1965 is given in table 2.

#### Dead Pups Counted

In 1971, dead pups on the Pribilof Islands were counted from 20 August to 3 September (table A-12). Dead pups totaled 46,439 on St. Paul Island and 5,220 on St. George Island, 2.3 and 1.6 times the respective number of dead pups counted in 1970. The number of dead pups counted from 1962 to 1971, plus a 5-percent addition for animals overlooked, is given in table A-13.

Table 2. --Dead seals counted that were older than pups,  
Pribilof Islands, Alaska, 1965-71

Year	St. Paul Island		St. George Island		Total	
	Males	Females	Males	Females	Males	Females
	-----Number-----		-----Number-----		-----Number-----	
1965	158	No count	No count	No count	158	No count
1966	181	172	41	55	222	227
1967	108	157	41	28	149	185
1968	98	141	33	22	131	163
1969	94	141	22	29	116	170
1970	52	124	4	53	56	177
1971	39	91	5	37	44	128

In 1971, counts of dead seals older than pups on the Pribilof Islands included 44 males and 128 females, the lowest number for either sex since the counts were begun in 1965. The seals were collected from most of the animals and will be used for age distribution and death rate studies (some seals had lost their canines). The number of dead animals counted each year since 1965 is given in Table 2.

#### Dead Pups Counted

In 1971, dead pups on the Pribilof Islands were counted from 30 August to 3 September (Table A-12). Dead pups totaled 46, 419 on St. Paul Island and 2,520 on St. George Island, A.S. and 1.6 times the respective number of dead pups counted in 1970. The number of dead pups counted from 1965 to 1971, plus a 5-percent addition for animals overlooked, is given in Table A-13.

Weights of Living Pups

Living pups have been weighed on St. Paul Island about 1 September each year since 1957. The mean weights in 1971 (table 3) were similar to the overall means for all years (table A-14). Analysis of variance showed a significant difference between sexes and rookeries ( $P < 0.01$ ). The purpose of the weighing program is to determine if the weights of pups are a reliable indicator of survival. A plot of the total kill of males from a year class and mean pup weights, however, shows no relationship for the years 1957 through 1967, the period for which we have complete data.

Patrick Kozloff and  
Ancel Johnson

Table 3. --Mean and variance of seal pup weights, by sex and rookery, St. Paul Island, 1-3 September 1971

Sex and rookery	Sample size Number	Variance	Mean Kg.
<u>Males</u>			
Zapadni Reef	100	3.4104	9.3
Polovina	100	4.1742	10.0
Morjovi	100	2.8706	8.7
Reef	100	3.0625	9.5
All rookeries	400		9.4
<u>Females</u>			
Zapadni Reef	100	2.7635	8.2
Polovina	100	4.8049	8.4
Morjovi	100	2.7296	7.7
Reef	100	2.6304	8.0
All rookeries	400		8.1

## PATHOLOGY

From 30 June to 15 August M. C. Keyes and W. B. McGuire collected 486 dead pups from under catwalks on study areas at Reef and Northeast Point Rookeries (Marine Mammal Biological Laboratory, 1970). Of these, 463 were necropsied, and 23 were discarded as unsuitable for examination because of advanced post-mortem degeneration.

Tabulation of the primary diagnoses<sup>1/</sup> for pups necropsied shows that the main causes of death were hookworm disease and malnutrition, which together accounted for 73.5 percent of the deaths. Microbial infection, trauma, multiple hemorrhage-perinatal complex, miscellaneous, and undetermined causes were less important (table 4).

A comparison of the incidence of these diagnoses over a 5-year period for study areas 1 and 3 (figs. 6 and 7) shows statistically significant year-to-year variation, particularly for malnutrition and hookworm disease (table 5a).

Referring to observations of pup deaths on study area 1 from 1964 to 1967 (Marine Mammal Biological Laboratory, 1971) and observations from 1967 to 1971 (table 5a), peaks in the total number of deaths have occurred at 3-year intervals, 1965, 1968, and 1971 (table 5b). These peaks correspond to increases in deaths from malnutrition in 1968 and 1971, and it is likely that a similar relationship existed in 1965.<sup>2/</sup> Deaths from malnutrition on study

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<sup>1/</sup> The cause of death for each necropsy is diagnosed as primary, secondary, tertiary, and so on. A specific cause is designated primary if it is the most serious or if it preceded and influenced critical changes that eventually led to death. Secondary and tertiary diagnoses, where indicated, are not tabulated in this report but are recorded on individual necropsy forms. The distribution of secondary among primary causes was reported for necropsies performed in 1966 (Marine Mammal Biological Laboratory, 1969).

<sup>2/</sup> The study area was cleared at intervals throughout the season in 1965, but only about 1 percent of the pups were necropsied; the rest were only counted. However, most of the dead pups counted and removed were thin and appeared to have died of malnutrition (Research in fur seal mortality, St. Paul Island, Alaska, 19 July to 3 September 1965).

Table 4.--Primary diagnoses<sup>1/</sup> for causes of death among seal pups, three mortality study areas, St. Paul Island, 30 June to 15 August 1971

Primary diagnoses	Study areas							
	Reef Rookery				Northeast Point			
	Area 1		Area 2		Area 3		Total	
	Old catwalk		New catwalk		Hutchinson Hill			
Dead pups		Dead pups		Dead pups				
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Malnutrition	46	37.1	18	24.7	92	31.8	156	32.1
Hookworm disease	28	22.6	32	43.8	141	48.8	201	41.4
Infection (microbial)	10	8.1	6	8.2	14	4.8	30	6.2
Enteritis	(4)	(3.2)	(2)	(2.7)	(7)	(2.4)	(13)	(2.7)
Navel	(2)	(1.6)	(2)	(2.7)	(2)	(0.7)	(6)	(1.2)
Pleuritis	(0)	(0.0)	(1)	(1.4)	(5)	(1.7)	(6)	(1.2)
Pneumonia	(2)	(1.6)	(0)	(0.0)	(0)	(0.0)	(2)	(0.4)
Abscess	(2)	(1.6)	(0)	(0.0)	(0)	(0.0)	(2)	(0.4)
Peritonitis	(0)	(0.0)	(1)	(1.4)	(0)	(0.0)	(1)	(0.2)
Trauma	5	4.0	0	0.0	6	2.1	11	2.2
Bite wounds	(1)	(1.6)	(0)	(0.0)	(3)	(1.0)	(4)	(0.8)
Skull fracture	(0)	(0.0)	(0)	(0.0)	(1)	(0.4)	(1)	(0.2)
Liver rupture	(4)	(3.2)	(0)	(0.0)	(2)	(0.7)	(6)	(1.2)
Multiple hemorrhage-perinatal complex	6	4.8	2	2.7	7	2.4	15	3.1
Miscellaneous	5	4.0	1	1.4	11	3.8	17	3.5
Stillborn	(5)	(4.0)	(1)	(1.4)	(7)	(2.4)	(13)	(2.7)
Hernia	(0)	(0.0)	(0)	(0.0)	(1)	(0.4)	(1)	(0.2)
Dystocia	(0)	(0.0)	(0)	(0.0)	(1)	(0.4)	(1)	(0.2)
Meconium impaction	(0)	(0.0)	(0)	(0.0)	(1)	(0.4)	(1)	(0.2)
Aspiration pneumonia	(0)	(0.0)	(0)	(0.0)	(1)	(0.4)	(1)	(0.2)
Undetermined	15	12.1	6	8.2	12	4.2	33	6.8
Unsuitable for examination	9	7.3	8	11.0	6	2.1	23	4.7
Total	124	100.0	73	100.0	289	100.0	486	100.0

<sup>1/</sup> See footnote <sup>1/</sup> in text.

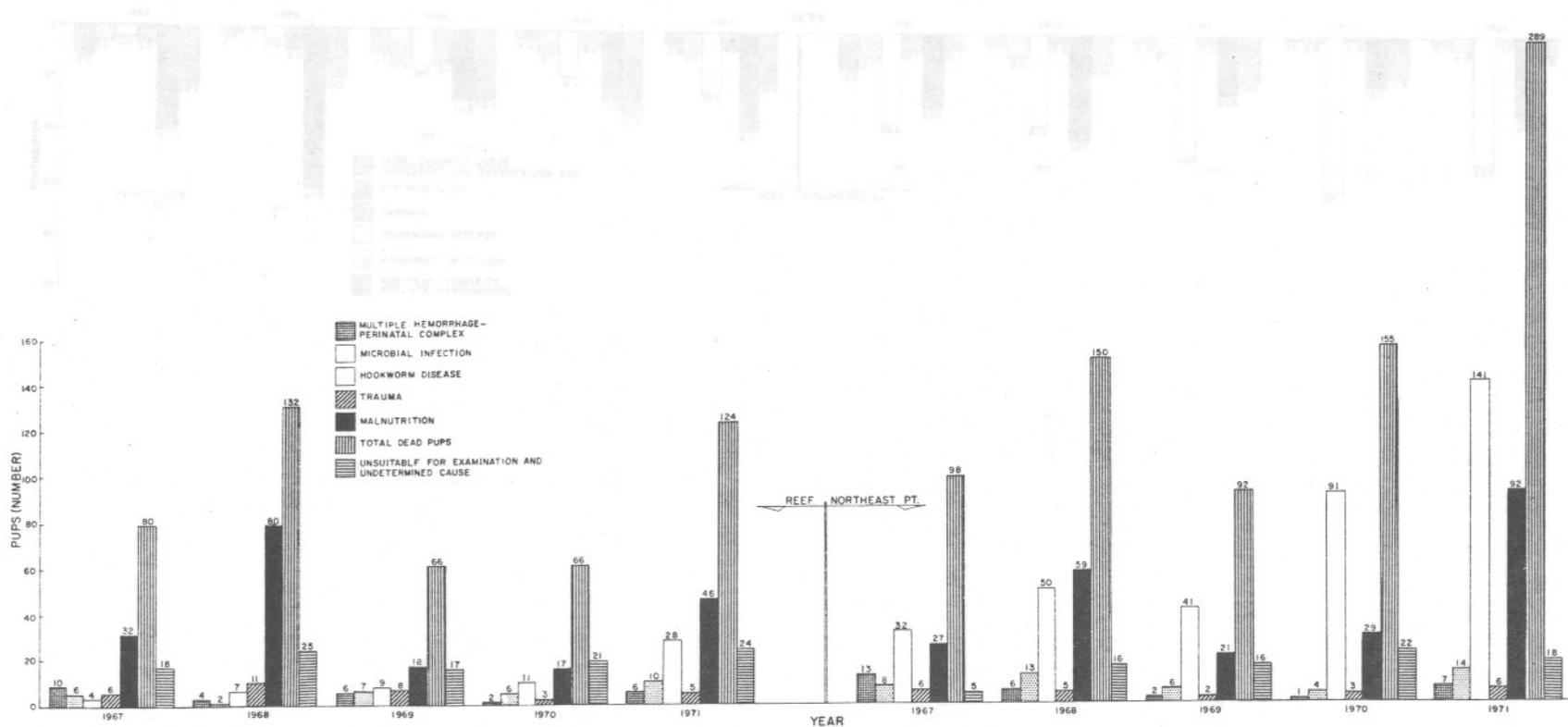


Figure 6. --Number of pups that died of various causes, Reef Rookery study area 1, and Northeast Point study area 3, 1957-71, St. Paul Island.

Multiple hemorrhage-perinatal complex 1967-71, St. Paul Island  
 Figure 7. --Percentage of pups that died of various causes, Reef Rookery study area 1, and

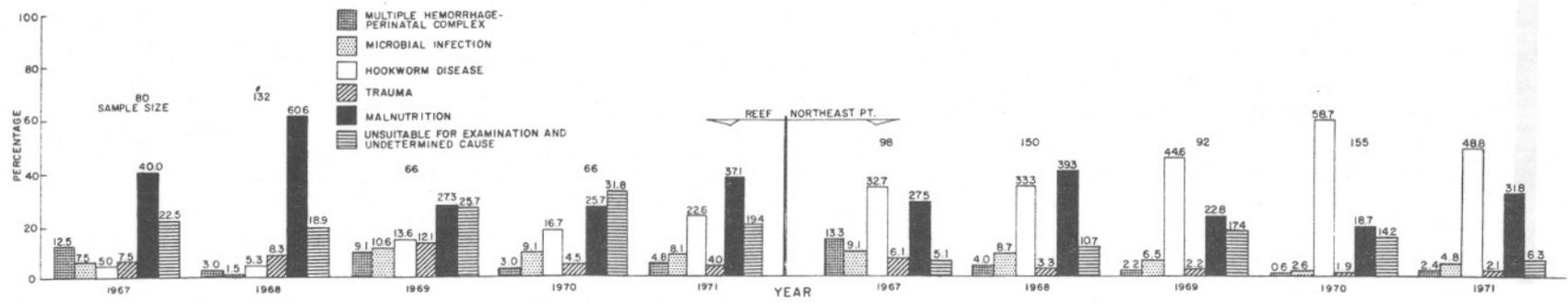


Figure 7. --Percentage of pups that died of various causes, Reef Rookery study area 1, and Northeast Point study area 3, 1967-71, St. Paul Island.

Table 5a.--Primary diagnoses for causes of death among seal pups, three mortality study areas combined, a 5-year summary (1967-71), St. Paul Island

Primary diagnoses	1967	1968	1969	1970	1971	5-year totals	
	-----Number-----					Number	Percent
Malnutrition	72	181	56	55	156	520	33.2
Hookworm disease	37	64	58	105	201	465	29.7
Microbial infection	20	20	24	11	30	105	6.7
Multiple hemorrhage- perinatal complex	33	19	11	7	15	85	5.4
Trauma	16	21	13	9	11	70	4.5
Miscellaneous	15	7	7	12	17	58	3.7
Undetermined	17	12	19	22	33	103	6.6
Unsuitable for examination	22	55	20	36	23	156	10.0
Total	232	379	208	257	486	1,562	100.0
Dead pups counted, both islands	17,426	31,438	15,550	25,040	51,659	141,113	
Percent of total dead pups examined							1.1

Table 5b. --Number of seal pups dying of malnutrition and hookworm disease, study area 1, 1964 and 1966-71, and study area 3, 1967-71, St. Paul Island, late June to 15 August

	1964	1965	1966	1967	1968	1969	1970	1971
				<u>Area 1</u>				
Total deaths	161	<u>337</u>	164	80	<u>132</u>	66	66	<u>124</u>
Malnutrition	41	<u>1/</u>	67	32	<u>80</u>	18	17	<u>46</u>
Hookworm	13	<u>1/</u>	24	4	7	9	11	28
				<u>Area 3</u>				
Total deaths	<u>2/</u>	<u>2/</u>	<u>2/</u>	98	<u>150</u>	92	155	<u>289</u>
Malnutrition	<u>2/</u>	<u>2/</u>	<u>2/</u>	27	<u>59</u>	21	29	<u>156</u>
Hookworm	<u>2/</u>	<u>2/</u>	<u>2/</u>	32	50	41	91	201

1/ See footnote 2/ in text.

2/ The study area was not established and used until 1967.

area 3 show the same pattern for 1968 and 1971, although the peaks are accentuated by greater numbers of deaths from hookworm disease. Thus, on the mortality study areas, deaths from malnutrition appear to show cyclical increases every 3 years and correspond to increases in the total dead pup counts. Deaths from hookworm disease accentuate these peaks in mortality, but do not seem to be cyclic. Rather, they seem to have increased yearly since the end of herd reduction, suggesting increases in both the pup and hookworm populations on the study areas, a condition more obvious on area 3 than on area 1. Indeed, casual observations of pup distribution and concentration on area 3 suggest a gradual increase in the number of pups there.

A 5-year summary of necropsy diagnoses for study areas 1, 2, and 3 (table 5a), when compared to annual percentages in figure 7, reveals that although some annual values for each diagnosis category show significant variation, they do not deviate to an extreme degree from the 5-year average represented by 1,562 necropsies; 1.1 percent of the 5-year total (141,113) of dead pups counted on all rookeries of both islands.

Mark C. Keyes

## MARKING

Estimates of year-class sizes of pup populations and studies of growth, survival, mortality, distribution at sea, homing tendency, and behavior are based on mark-recapture data.

### Application of Marks

Several kinds of marks have been used on fur seals. Monel cattle-ear tags have been attached to seals of both sexes at various ages on St. Paul Island since 1941 and on St. George Island from 1956 to 1968. Pups were last marked with tags in 1968. Since 1969 only male seals selected at estimated ages 1 and 2 years have been given tags, whereas pups of both sexes have been marked by cryogenic (freeze) branding (fig. 8) or by removing part of a flipper. Tables A-16 and A-17 give the number of pups marked by various methods since 1962, and table A-18 shows male seals in estimated ages 1 and 2 years marked with tags since 1961.

### Pups

In 1971, pups were marked by removing the tips of hind flipper digits.

Flipper marking. --Five thousand pups on St. George Island were marked on the right hind flipper in August by removing the tip of the third digit, up to the web; the left hind flippers of 19,995 pups were marked on St. Paul Island in September by removing the tip of the third digit (fig. 9). Marking quotas of 5,000 pups and 20,000 pups were distributed among the rookeries of their respective islands according to the distribution of class 3 males (adult males with territories and females) counted in mid-July of 1971 on St. George Island and of 1969 on St. Paul Island.

### Male Seals Ages 1 and 2 Years

We double-tagged 3,992 young male seals on St. Paul Island in 1971 by attaching a 1Y-series tag to the trailing edge of each front flipper at the hairline (fig. 9). The ages of these seals at the time of tagging will be ascertained from canine teeth collected from the animals when they are killed subsequently on the Pribilof Islands or elsewhere.

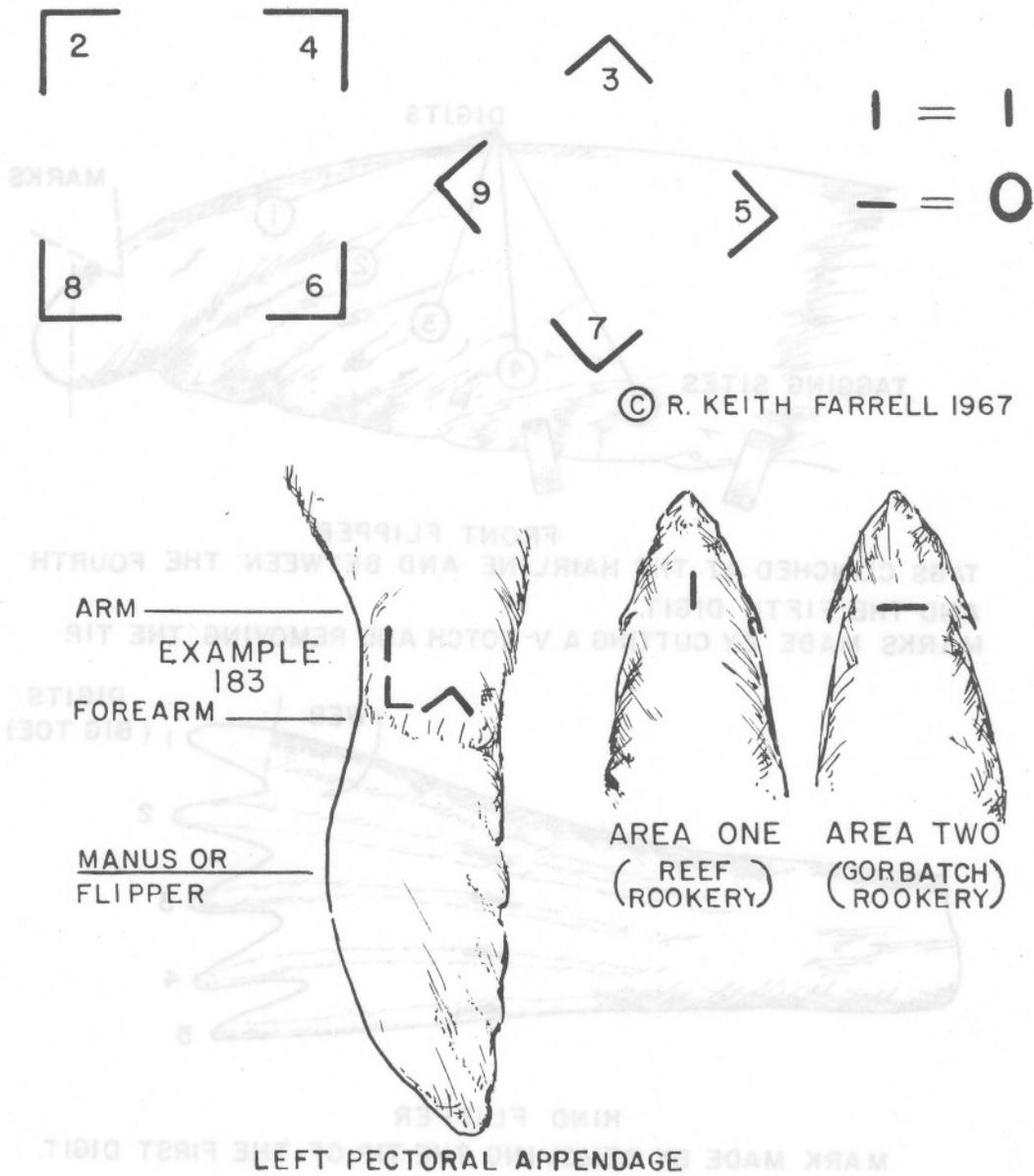
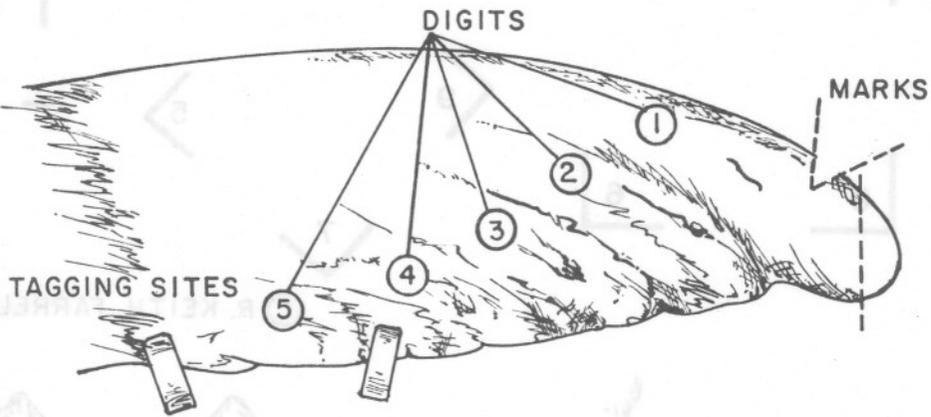
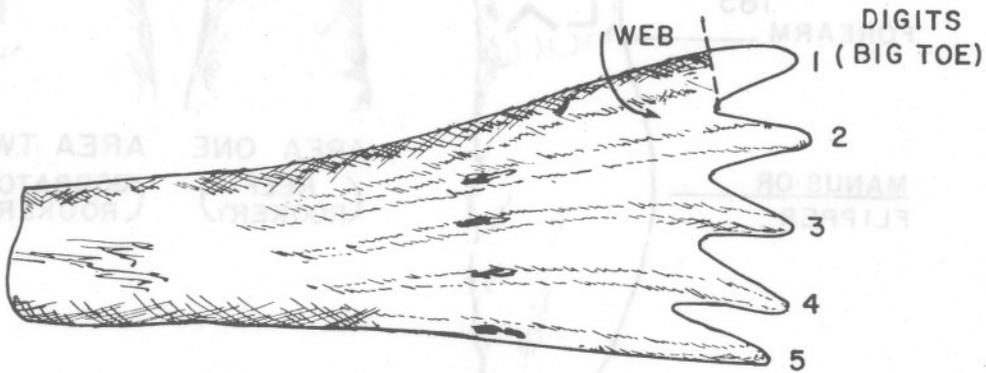


Figure 8. --System of identification symbols used as cryogenic brands applied to pups, Reef and Gorbach Rookeries, St. Paul Island, Alaska.



**FRONT FLIPPER**  
 TAGS CLINCHED AT THE HAIRLINE AND BETWEEN THE FOURTH AND THE FIFTH DIGIT.  
 MARKS MADE BY CUTTING A V-NOTCH AND REMOVING THE TIP.



**HIND FLIPPER**  
 MARK MADE BY REMOVING THE TIP OF THE FIRST DIGIT.

Figure 9. ---Examples of mark locations used on fur seals, Pribilof Islands, Alaska.

Of the total number of male seals tagged, 17 were known yearlings and 181 were known 2-year-olds as determined by their respective pup marks applied in 1970 and 1969 on the Pribilof Islands (table A-19); 3,794 had never been marked. Table A-20 shows a record of male seals tagged at estimated ages 1 and 2 years in 1971.

Patrick Kozloff

### Marking and Recapture

#### Recapture of Marked Seals

Marked seals recovered in 1971 on the Pribilof Islands are listed in tables A-21 to A-23. The incidence of tag loss based on the recapture of animals given two tags or a tag plus a flipper mark is shown in tables 6 and 7. Generally, the rate of loss among animals tagged as pups is somewhat higher than that of animals tagged at age 1 or older. The rate of tag loss is sufficient to cause significant bias in estimates of the population based on recapture if animals are marked by tagging only. Presumably, the loss of identification among animals marked with a flipper mark is insignificant.

Ancel M. Johnson

### POPULATION ESTIMATES

Estimates of several vital statistics of fur seal populations are based on mark-recapture data. Seals from several year classes have been marked at ages 0, 1, 2, and 3 years and marked animals are identified and recorded as they appear in the kill at ages 2 to 5 years. Males only are marked at age 1 or older. Estimates of abundance, age specific survival and utilization rates, and escapement have been made for those year classes for which sufficient data are available. The number of pups born in 1971 was not estimated by the shearing-sampling method. Because of the disturbance associated with this method, it will be used periodically only. For seals tagged when older than pups, the age of each seal at the time of tagging was determined from a canine tooth collected when killed. Confidence limits were not calculated for any of the estimates because of known but unmeasurable bias caused by increased mortality among marked animals associated with marking.

Table 6. --Summary of tag loss for male seals tagged as pups, tag series S through U, Pribilof Islands, Alaska

Year class and tag series	Age at recovery  Years	St. Paul Island				St. George Island			
		Tagged seals (a)	Lost-tag seals (b)	Total (a)+(b)	Incidence of tag loss (b)/[(a)+(b)]	Tagged seals (a)	Lost-tag seals (b)	Total (a)+(b)	Incidence of tag loss (b)/[(a)+(b)]
		-----Number-----				-----Number-----			
1966									
S	2	35	22	57	0.39	6	10	16	0.62
S	3	285	283	568	0.50	58	13	71	0.18
S	4	138	223	361	0.62	45	21	66	0.32
S	5	11	42	53	0.79	10	10	20	0.50
Total		469	570	1,039	0.55	119	54	173	0.31
1967									
T	2	76	19	95	0.20	9	4	13	0.31
T	3	442	216	658	0.33	65	10	75	0.13
T	4	213	150	363	0.41	60	4	64	0.06
Total		731	385	1,116	0.34	134	18	152	0.12
1968									
U	2	31	13	44	0.30	0	1	1	1.00
U	3	169	103	272	0.38	20	11	31	0.35
Total		200	116	316	0.37	20	12	32	0.38

Table 7 .--Summary of tag loss for male seals tagged at age 1 or older, Pribilof Islands, Alaska

Tag series	Time elapsed since tagging	Both tags recovered	Incidence of tag loss	
			(p) <sup>1/</sup>	
	Years	Number	Number	
2T	1	404	30	0.04
2T	2	261	51	0.09
2T	3	19	11	0.22
2T	4	5	3	0.23
Total		689	95	0.06
2U	1	332	108	0.14
2U	2	240	146	0.23
2U	3	21	17	0.29
Total		593	271	0.19
1T	1	84	7	0.04
1T	2	177	42	0.11
1T	3	80	26	0.14
1T	4	9	1	0.05
Total		350	76	
1U	1	59	12	0.09
1U	2	121	60	0.20
1U	3	20	23	0.36
Total		200	95	
1V	1	648	384	0.23
1V	2	257	263	0.34
Total		905	647	
1W	1	519	158	0.13

$$\frac{1}{p} = \frac{n_1}{2n_2 + n_1} ; \text{ where } n_1 = \text{number recovered with one tag lost;} \\ n_2 = \text{number recovered with no tag loss.}$$

Number of Seal Pups Born

Except in 1950, pups have been marked each year since 1947 in sufficient numbers to provide a basis for estimating the number born. Pups are marked in late August or September after the dead pups have been counted. Therefore, the total number of pups born is calculated by adding the count of dead pups to estimate based on mark-recapture data. Estimates of the number of pups at the time of marking based on recaptures during 1971 are shown in table 8. Estimates of the number of pups born based on total recaptures through 1971 for each year class and dead pup counts are given in table 9. The estimate of 572,000 for 1968 and 172,000 for 1969 deviate considerably from each other and from earlier estimates. The estimate for 1969, however, is based only on recoveries at age 2 and therefore is not surprising, but the unreasonably high estimate for the 1968 year class is based on a much larger number of recoveries at ages 2 and 3 and would not be expected to deviate substantially from the estimate of the 1967 year class. It is possible that mortality caused by marking was abnormally high that year, resulting in the inflated estimate. The kill through 1971 from the 1968 year class is below average, indicating low survival of the year class, and it is probable that mortality among marked animals is an increasing function of mortality of unmarked seals in the year class. The recovery of marks and the size of the kill at ages 4 and 5 from the 1968 year class will help in interpreting biological or other changes that have occurred within the herd.

Estimates based on mark recapture data are always higher than those based on shearing and sampling of live pups (table 9). Because of known sources of bias in mark-recapture estimates, we believe that shearing and sampling estimates more closely approximate the actual number of pups born.

Table 8 .--Estimates of the seal pup population, year classes 1965-69, at time of marking from recoveries in 1971 of marked male seals in ages 2 to 6, Pribilof Islands, Alaska

Year class	Age	Killed (C)	Marked (M)	Recovered (R)	Estimate of population at time of marking <sup>1/</sup> (N) <sup>2/</sup>
	Years	Number			
1965	6	271	<sup>3/</sup> 10,000	9	272,027
1965	6	271	<sup>4/</sup> 10,080	16	161,296
1965	6	271	<sup>5/</sup> 10,007	1	-
1965	6	271	<sup>6/</sup> 30,087	26	303,109
1966	5	1,805	<sup>3/</sup> 12,499	73	305,068
1966	5	1,805	<sup>7/</sup> 12,078	63	340,854
1966	5	1,805	<sup>6/</sup> 24,577	136	323,999
1967	4	15,024	<sup>3/</sup> 12,472	427	437,866
1968	3	14,340	<sup>3/</sup> 11,675	303	550,808
1969	2	355	<sup>7/</sup> 25,000	56	156,147

<sup>1/</sup> Estimates do not include counts of dead pups.

$$\sup{2/} \hat{N} = \frac{(C+1)(M+1)}{(R+1)}$$

<sup>3/</sup> Marked by tagging.

<sup>4/</sup> Marked by removing the tip of the first digit on the right hind flipper.

<sup>5/</sup> Marked by cutting a V-notch into the leading edge of the right front flipper.

<sup>6/</sup> All marked seals.

<sup>7/</sup> Seals marked by removing the tip of a hind digit.

Table 9. --Estimates of the number of seal pups born,  $\frac{1}{}$  year classes 1961-70, from mark-recaptures among males ages 2 through 5 and from shearing and sampling of live pups, Pribilof Islands, Alaska

Year class	Estimate from	Estimate from
	mark-recaptures ages 2 through 5	shearing and sampling of live pups
	<u>Number</u>	<u>Number</u>
1961	544, 000	438, 000
1962	477, 000	362, 000
1963	443, 000	343, 000
1964	421, 000	370, 000
1965	387, 000	347, 000
1966	432, 000	388, 000
1967	$\frac{2}{}$ 441, 000	--
1968	$\frac{3}{}$ 572, 000	--
1969	$\frac{4}{}$ 172, 000	304, 000
1970	--	306, 000

$\frac{1}{}$  Estimate includes counts of dead pups.

$\frac{2}{}$  Based on recoveries through age 4.

$\frac{3}{}$  Based on recoveries through age 3.

$\frac{4}{}$  Based on recoveries at age 2 only.

Abundance, Survival, and Utilization of Males  
Older Than Pups

Males older than pups have been double-tagged in late September or early October of most years since 1961. Recoveries of these marked animals in the kill at ages 2 through 5 years provide a basis for making estimates of abundance (table 10). From these estimates and the size of the kill, survival, utilization, and escapement can be calculated (table 11). Abundance is estimated from the total kill and recoveries for appropriate time periods.

Before making estimates of abundance, three difficulties must be overcome. The first two present no particular problem, but the best way to overcome the third is less obvious. A complete discussion of the procedures used was presented by the Marine Mammal Biological Laboratory (1971) and will only be summarized here. First, the ages of small males are not known at the time of tagging, therefore the distribution of tags applied by age must be calculated from the age distribution determined for marked animals after they have been killed. Secondly, the ages of several tagged males recovered each year cannot be determined because the head or flippers are separated from the body during skinning. These males are assigned ages in proportion to the age composition of animals for which ages were determined. The third difficulty is tag loss. Considerable numbers of small males given two tags lose both before recovery but are recognizable from "tag scars." We can determine ages but not tag series for these animals. To compensate for double-tag loss, we have adjusted the estimated number tagged by the factor  $(1-p^2)$ , where  $p$  is the probability of losing one tag as estimated from recoveries of animals that had been double tagged (table 7). The factor  $p^2$  is an estimate of double-tag loss, assuming that the probability of losing one or both tags is independent.

Table 10. --Number of male fur seals ages 0 to 3 years, estimated from mark-recapture data, year classes<sup>1/</sup> 1964-68, Pribilof Islands, Alaska

Age	Year class				
	1964	1965	1966	1967	1968
0 <sup>2/</sup>	210,000 185,000	194,000 174,000	216,000 194,000	220,000 ---	286,000 --
1 <sup>3/</sup>	126,000	102,000	74,000	101,000	32,000
2 <sup>3/</sup>	76,000	58,000	60,000	79,000	71,000
3 <sup>3/</sup>	--	23,000	31,000	76,000	--

<sup>1/</sup> All estimates not available for some year classes.

<sup>2/</sup> Estimated number at time of marking from table 9 divided by 2, first value from mark-recapture estimate and second estimate from shearing and sampling.

$$\hat{N}_i = \frac{M_i C_i^*}{r_i^*}; \text{ where } \hat{N}_i = \text{estimated number of males at age } i;$$

$M_i = \text{number of males effectively marked at age } i;$

$C_i^* = \text{total kill of males from year class after age } i;$

$r_i^* = \text{total number of recaptures of } M_i.$

Table 11. --Reconstruction of the male segment of the 1964-68 year classes based on estimates<sup>1/</sup> from tables 9 and 10 and the kills<sup>1/</sup> from each year class

Statistics <sup>2/</sup>	Year class				
	1964	1965	1966	1967	1968
$N_0^{3/}$	<u>210,000</u> 185,000	<u>194,000</u> 174,000	<u>216,000</u> 194,000	<u>220,000</u> --	<u>286,000</u> --
$s_1^{3/}$	0.60 0.68	0.53 0.59	0.34 0.38	0.46 --	0.11 --
$N_1$	<u>125,718</u>	<u>102,232</u>	<u>74,033</u>	<u>101,475</u>	<u>32,485</u>
$s_2$	0.63	0.59	0.84	0.81	>1
$R_2$	79,441	60,766	62,022	82,254	73,245
$C_2$	<u>3,533</u>	<u>2,940</u>	<u>2,040</u>	<u>3,051</u>	<u>1,823</u>
$U_2$	0.04	0.05	0.03	0.04	0.0
$N_2$	<u>75,908</u>	<u>57,826</u>	<u>59,982</u>	<u>79,208</u>	<u>71,422</u>
$s_3^{4/}$	0.85	0.80	0.86	0.85	--
$R_3$	64,522	46,055	51,385	67,327	--
$C_3$	<u>34,613</u>	<u>22,978</u>	<u>20,471</u>	<u>25,092</u>	--
$U_3$	0.54	0.50	0.40	0.37	--
$N_3$	29,909	<u>23,077</u>	<u>30,914</u>	<u>5/75,646</u>	--
$s_4^{4/}$	0.85	0.85	0.85	0.85	--
$R_4$	25,423	19,615	26,277	35,900	--
$C_4$	<u>16,912</u>	<u>12,769</u>	<u>13,822</u>	<u>15,020</u>	--
$U_4$	0.67	0.65	0.53	0.42	--

Footnotes at end of table.

Table 11. --Reconstruction of the male segment of the 1964-68 year classes based on estimates<sup>1/</sup> from tables 9 and 10 and the kills<sup>1/</sup> from each year class--Continued

Statistics <sup>2/</sup>	Year classes				
	1964	1965	1966	1967	1968
$N_4$	8,511	6,846	12,455	20,880	--
$s_5$ <sup>4/</sup>	0.85	0.85	0.85	0.85	--
$R_5$	7,234	5,819	10,587	17,748	--
$C_5$	2,149	1,278	1,805	--	--
$U_5$	0.30	0.22	0.17	--	--
$N_5$	5,085	4,541	8,782	--	--

1/ Estimates based on mark-recapture data or shearing and sampling, and kill figures are underlined. All other values are calculated from these values or averages.

- 2/  $N_i$  = estimated number of males age  $i$ , after kill.  
 $s_i$  = calculated survival rate from age  $i-1$  to  $i$ , excluding fishing mortality, ( $s_i = R_{i+1}/N_i$ ).  
 $R_i$  = calculated number of males in year class at beginning of year  $i$ , about 1 July, ( $R_i = N_i + C_i$ ).  
 $C_i$  = number of males age  $i$  killed from year class;  
 $C_0 = C_1 = 0$  for all year classes.  
 $U_i$  = utilization rate of males age  $i$ , ( $U_i = C_i/R_i$ ).

3/ The first value is the estimate based on mark-recapture from males age 2 through 5, the second value is based on the estimate from shearing and sampling live pups, both from table 10.

4/ Data are available to calculate values of  $s_3$  for the 1965 and 1966 year classes only. All other values of  $s_3$ ,  $s_4$ , and  $s_5$  were assumed to be 0.85.

5/ The estimated value, 75,646 is obviously too high, so the value 42,235 was used in its place,  $R_3 - C_3 = 42,235$ .

Estimates of abundance of males at ages 0 through 3 years are shown for year classes 1964-68 in table 10. The data on which the estimates are based are given in appendix table 22. Except for the number of pups born,  $N_0$ , the estimates represent the number of males in the population at the time of marking in September or early October after the kill of the year class at ages 2 and 3. Using the estimates in table 10 as a basis, the male segment of the year classes have been reconstructed as shown in table 11. Values given for the 1964, 1965, and 1966 year classes seem reasonable. Recovery data are complete for these three year classes.

The estimates at ages 0, 1, and 2 for the 1967 year class are similar to estimates for the 1964-66 year classes, but the estimate at age 3 is much too high. If the estimated number of males at age 3 for the 1967 year class is ignored--only 69 males were effectively marked--the estimates and calculated values are similar to those for the 1964-66 year classes.

As mentioned in the previous section of this report, the estimated number of pups born in 1968 based on mark-recapture is unreasonably high. The estimate for the number of yearling males is reasonable in relation to the low kill from the year class at age 3, but the estimate for age 2 is much higher. The data for the 1968 year class will not be complete until 1973, at which time it should be possible to determine which estimates are most reasonable.

If values for the 1964-66 year classes (table 11) and the annual survival rate of males in ages 6 through 9 is about 0.85, the recruitment of males at age 10 years from these year classes would be between 2,000 and 4,000 animals. The annual death rate among males 10 years and older is between 0.3 and 0.4. Recent counts of adult males on land have been about 8,000; the total population of males 10 years and older is not known but probably is in excess of 10,000. Annual recruitment needed to maintain a population of 10,000 adult males is between 3,000 and 4,000. It is likely that recruitment in excess of 4,000 males is needed to maintain the present level of the adult male population.

Ancel M. Johnson

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## GLOSSARY

The following terms used in fur seal research and management on the Pribilof Islands have special meanings or are not readily found in standard dictionaries.

Checkmark A notch, slit, hole, or other mark made on a seal flipper when a tag is applied, to ensure later recognition of an animal that has lost its tag. See mark and lost tag.

Drive The act of surrounding and moving groups of seals on land from one location to another.

Escapement Seals that were not killed because they were too old, too large, or were not available.

Flipper mark See mark.

Hauling Ground An area, usually near a rookery, on which nonbreeding seals congregate. See rookery.

Haul Out The act of seals moving from the sea to a rookery or hauling ground on shore.

Known-age Refers to a seal whose age is known because the animal bears an inscribed tag or has a certain combination of tag-scar and checkmark.

Lost-tag Refers to a seal known to have been tagged as a pup because it bears a checkmark.

Male Seals, Adult Class 1 Shoreline - Full-grown males about age 10 and older without females but apparently with established territories at the high-tide mark.

Class 2 Territorial without females - Full-grown males about age 10 and older without females but with established territories on the rookery.

Class 3 Territorial with females - Full-grown males about age 10 and older with females and established territories on the rookery.

Class 4 Back fringe - Full-grown and partly grown males about age 7 and older without females and territories that are along the inland fringe of the rookery.

Class 5 Hauling ground - Full-grown and partly grown males about age 7 and older without females that are on traditional hauling grounds.

Mark Examples of marks are the tip of a digit from a hind flipper removed, a V-notch cut into the leading edge of a front flipper near the tip, or the tip of a front flipper sliced off.

Rookery An area on which breeding seals congregate.

Round The sequence in which hauling grounds on St. Paul Island are visited to harvest seals. When used, a circuit or round of the hauling grounds is completed in 5 days and the procedure is repeated throughout the kill of males. The mean round of the kill is calculated by multiplying the round number by the number killed in that round and dividing the cumulative product by the cumulative kill.

Tagged Describes a seal having an inscribed metal tag or tags attached to one or more of its flippers.

Tag Recoveries Includes tags recovered, marked seals recovered, and seals identified from checkmarks as having lost their tags. See checkmark, marked, and lost tag.

## Part II. PELAGIC FUR SEAL INVESTIGATIONS, 1971

Ocean research on fur seals is carried out by the United States under terms of the Interim Convention on Conservation of North Pacific Fur Seals (1957) and its amending Protocol (1963). Guidelines for research are provided partly by the North Pacific Fur Seal Commission, which meets annually, and partly by the Marine Mammal Biological Laboratory. Information is gathered on the pelagic life of fur seals for the Commission and to provide information useful for managing fur seals that return each summer to the Pribilof Islands. The ecology of fur seals is a continuing study.

## RESEARCH IN 1971

Pelagic fur seal research was carried out off Washington from 8 March through 27 May 1971 (research cruise 34) from the chartered vessel M/V Tonquin.<sup>3/</sup> This report contains results developed from studies of data and specimen materials obtained during the cruise.

Equipment and methods used to collect seals, preserve specimens, and record data at sea and in the laboratory have been described by Fiscus, Baines, and Wilke (1964) and by Fiscus and Kajimura (1967). In 1971, we supplanted the counter with a beam scale, which gave us greater accuracy in weighing fetuses and other specimen materials at sea. Accuracy to one gram was obtained on specimens.

Tissue samples were taken from all fur seals collected, then used for monitoring pesticide and heavy metal levels, and for determining if organs concentrate certain chemical products or metals at differing rates. Kinds of tissues and number of samples were: fat--353, liver--353, fur--49, kidney--51, heart--5. Fetal samples were: fat--111, liver--111, brain--9, heart--5, kidney--10. The samples were cut to size, placed in polyethylene or foil-lined bags and glass jars, and frozen. The results of the analyses of these samples will be published elsewhere.

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<sup>3/</sup> Registered length 29.4 m (96.6 feet), 200 tons net, 350 horsepower, cruising speed 16.7 km per hour (9 knots).

### Distribution

In mid-March seals were found along the continental shelf and slope off Grays Harbor and Willapa Bay (fig. 10, table B-1). Seals were still abundant in this area in April and also on La Perouse Bank, 74 km west of Cape Flattery during the latter half of the month (fig. 11, table B-2). Few seals were seen offshore as we worked west to about 157 km off the Columbia River and then northward towards Grays Harbor 25-27 April.

In May, we found seals near La Perouse Bank west of Cape Flattery and southward along the continental slope (fig. 12, table B-3). The vessel traveled offshore to Cobb Seamount (517 km off Cape Shoalwater, Wash.) between 1200 on 4 May and 1800 on 6 May. A few seals were present along the continental slope between latitudes  $46^{\circ}25'$  and  $46^{\circ}33'$  N. on 4 May; 18 were seen during 28 observation hours. We collected 2 seals on the seamount 6 May and sighted 15 while operating within 30 miles of the area 7 May. Weather and sea conditions deteriorated by midafternoon of 7 May and remained poor the following day when only four seals were seen. Sea conditions improved during the night of 8 May and by the following morning as the vessel approached the continental slope off the Columbia River seals were seen with increasing frequency. Seals were numerous along the continental shelf and slope northward from the Columbia River to Grays Harbor 10-12 May. Between 21 and 27 May the vessel cruised from the Columbia River northward to La Perouse Bank and returned, crossing the continental shelf and slope. Seals were nowhere abundant; the largest number seen during this period was 15 on 23 May.

### Abundance

Although we were prepared by 1 March, a series of storms made it impossible for us to go to sea before 8 March. During March the vessel spent parts of 13 days ( $11.75 \text{ BHD}^{\frac{4}{}}$ ) at sea and 18 days stormbound in port. In April, we spent parts of 20 days ( $18.75 \text{ BHD}$ ) at sea, and in May, parts of 21 days ( $20 \text{ BHD}$ ).

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<sup>4/</sup> BHD--a boat-hunting day is a day in which a vessel is used for 8 hours or more, units of boat-hunting days are 0.25, 0.50, 0.75, and 1.00 (see tables B-4 and B-5).





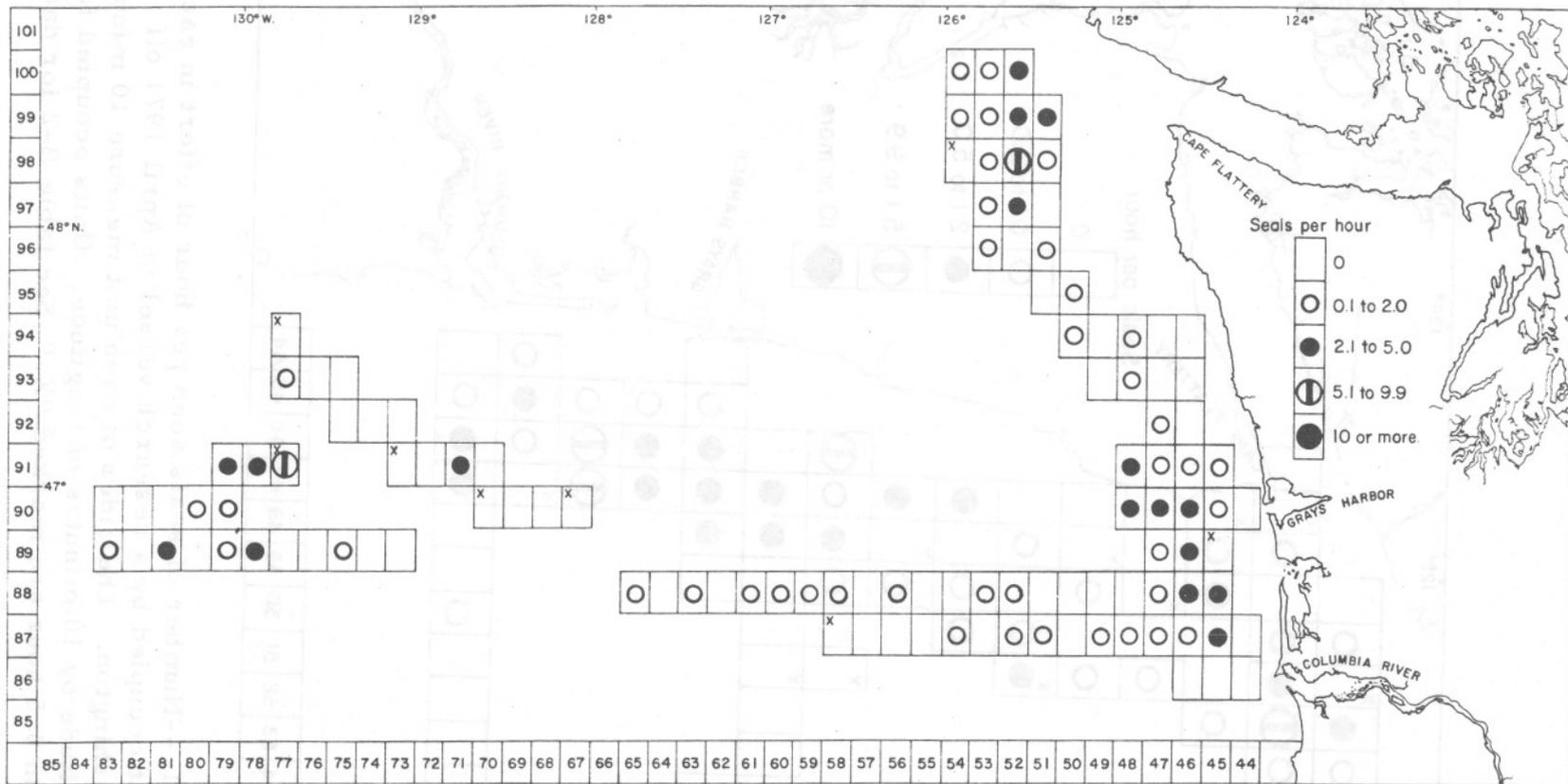


Figure 12. --Number of seals seen per hour of effort in each areal unit occupied by a research vessel in May 1971 off Washington. The sides of each unit measure 10 minutes of latitude by 10 minutes of longitude. Units occupied for less than 0.5 hour are marked "X." See table B-3 for data.

On only 2 days during the 3-month period did we sight more than 100 seals; 105 seals were seen 17 March and 117 were sighted 1 April. The average number of seals seen per boat-hunting day in 1971 was 26.2. The number and relative abundance of seals seen and collected off Washington in 1971 by 10-day periods is shown in tables B-4 and B-5. During this cruise, 1,323 seals were sighted and 353 were collected. The numbers and percentages of seals sighted, collected, and lost (wounded or killed) during pelagic research cruises since 1958 are given in tables B-6 and B-7. More wounded or dead seals escape or sink in stormy than in calm seas.

Grouping of seals sighted is shown in table B-8. The largest group seen in 1971 was 10 seals sighted 1 April 48 km west of Willapa Bay, Wah. Most sighted seals were solitary (39.9%), or in groups of two (23.9%) or three (18.4%); 17.8 percent of the sighted seals were in groups of 4 to 10.

#### Age and Sex

The ages and sex of seals collected in 1971 is given in table 12. Yearling seals of both sexes formed 11.7 percent of the total catch in 1971. In 1970, 5 percent of the total catch during approximately the same months were yearlings; this difference may be explained in part by the distribution pattern of yearling seals. Yearlings are usually found in greatest abundance on the continental shelf during winter and late spring off Washington. In 1970, we spent more time in offshore areas where yearlings are usually much less abundant.

Fifteen percent (53) of the total catch were males in ages 1 to 4 years. The younger year classes (ages 1-7) of females formed 68 percent of the catch for this sex. The oldest seal taken was a 22-year-old pregnant female.

#### Recoveries of Marked Seals

Fur seals are tagged or marked each year by the United States on the Pribilof Islands and the U. S. S. R. on the Commander, Robben, and Kuril Islands. This program is discussed in Part I, page 22 of this report.

Table 12. --Age and sex, by month, of fur seals collected pelagically by the United States off Washington, 8 March to 27 May 1971

Age Years	March				April				May				Total			
	Male		Female		Male		Female		Male		Female		Male		Female	
	No.	Percent	No.	Percent	No.	Percent	No.	Percent	No.	Percent	No.	Percent	No.	Percent	No.	Percent
1	3	23.1	2	2.4	2	18.2	8	7.2	15	51.7	11	10.6	20	37.7	21	7.1
2	5	38.4	1	1.2	3	27.3	4	3.6	9	31.0	9	8.6	17	32.1	14	4.7
3	2	15.4	6	7.3	1	9.1	16	14.5	3	10.4	17	16.3	6	11.3	39	13.1
4	3	23.1	15	18.1	5	45.4	14	12.6	2	6.9	27	26.0	10	18.9	56	18.8
5	-	-	7	8.4	-	-	9	8.1	-	-	8	7.7	-	-	24	8.1
6	-	-	8	9.7	-	-	11	9.9	-	-	7	6.7	-	-	26	8.7
7	-	-	7	8.4	-	-	11	9.9	-	-	5	4.8	-	-	23	7.7
8	-	-	7	8.4	-	-	6	5.4	-	-	2	1.9	-	-	15	5.0
9	-	-	5	6.0	-	-	3	2.7	-	-	3	2.9	-	-	11	3.7
10	-	-	5	6.0	-	-	6	5.4	-	-	7	6.7	-	-	18	6.0
11	-	-	5	6.0	-	-	1	0.9	-	-	4	3.9	-	-	10	3.4
12	-	-	7	8.4	-	-	6	5.4	-	-	3	2.9	-	-	16	5.4
13	-	-	4	4.9	-	-	4	3.6	-	-	-	-	-	-	8	2.7
14	-	-	1	1.2	-	-	2	1.8	-	-	-	-	-	-	3	1.0
15	-	-	-	-	-	-	4	3.6	-	-	-	-	-	-	4	1.3
16	-	-	2	2.4	-	-	-	-	-	-	1	1.0	-	-	3	1.0
17	-	-	-	-	-	-	2	1.8	-	-	-	-	-	-	2	0.7
18	-	-	-	-	-	-	3	2.7	-	-	-	-	-	-	3	1.0
20	-	-	-	-	-	-	1	0.9	-	-	-	-	-	-	1	0.3
22	-	-	1	1.2	-	-	-	-	-	-	-	-	-	-	1	0.3
Total	13		83		11		111		29		1/104		53		298	

1/ Plus two females taken in May from which teeth were lost and age could not be determined.

Two males, ages 1 and 4 years, and 20 females, ages 1 to 12 years, that had been tagged or marked as pups on the Pribilof or Commander Islands were taken off Washington in 1971 (table 13). Two of the females had been tagged by Soviet biologists; a yearling on Northern Rookery, Bering Island in 1970 and a 5-year-old on Southeastern Rookery, Medny Island in 1966.

Major tagging or marking programs were begun in 1958 or earlier by the U.S.S.R. and the United States to facilitate studies of the populations on their breeding grounds and at sea along migration routes. The following paragraphs summarize known Soviet tag recoveries in the eastern North Pacific Ocean.

Fur seal pups were first tagged by the U.S.S.R. in 1957. The first known Soviet tag recovered on the Pribilof Islands was taken from a female seal 16 August 1958 at Northeast Point Rookery, St. Paul Island, Alaska.<sup>5/</sup> Several fur seals tagged on the Commander Islands are now taken each year on the Pribilof Islands and seals tagged on Robben Island are occasionally recovered there. Pribilof-tagged seals are regularly taken on the Commander Islands and a few have been seen or taken on the Kuril Islands and on Robben Island, and by research vessels in the western North Pacific Ocean off Japan (North Pacific Fur Seal Commission, 1965; 1969).<sup>6 7 8/</sup>

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<sup>5/</sup> Abegglen, Carl E., Alton Y. Roppel, and Ford Wilke. Alaska fur seal investigations, Pribilof Islands, Alaska, report of field activities, June-September 1958. Marine Mammal Biological Laboratory, Seattle, Wash. Processed report, 187 pp.

<sup>6/</sup> Japanese Fisheries Agency. Japanese pelagic investigations on fur seals. Annual reports for 1967-70.

<sup>7/</sup> Arseniev, V. A. Report on U.S.S.R. fur seal investigations. All Union Research Institute of Marine Fisheries and Oceanography (VNIRO), Moscow. Annual reports for 1967-70.

<sup>8/</sup> North Pacific Fur Seal Commission. Report on investigations in 1962-63. [In press.]

Table 13. --Tag recoveries from fur seals collected pelagically by the United States off Washington, 8 March to 27 May 1971

[Figures in parentheses indicate number of animals that had lost tags; they are included in the totals]

Age	Year of tagging	Tag series	Seals tagged or marked	Tag recovery		Seals collected in each age group <sup>1/</sup>	
				♂	♀	♂	♀
Years			Number	--Number--		---Number----	
1	1970	<sup>2/</sup> Marked	25,030	1	<sup>3/</sup> 1	20	21
2	1969	<sup>2/</sup> Marked	25,000	-	1	17	14
3	1968	U	11,675	-	2	6	39
4	1967	T	12,472	1	1	10	56
5	1966	S	24,580	-	<sup>4/</sup> 2	-	24
6	1965	R	30,087	-	6(1)	-	26
7	1964	Q	24,991	-	4(2)	-	23
10	1961	N	49,921	-	2(1)	-	18
12	1959	L	49,881	-	1(1)	-	16

<sup>1/</sup> Table does not include seals born in years when seals were not tagged or marked, nor year classes from which no tagged or marked seals were taken.

<sup>2/</sup> See table A-17, Seal pups tagged and marked, Pribilof Islands, Alaska, 1962-71.

<sup>3/</sup> Seal tagged by U. S. S. R. on Bering Island, Northern Rookery (CB1628).

<sup>4/</sup> One tagged by U. S. S. R. on Medny Island, Southeastern Rookery (Y27779).

The first Soviet-tagged seal recovered at sea was taken by U.S. biologists in Unimak Pass in 1962 (Fiscus, Baines, and Wilke, 1964). The first Soviet-tagged seal reported from the eastern North Pacific Ocean south of the Aleutian Islands was found dead 7 May 1964 on Vancouver Island.<sup>9/</sup> Since 1964, 19 seals tagged on the Commander Islands are known to have been seen (on San Miguel Island), stranded, or taken along the west coast of the United States from San Miguel Island, Calif., northward to Southeastern Alaska (U.S. and Canadian research vessel reports, strandings, and observations). Tagged females ranged in age from 1 to 11 years and males from 1 to 2.

The San Miguel Island recoveries are particularly interesting because the island is near the southern limit of winter fur seal distribution in the eastern North Pacific Ocean. A small fur seal colony was discovered on San Miguel Island 21 July 1968 (Peterson and LeBoeuf, 1969). One of the fur seals ashore that day was a female that had been tagged 8 years before on Bering Island in 1960. This seal was seen there again on 11 August and 22 July 1971 (R. L. DeLong, graduate student, Univ. of Calif., Berkeley, pers. comm. 1971). Another female seal (6-year-old) that had been tagged on Medny Island in 1965 was seen on San Miguel Island 29 October 1971 (R. L. DeLong, pers. comm.).

Seals tagged on Robben or the Kuril Islands are yet to be recovered off the west coast of the United States.

#### Lengths and Weights

Mean lengths and weights are given in tables B-9 to B-12 for pregnant and nonpregnant females collected during 1971, and in tables B-13 and B-14 for males. Mean lengths and weights of male and female fetuses taken during 1971 are shown by 10-day periods in table B-15.

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<sup>9/</sup> Pike, G. C., I. B. MacAskie, and A. Craig. Report on Canadian pelagic fur seal research in 1965. Fisheries Research Board of Canada, Nanaimo, B. C. Processed report.

### Reproduction

The youngest pregnant females collected were six primiparous 5-year-old seals (compared with a 4-year-old taken in 1969). The oldest pregnant female was age 22 years and the oldest nonpregnant females were two 17-year-old seals. According to the condition of their uterine horns and the presence of resorbing corpora lutea, three females had aborted. One of these females was 10 years old and primiparous.

Most mature females ovulate each year. Missed pregnancies occur when the egg is not fertilized or fails to implant after conception. Resorbing corpora lutea indicated that 46 percent of the nonpregnant female seals in ages 5 to 22 years had missed pregnancies in 1971. The missed pregnancy rate among females collected in this area, though similar for 1969 and 1971, was lower in 1970. Apparent fluctuations may be caused in part by small sample sizes. Table B-16 shows the reproductive condition by month of female seals taken during 1971.

Table B-17 gives the pregnancy rates of females age 3 and older collected in 1971, and table 14 gives the rates of all females age 3 or older collected pelagically in the eastern North Pacific Ocean by the United States since 1958. Rates for 5-year-old seals collected in 1971 were lower (25.0%) than those of females taken in 1969 (34.8%) and 1970 (35.1%). The percentage of pregnant females in combined age classes (6-26 years), however, had increased from 69.7 percent in 1969 and 70.6 percent in 1970 to 76.4 percent in 1971. Seals obtained during each of these years were taken from the same area, however, times of collection differed. In 1969, the seals were taken in February and March, in 1970 from March through early June, and in 1971 from March through May.

#### Uterine Horn of Conception and Fetal Sex Ratio

The fur seal's first conception seems to occur randomly in either side of its bicornuate uterus, then alternately between horns thereafter. Fifty-one percent of 116 pregnant seals taken in 1971 and of 6, 124 pregnant and post-parturient females taken since 1958 had conceived in the left uterine horn.

The fetal sex ratio in fur seals is about equal. We have examined 5, 373 fetuses since 1958, of which 49 percent were males and 51 percent females. In 1971, 47 percent (55) of 116 fetuses were males and 53 percent (61) were females.

Table 14. --Number of female seals collected pelagically by the United States in the eastern Pacific Ocean and (in parentheses) percentage pregnant, 1958-71

Age Years	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1958-71 combined
	Number														
3	39 (2.6)	43 (0.0)	18 (0.0)	84 (0.0)	93 (1.1)	53 (0.0)	74 (0.0)	51 (0.0)	30 (0.0)	10 (0.0)	35 (0.0)	19 (0.0)	62 (0.0)	39 (0.0)	650 (0.3)
4	42 (2.4)	93 (6.4)	36 (2.8)	96 (1.0)	140 (2.9)	113 (7.1)	62 (1.6)	73 (0.0)	68 (1.5)	9 (0.0)	95 (5.3)	32 (3.1)	66 (0.0)	56 (0.0)	981 (3.0)
5	70 (45.7)	114 (56.1)	55 (49.1)	68 (20.6)	123 (26.0)	162 (43.8)	84 (35.7)	23 (26.1)	66 (27.3)	9 (44.4)	37 (37.8)	23 (34.8)	37 (35.1)	24 (25.0)	895 (37.9)
6	99 (80.8)	118 (77.1)	45 (80.0)	62 (75.8)	72 (54.2)	90 (74.4)	81 (75.3)	37 (56.8)	35 (71.4)	20 (60.0)	47 (76.6)	23 (56.5)	41 (63.4)	26 (69.2)	796 (71.9)
7	103 (89.3)	143 (76.2)	66 (78.8)	95 (75.8)	93 (84.9)	77 (88.3)	44 (77.3)	24 (79.2)	46 (78.3)	7 (71.4)	69 (72.5)	27 (63.0)	19 (84.2)	23 (87.0)	836 (80.0)
8	102 (89.2)	164 (86.6)	105 (85.7)	107 (79.4)	98 (89.8)	87 (97.7)	46 (84.8)	33 (84.8)	43 (79.1)	7 (85.7)	38 (78.9)	22 (72.7)	23 (82.6)	15 (80.0)	890 (85.8)
9	81 (96.3)	108 (88.9)	144 (92.4)	114 (93.9)	73 (83.6)	60 (85.0)	30 (83.3)	17 (70.6)	20 (100.0)	12 (100.0)	40 (82.5)	5 (100.0)	22 (77.3)	11 (54.5)	737 (89.2)
10	97 (87.6)	96 (85.4)	129 (91.5)	112 (93.8)	100 (89.0)	72 (93.1)	49 (87.8)	10 (90.0)	13 (84.6)	11 (90.9)	40 (77.5)	21 (81.0)	13 (61.5)	18 (77.8)	781 (88.2)
11	113 (92.0)	98 (89.8)	136 (91.2)	82 (89.0)	91 (89.0)	88 (94.3)	42 (85.7)	18 (83.3)	23 (78.3)	4 (100.0)	39 (76.9)	26 (73.1)	14 (78.6)	10 (80.0)	784 (88.5)
12	134 (82.0)	76 (88.2)	106 (90.6)	71 (93.0)	97 (89.7)	92 (92.4)	51 (84.3)	15 (73.3)	16 (100.0)	3 (66.7)	40 (90.0)	24 (83.3)	13 (69.2)	16 (81.2)	754 (87.7)
13	110 (82.7)	56 (89.3)	120 (87.5)	76 (82.9)	58 (94.8)	76 (90.8)	33 (84.8)	8 (100.0)	12 (100.0)	3 (100.0)	24 (83.3)	11 (36.4)	14 (64.3)	8 (100.0)	609 (86.2)
14	92 (81.5)	70 (84.3)	107 (80.4)	67 (92.5)	65 (87.7)	57 (80.7)	38 (76.3)	10 (80.0)	14 (85.7)	1 (100.0)	26 (80.8)	7 (71.4)	1 (100.0)	3 (66.7)	558 (83.2)
15	71 (78.9)	87 (88.5)	67 (83.6)	68 (79.4)	53 (81.1)	75 (85.3)	41 (65.9)	14 (78.6)	15 (93.3)	3 (66.7)	30 (86.7)	4 (100.0)	5 (100.0)	4 (50.0)	537 (82.1)
16	56 (78.6)	69 (75.4)	53 (71.7)	55 (85.5)	50 (82.0)	45 (82.2)	22 (72.7)	12 (83.3)	5 (80.0)	6 (100.0)	26 (96.2)	5 (60.0)	3 (100.0)	3 (66.7)	410 (80.0)
17	36 (56.6)	36 (80.6)	46 (67.4)	24 (62.5)	44 (72.7)	28 (71.4)	21 (61.9)	10 (80.0)	5 (40.0)	2 (0.0)	21 (81.0)	7 (57.1)	-	2 (0.0)	282 (67.7)
18	22 (59.1)	27 (85.2)	23 (82.6)	25 (64.0)	25 (72.0)	12 (58.3)	20 (60.0)	8 (37.5)	-	-	11 (72.7)	4 (75.0)	6 (16.7)	3 (100.0)	186 (67.7)
19	14 (28.6)	16 (81.3)	19 (57.9)	10 (50.0)	15 (60.0)	5 (60.0)	7 (57.1)	2 (0.0)	3 (33.3)	-	10 (60.0)	2 (50.0)	2 (0.0)	-	105 (54.3)
20	3 (33.3)	5 (40.0)	6 (16.7)	7 (100.0)	11 (72.7)	11 (45.5)	10 (20.0)	2 (0.0)	1 (0.0)	1 (0.0)	7 (71.4)	-	-	1 (100.0)	65 (49.2)
21	1 (100.0)	7 (85.7)	6 (50.0)	2 (50.0)	3 (100.0)	4 (50.0)	-	1 (0.0)	1 (0.0)	-	3 (33.3)	-	1 (0.0)	-	29 (58.6)
22	1 (0.0)	5 (40.0)	-	-	3 (66.7)	-	-	-	-	1 (0.0)	3 (0.0)	-	-	1 (100.0)	14 (35.7)
23	-	1 (0.0)	1 (0.0)	1 (0.0)	-	2 (0.0)	1 (100.0)	1 (0.0)	-	-	1 (0.0)	-	-	-	8 (12.5)
24	-	1 (0.0)	1 (0.0)	1 (0.0)	1 (0.0)	-	-	-	-	-	-	-	-	-	4 (0.0)
26	-	1 (0.0)	-	-	-	-	-	-	-	-	-	-	-	-	1 (0.0)
Total	1,286 (76.1)	1,434 (73.8)	1,289 (79.7)	1,227 (68.5)	1,308 (63.4)	1,209 (69.3)	756 (58.7)	369 (45.8)	416 (52.3)	109 (61.5)	642 (61.4)	262 (53.4)	342 (40.4)	263 (44.1)	10,912 (66.6)
6-26 years	1,135 (83.3)	1,184 (83.4)	1,180 (84.4)	979 (84.3)	952 (83.2)	881 (86.0)	536 (77.0)	222 (73.4)	252 (81.3)	81 (77.8)	475 (78.9)	188 (69.7)	177 (70.6)	144 (76.4)	8,386 (82.2)

### Feeding Habits

Our examinations of the contents of over 2,400 stomachs of fur seals taken off Washington since 1958 reveal that these animals consume a wide variety of fishes and cephalopods.

Of 353 seals collected off Washington from 8 March to 27 May 1971, 204 stomachs (58%) contained food and 149 (42%) were empty (table 15). Five food species contributed 91 percent of the total food volume (fig. 13). Northern anchovy, Engraulis mordax, was the leading food species, contributing 32 percent of the total volume; followed in order by Salmonidae (coho, sockeye, and chinook salmon) (24%); Pacific hake, Merluccius productus (15%); capelin, Mallotus villosus (11%); and Pacific herring, Clupea harengus pallasii (9%). The locations where principal food species were found in stomachs of fur seals taken off Washington in 1971 are shown in figures 14 to 19.

### Relation of Food of Fur Seals to Commercial Fisheries

Salmon, Oncorhynchus spp., were the most valuable commercial fish eaten by fur seals collected off Washington in 1971. Salmon (40 occurrences) were second only to 64 occurrences of northern anchovy. Coho salmon, O. kisutch; sockeye, O. nerka; and chinook, O. tshawytscha, were identified from scales.<sup>10/</sup> Scales indicated that most salmon were immature, showing freshwater growth only. One salmon had spent a year in the ocean.

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<sup>10/</sup> Salmon scales were identified and ages determined by Kenneth H. Mosher, Northwest Fisheries Center, National Marine Fisheries Service, Seattle, Wash.

Table 15. --Stomach contents of fur seals collected pelagically  
by the United States off Washington, 8 March to  
27 May 1971<sup>1/</sup>

Food	Spring		Frequency Number
	March-May		
	Volume Cc.	Percent	
Fish			
<u>Lampetra tridentata</u>	135	0.3	3
Clupeidae	T	0.0	7
<u>Alosa sapidissima</u>	63	0.1	5
<u>Clupea harengus pallasii</u>	4,844	9.2	25
<u>Engraulis mordax</u>	16,685	31.8	64
Salmonidae	12,389	23.6	40
Osmeridae	70	0.1	3
<u>Mallotus villosus</u>	5,979	11.4	33
<u>Thaleichthys pacificus</u>	81	0.1	4
Myctophidae	T	0.0	1
Gadidae	T	0.0	5
<u>Merluccius productus</u>	7,708	14.7	15
<u>Sebastes</u> spp.	2,297	4.4	9
Unidentified	783	1.5	46
Squid			
<u>Loligo opalescens</u>	246	0.5	38
<u>Onychoteuthis</u> sp.	258	0.5	15
<u>Abraliopsis</u> sp.	T	0.0	1
Gonatidae	269	0.5	37
<u>Gonatus</u> sp.	T	0.0	16
<u>Gonatopsis borealis</u>	362	0.7	5
<u>Chiroteuthis veranyi</u>	T	0.0	5
Unidentified	T	0.0	1
Bird	321	0.6	2
Pebbles	T	0.0	1
Organic material	T	0.0	1
Isopoda	T	0.0	1
Crustacea	T	0.0	2
Gastropoda	T	0.0	1
Total	52,490		
Stomachs with food	204		
Stomachs empty	149		

<sup>1/</sup> T=trace ( $\leq 5$  cc.). Trace counts are included in frequency counts.

Table 13.--Stomach contents of fur seals collected biologically by the United States off Washington, 8 March to 17 May 1971.

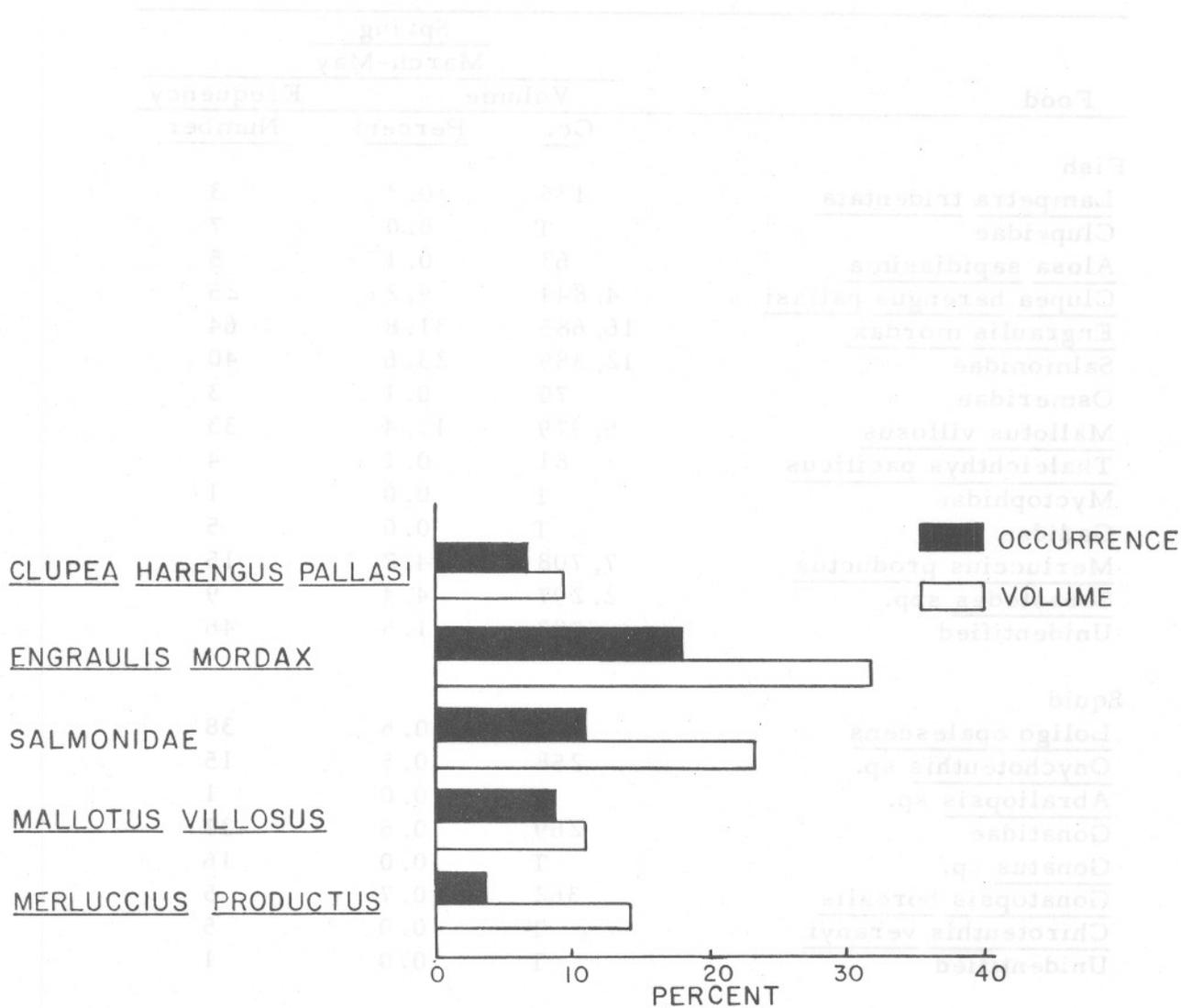


Figure 13.--Percentage of stomach content volume and percentage occurrence of principal food species in fur seal stomachs collected off Washington in 1971.

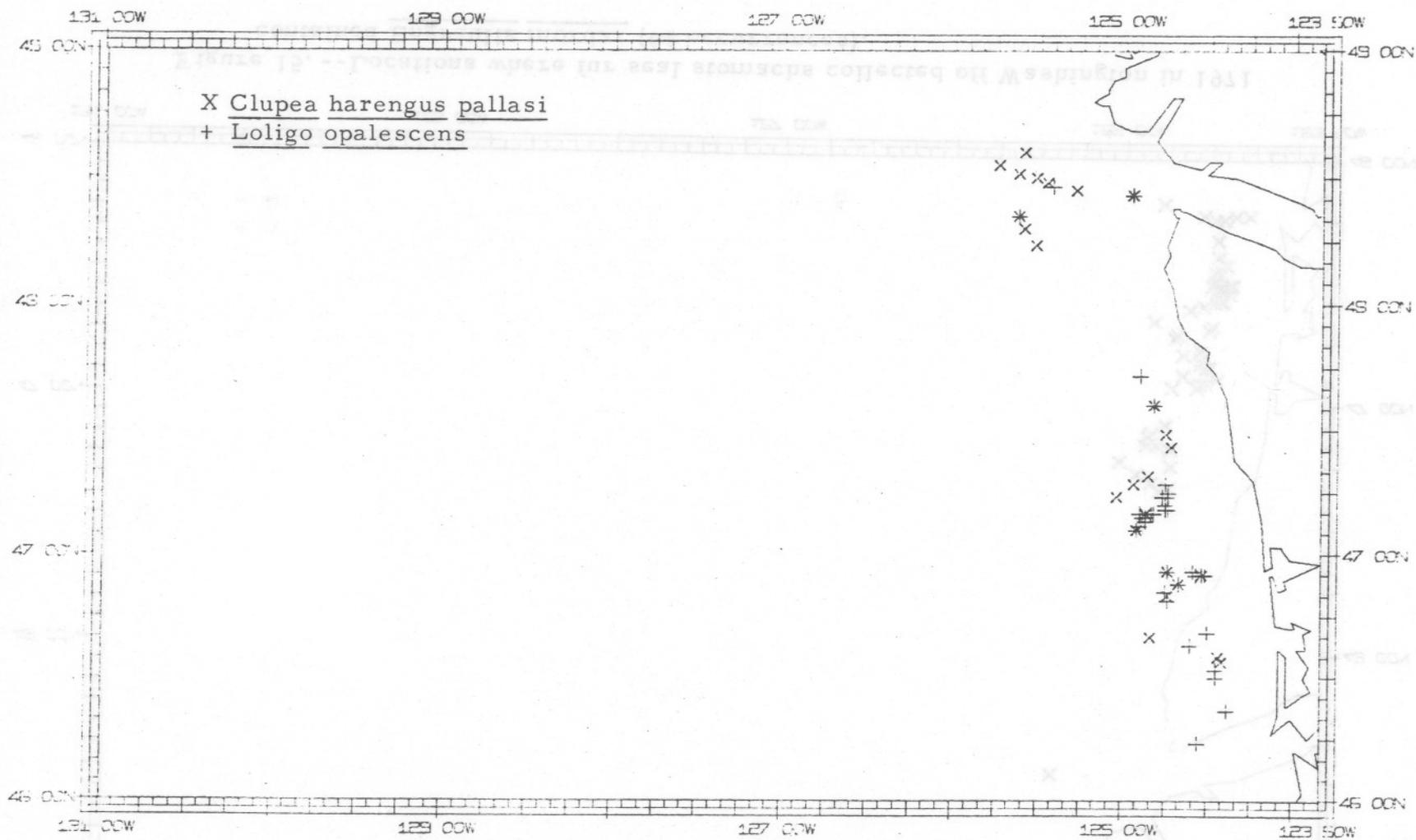


Figure 14. --Locations where fur seal stomachs collected off Washington in 1971 contained Clupea harengus pallasii (25 occurrences) and Loligo opalescens (38 occurrences).

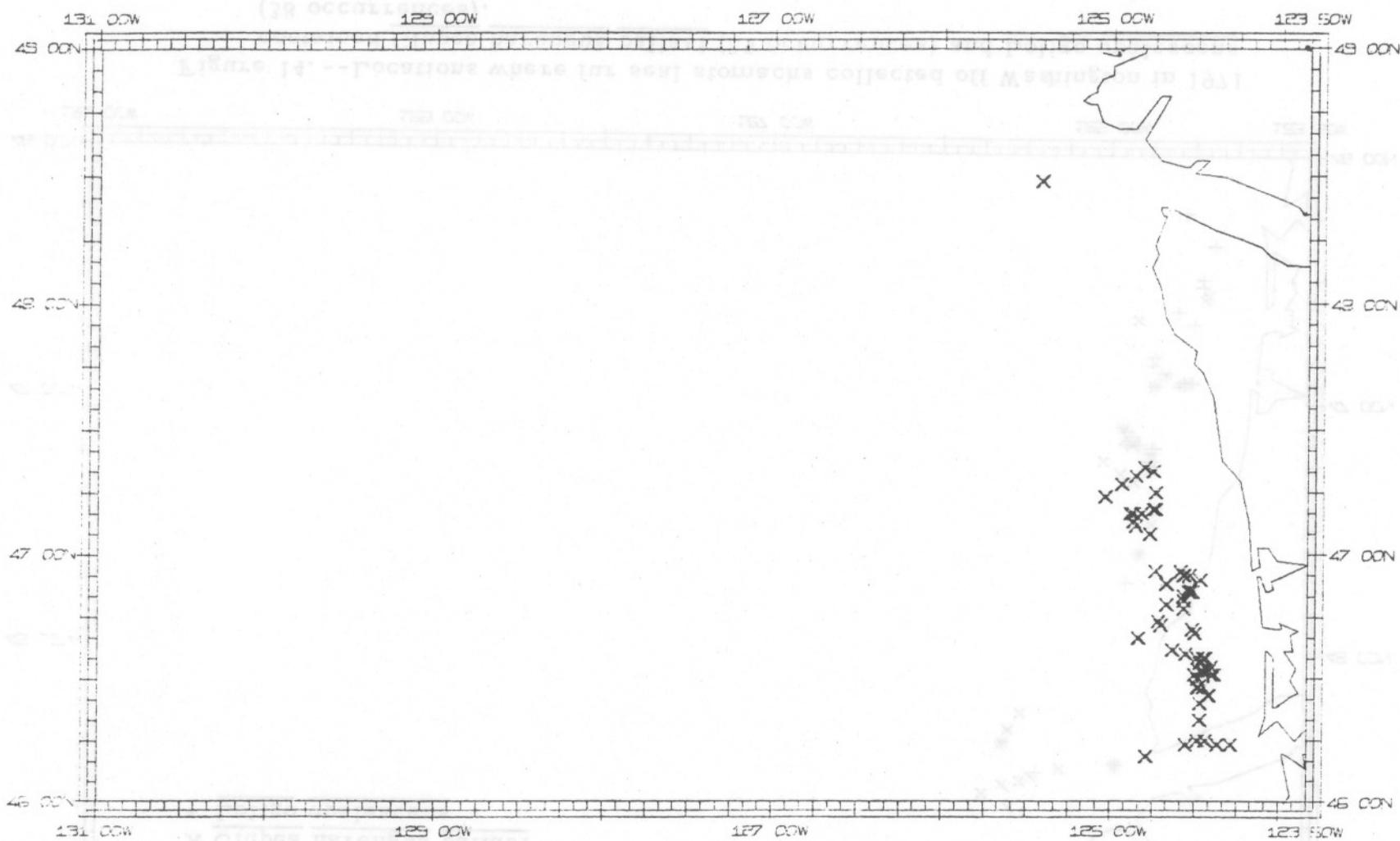


Figure 15. --Locations where fur seal stomachs collected off Washington in 1971 contained Engraulis mordax (64 occurrences).

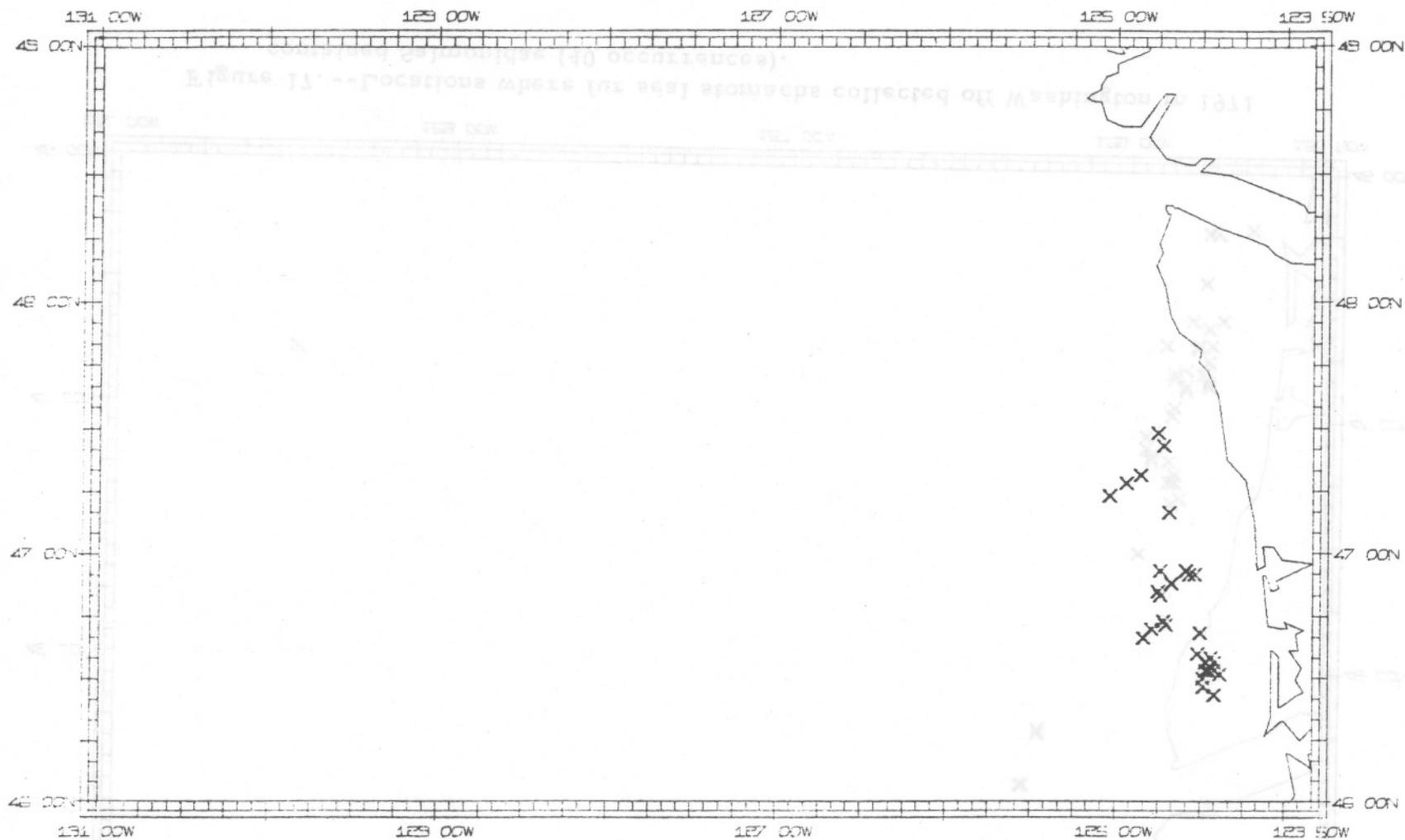


Figure 16.--Locations where fur seal stomachs collected off Washington in 1971 contained Mallotus villosus (33 occurrences).

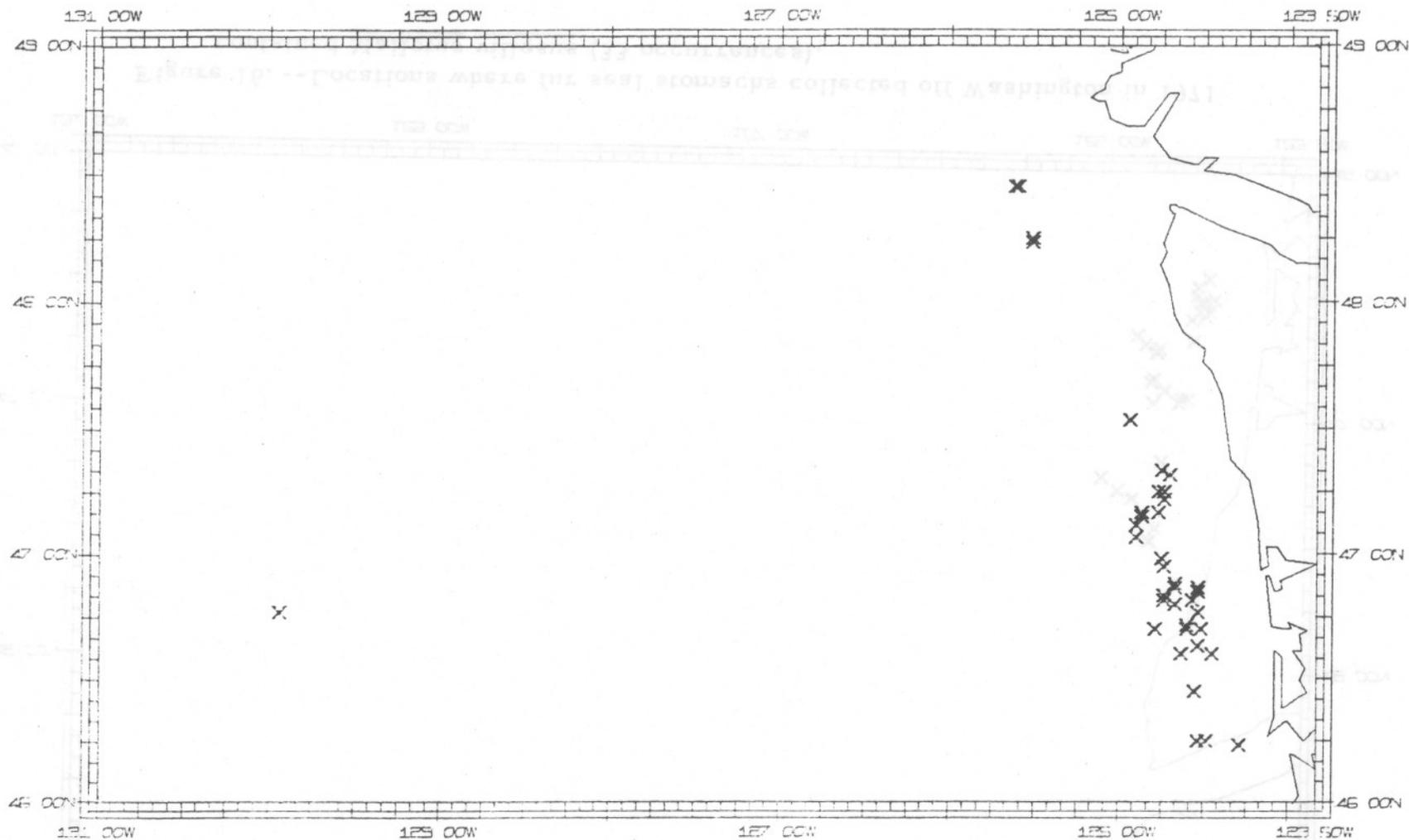


Figure 17. --Locations where fur seal stomachs collected off Washington in 1971 contained Salmonidae (40 occurrences).

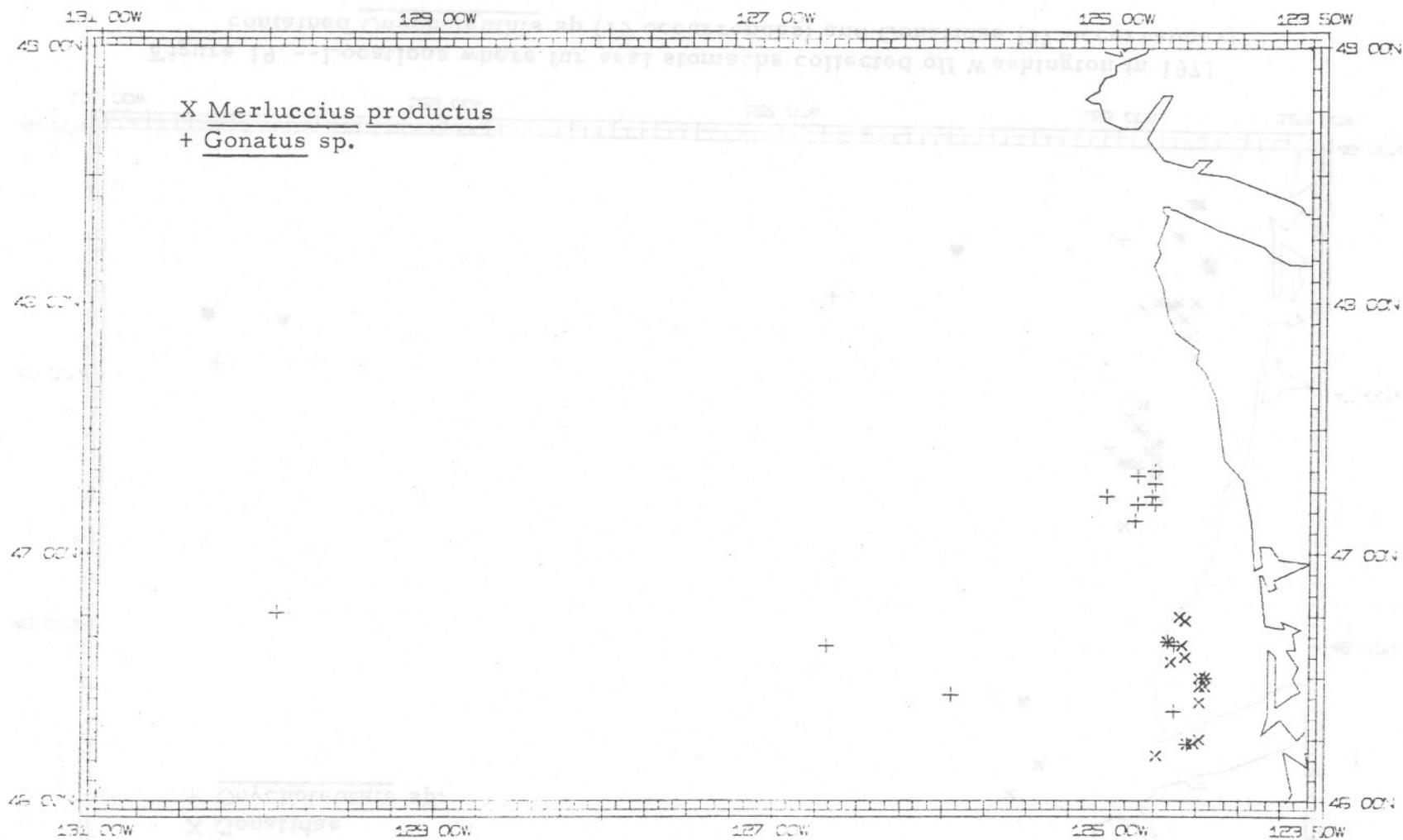
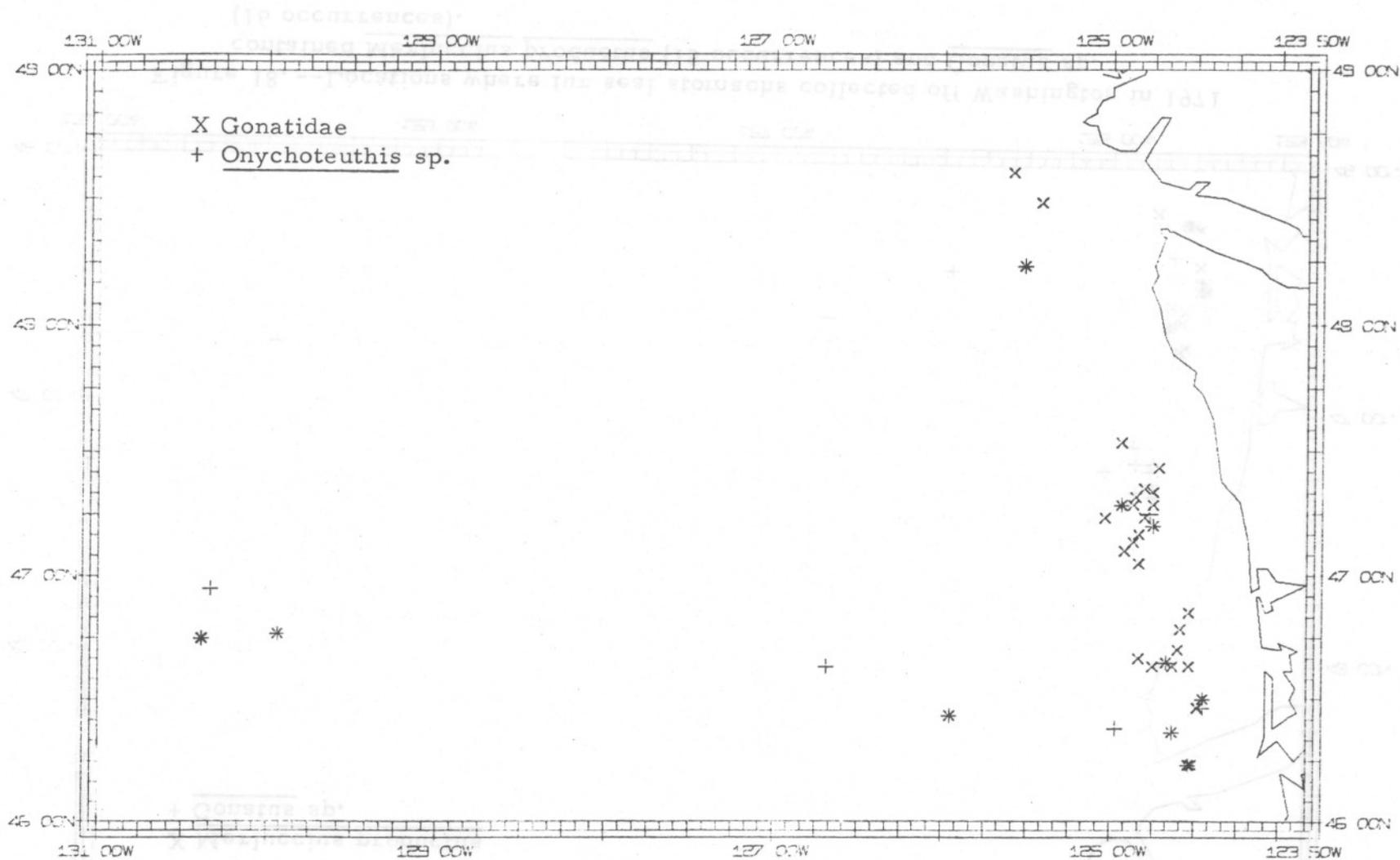


Figure 18. --Locations where fur seal stomachs collected off Washington in 1971 contained Merluccius productus (15 occurrences) and Gonatus sp. (16 occurrences).



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Table A-2. --Cumulative age classification of male seals killed on St. Paul Island, 23 June to 31 July 1971

Date	Rookery <sup>1/</sup>	Estimated seals killed from each age group					Total kill	Seals killed from each age group				
		2	3	4	5	6		2	3	4	5	6
		-----Number-----					-----Percent-----					
June												
23	REEF	-	25	198	56	5	284	-	9	69	20	2
23	POL	-	25	250	77	5	357	-	7	70	22	1
24	NEP(west)	-	37	292	101	5	435	-	9	67	23	1
24	NEP(east)	-	48	408	129	11	596	-	8	68	22	2
25	ZAP	-	118	569	231	21	939	-	12	61	25	2
26	REEF	-	173	792	321	39	1,325	-	13	60	24	3
26	TZR	-	206	959	421	50	1,636	-	12	59	26	3
26	L-K	-	224	1,008	463	50	1,745	-	13	58	26	3
28	NEP(west)	-	242	1,151	505	50	1,948	-	12	59	26	3
28	NEP(east)	-	267	1,296	537	50	2,150	-	13	60	25	2
29	ZAP	-	414	1,564	621	61	2,660	-	16	59	23	2
29	TZR	-	425	1,595	652	61	2,733	-	16	58	24	2
29	POL	-	450	1,681	708	92	2,931	-	16	57	24	3
30	REEF	-	584	2,035	769	102	3,490	-	17	58	22	3
30	L-K	-	589	2,070	774	107	3,540	-	17	58	22	3
30	TZR	-	589	2,106	774	107	3,576	-	16	59	22	3
July												
1	NEP(west)	-	606	2,144	774	107	3,631	-	17	59	21	3
1	NEP(east)	-	644	2,343	780	113	3,880	-	17	60	20	3
2	ZAP	-	731	2,616	856	125	4,328	-	17	60	20	3
3	POL	-	752	2,738	893	130	4,513	-	16	61	20	3
3	TZR	-	758	2,797	905	130	4,590	-	16	61	20	3
3	L-K	-	784	2,831	905	130	4,650	-	17	61	19	3
6	REEF	-	851	2,903	921	130	4,805	-	18	60	19	3
7	ZAP	-	1,020	3,077	932	130	5,159	-	20	60	18	2
8	NEP(west)	-	1,090	3,210	932	130	5,362	-	21	60	17	2
8	NEP(east)	-	1,225	3,524	949	130	5,828	-	21	61	16	2
9	POL	-	1,260	3,677	961	130	6,028	-	21	61	16	2
9	TZR	-	1,467	3,871	967	130	6,435	-	23	60	15	2
9	L-K	-	1,477	3,916	972	130	6,495	-	23	60	15	2
10	REEF	6	1,980	4,384	983	136	7,489	-	26	59	13	2
12	ZAP	6	2,205	4,690	1,009	136	8,046	-	27	58	13	2
13	NEP(west)	6	2,343	4,794	1,019	136	8,298	-	28	58	12	2
13	NEP(east)	11	2,558	5,087	1,024	136	8,816	-	29	58	12	1
14	REEF	21	3,047	5,542	1,030	136	9,776	-	31	57	11	1
15	POL	21	3,109	5,764	1,036	136	10,066	-	31	57	10	2
15	TZR	21	3,242	5,966	1,047	141	10,417	-	31	57	10	2
15	L-K	21	3,393	6,111	1,064	141	10,730	-	32	57	10	1
16	ZAP	26	3,985	6,800	1,075	180	12,066	-	33	56	9	2
17	NEP(west)	26	4,069	6,867	1,080	180	12,222	-	33	56	9	2
17	NEP(east)	31	4,378	7,176	1,091	180	12,856	-	34	56	9	1
19	REEF	38	4,870	7,517	1,109	180	13,714	-	36	55	8	1
20	POL	38	5,109	7,823	1,114	180	14,264	-	36	55	8	1
20	TZR	42	5,247	7,961	1,127	180	14,557	-	36	55	8	1
20	L-K	42	5,399	8,130	1,132	180	14,883	-	36	55	8	1
21	ZAP	53	5,717	8,338	1,143	180	15,431	-	37	54	8	1
22	NEP(west)	61	5,936	8,466	1,143	180	15,786	-	38	54	7	1
22	NEP(east)	81	6,101	8,590	1,147	180	16,099	1	38	53	7	1
23	REEF	93	6,487	8,916	1,167	185	16,848	1	38	53	7	1
23	TZR	93	6,655	9,028	1,175	185	17,136	-	39	53	7	1
24	POL	93	6,808	9,213	1,187	185	17,486	-	39	53	7	1
24	TZR	97	6,905	9,266	1,187	185	17,640	1	39	52	7	1
24	L-K	101	7,001	9,333	1,195	185	17,815	1	39	52	7	1
26	ZAP	157	8,772	10,124	1,227	190	20,470	1	43	49	6	1
27	NEP(west)	179	8,990	10,305	1,238	190	20,902	1	43	49	6	1
27	NEP(east)	204	9,435	10,626	1,271	190	21,726	1	43	49	6	1
28	REEF	225	10,242	11,042	1,288	190	22,987	1	44	48	6	1
28	TZR	231	10,427	11,148	1,288	190	23,284	1	45	48	5	1
29	POL	231	10,708	11,417	1,294	190	23,840	1	45	48	5	1
29	TZR	257	11,028	11,577	1,294	190	24,346	1	45	48	5	1
29	L-K	277	11,245	11,808	1,301	190	24,821	1	45	48	5	1
30	ZAP	289	12,004	12,042	1,326	190	25,851	1	46	47	5	1
30	TZR	298	12,249	12,226	1,326	190	26,289	1	47	46	5	1
31	NEP(west)	323	12,750	12,437	1,333	190	27,033	1	47	46	5	1
31	NEP(east)	323	12,888	12,503	1,338	190	27,242	1	47	46	5	1

<sup>1/</sup> NEP(east)=east or Morjovi side of Northeast Point; NEP(west)=west or Vostochni side of Northeast Point; TZR=Tolstoi, Zapadni Reef, and Little Zapadni; POL=Polovina and Little Polovina; ZAP=Zapadni; REEF=Reef, Gorbach, and Ardiguen; L-K=Lukanin and Kitovi.

Table A-3 ---Age classification of male seals killed on St. George Island, 23 June to 30 July 1971

Date	Rookery <sup>1/</sup>	Males killed Number	Tooth sample Number	Seals in each age group of sample					Estimated seals killed from each age group									
				2	3	4	5	6	2	3	4	5	6					
				Percent					Number									
June																		
23	NOR	125	36	-	-	47.2	38.9	13.9	-	-	59	49	17					
23	EAST	98	32	-	9.4	71.9	15.6	3.1	-	9	71	15	3					
25	ZAP	199	39	-	10.3	53.8	33.3	2.6	-	21	107	66	5					
28	NOR	72	14	-	14.3	78.5	7.2	-	-	10	57	5	-					
28	EAST	93	20	-	30.0	50.0	15.0	5.0	-	28	46	14	5					
30	NOR	117	24	-	41.7	50.0	8.3	-	-	49	58	10	-					
30	ZAP	45	11	-	9.1	36.4	54.5	-	-	4	16	25	-					
July																		
2	EAST	101	20	-	25.0	60.0	15.0	-	-	25	61	15	-					
2	ZAP	18	4	-	50.0	50.0	-	-	-	9	9	-	-					
6	NOR	150	28	-	25.0	60.7	14.3	-	-	37	91	22	-					
6	EAST	58	10	-	-	70.0	20.0	10.0	-	-	41	12	5					
7	ZAP	96	19	-	26.0	74.0	-	-	-	25	71	-	-					
7	STAR	47	9	-	11.0	67.0	22.0	-	-	5	32	10	-					
9	EAST	50	10	-	10.0	80.0	10.0	-	-	5	40	5	-					
9	NOR	129	26	-	42.3	57.7	-	-	-	55	74	-	-					
12	NOR	211	36	-	27.8	61.1	11.1	-	-	59	129	23	-					
12	ZAP	65	13	-	23.1	76.9	-	-	-	15	50	-	-					
12	STAR	31	6	-	33.0	33.0	17.0	17.0	-	11	10	5	5					
14	EAST	135	27	-	29.6	63.0	7.4	-	-	40	85	10	-					
14	NOR	122	24	-	16.7	75.0	8.3	-	-	20	92	10	-					
16	EAST	85	17	-	17.7	58.8	23.5	-	-	15	50	20	-					
16	NOR	107	20	5.0	35.0	55.0	5.0	-	5	38	59	5	-					
19	ZAP	52	11	-	9.1	81.8	9.1	-	-	5	42	5	-					
19	STAR	49	10	10.0	50.0	30.0	10.0	-	5	24	15	5	-					
19	NOR	141	31	-	29.0	64.5	6.5	-	-	41	91	9	-					
21	EAST	28	6	-	16.7	66.6	16.7	-	-	5	18	5	-					
21	NOR	147	29	-	62.1	34.5	3.4	-	-	92	50	5	-					
23	ZAP	111	22	4.6	40.9	31.8	22.7	-	5	46	35	25	-					
23	STAR	75	15	-	40.0	60.0	-	-	-	30	45	-	-					
23	NOR	297	62	1.0	37.0	59.0	3.0	-	3	109	176	9	-					
26	EAST	387	77	-	49.3	50.7	-	-	-	190	197	-	-					
26	NOR	372	75	-	41.2	52.0	-	6.8	-	153	193	-	26					
28	ZAP	119	22	-	45.5	54.5	-	-	-	54	65	-	-					
28	STAR	122	23	-	39.1	52.2	8.7	-	-	11	48	63	-					
28	NOR	103	21	-	23.8	66.7	9.5	-	-	24	69	10	-					
28	EAST	119	25	8.0	44.0	40.0	4.0	4.0	9	52	48	5	5					
30	EAST	19	18	-	37.8	62.2	-	-	-	7	12	-	-					
30	NOR	110	22	4.5	45.5	36.4	4.5	9.1	5	50	40	5	10					
30	ZAP	148	25	-	56.0	44.0	-	-	-	83	65	-	-					
Season total		4,553	939						32	1,456	2,517	467	81					

<sup>1/</sup> ZAP=Zapadni and South; EAST=East Reef and East Cliffs; NOR=North; STAR=Staraya Artil.

Table A- 4. --Cumulative age classification of male seals killed on St. George Island, 23 June to 30 July 1971

Date	Rookery <sup>1/</sup>	Estimated seals killed from each age group					Total kill	Seals killed from each age group				
		2	3	4	5	6		2	3	4	5	6
		-----Number-----					-----Percent-----					
June												
23	NOR	-	-	59	49	17	125	-	-	47	39	14
23	EAST	-	9	130	64	20	223	-	4	58	29	9
25	ZAP	-	30	237	130	25	422	-	7	56	31	6
28	NOR	-	40	294	135	25	494	-	8	60	27	5
28	EAST	-	68	340	149	30	587	-	12	58	25	5
30	NOR	-	117	398	159	30	704	-	17	57	22	4
30	ZAP	--	121	414	184	30	749	-	16	55	25	4
July												
2	EAST	-	146	475	199	30	850	-	17	56	23	4
2	ZAP	-	155	484	199	30	868	-	18	56	23	3
6	NOR	-	192	575	221	30	1,018	-	19	56	22	3
6	EAST	-	192	616	233	35	1,076	-	18	57	22	3
7	ZAP	-	217	687	233	35	1,172	-	18	59	20	3
7	STAR	-	222	719	243	35	1,219	-	18	59	20	3
9	EAST	-	227	759	248	35	1,269	-	18	60	19	3
9	NOR	-	282	833	248	35	1,398	-	20	60	18	2
12	NOR	-	341	962	271	35	1,609	-	21	60	17	2
12	ZAP	-	356	1,012	271	35	1,674	-	21	61	16	2
12	STAR	-	367	1,022	276	40	1,705	-	22	60	16	2
14	EAST	-	407	1,107	286	40	1,840	-	22	60	16	2
14	NOR	-	427	1,199	296	40	1,962	-	22	61	15	2
16	EAST	-	442	1,249	316	40	2,047	-	22	61	15	2
16	NOR	5	480	1,308	321	40	2,154	-	22	61	15	2
19	ZAP	5	485	1,350	326	40	2,206	-	22	61	15	2
19	STAR	10	509	1,365	331	40	2,255	-	23	60	15	2
19	NOR	10	550	1,456	340	40	2,396	-	23	61	14	2
21	EAST	10	555	1,474	345	40	2,424	-	23	61	14	2
21	NOR	10	647	1,524	350	40	2,571	-	25	59	14	2
23	ZAP	15	693	1,559	375	40	2,682	1	26	58	14	1
23	STAR	15	723	1,604	375	40	2,757	1	26	58	14	1
23	NOR	18	832	1,780	384	40	3,054	1	27	58	13	1
26	EAST	18	1,022	1,977	384	40	3,441	1	30	57	11	1
26	NOR	18	1,175	2,170	384	66	3,813	-	31	57	10	2
28	ZAP	18	1,229	2,235	384	66	3,932	-	31	57	10	2
28	STAR	18	1,240	2,283	447	66	4,054	-	31	56	11	2
28	NOR	18	1,264	2,352	457	66	4,157	-	30	57	11	2
28	EAST	27	1,316	2,400	462	71	4,276	-	31	56	11	2
30	EAST	27	1,323	2,412	462	71	4,295	-	31	56	11	2
30	NOR	32	1,373	2,452	467	81	4,405	1	31	56	10	2
30	ZAP	32	1,456	2,517	467	81	4,553	1	32	55	10	2

<sup>1/</sup> ZAP=Zapadni and South; EAST=East Reef and East Cliffs; NOR=North; STAR=Staraya Artil.

Table A-5. --Adult male seals counted, by class<sup>1/</sup> and rookery section, St. Paul Island, 21-26 June 1971

Rookery and class of male	Section														Total
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	
-----Number-----															
<u>Lukanin</u>															
1	2	4	-	-	-	-	-	-	-	-	-	-	-	-	6
2	12	10	-	-	-	-	-	-	-	-	-	-	-	-	22
3	24	34	-	-	-	-	-	-	-	-	-	-	-	-	58
4	0	0	-	-	-	-	-	-	-	-	-	-	-	-	0
5	54	0	-	-	-	-	-	-	-	-	-	-	-	-	54
<u>Kitovi<sup>2/</sup></u>															
1	0(1)	0	0	7	0	-	-	-	-	-	-	-	-	-	8
2	19(13)	1	22	29	12	-	-	-	-	-	-	-	-	-	96
3	25(13)	8	31	33	26	-	-	-	-	-	-	-	-	-	136
4	0(0)	0	0	0	0	-	-	-	-	-	-	-	-	-	0
5	0(0)	20	0	0	31	-	-	-	-	-	-	-	-	-	51
<u>Reef</u>															
1	2	7	2	3	0	8	0	5	3	3	0	-	-	-	33
2	51	84	54	35	54	41	51	45	41	38	28	--	--	-	522
3	7	19	6	0	19	14	0	16	11	12	6	-	-	-	110
4	0	0	0	0	0	0	0	0	0	1	3	-	-	-	4
5	0	10	0	0	181	0	0	0	0	0	38	-	-	-	229
<u>Gorbatch</u>															
1	1	5	1	0	0	1	-	-	-	-	-	-	-	-	8
2	64	25	26	11	17	50	-	-	-	-	-	-	-	-	193
3	29	37	19	8	14	29	-	-	-	-	-	-	-	-	136
4	0	1	4	0	0	0	-	-	-	-	-	-	-	-	5
5	83	0	2	128	0	0	-	-	-	-	-	-	-	-	213
<u>Ardiguen<sup>3/</sup></u>															
1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	46
3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	24
4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	40
<u>Sivutch<sup>3/</sup></u>															
1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	43
2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	205
3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	225
4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	316
<u>Morjovi<sup>4/</sup></u>															
1	2(1)	0	2	5	3	0	-	-	-	-	-	-	-	-	13
2	22(20)	9	21	22	12	27	-	-	-	-	-	-	-	-	133
3	19(5)	19	10	23	26	22	-	-	-	-	-	-	-	-	124
4	0(0)	2	0	0	0	0	-	-	-	-	-	-	-	-	2
5	50(0)	0	10	0	0	100	-	-	-	-	-	-	-	-	160
<u>Vostochni</u>															
1	0	0	3	0	0	4	2	1	3	0	0	2	2	0	17
2	23	19	19	16	12	43	18	34	31	23	24	26	29	13	330
3	16	11	11	19	16	21	14	25	20	10	16	26	35	14	254
4	0	0	1	1	0	0	0	1	1	0	0	0	0	0	4
5	9	14	0	42	2	45	0	0	0	0	4	43	0	35	194

Table A- --Adult male seals counted, by class<sup>1/</sup> and rookery section, St. Paul Island, 21-26 June 1971--  
Continued

Rookery and class of male	Section														Total
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	
-----Number-----															
<u>Little Polovina</u>															
1	1	1	-	-	-	-	-	-	-	-	-	-	-	-	2
2	47	41	-	-	-	-	-	-	-	-	-	-	-	-	88
3	10	4	-	-	-	-	-	-	-	-	-	-	-	-	14
4	0	4	-	-	-	-	-	-	-	-	-	-	-	-	4
5	17	0	-	-	-	-	-	-	-	-	-	-	-	-	17
<u>Polovina</u>															
1	1	3	-	-	-	-	-	-	-	-	-	-	-	-	4
2	29	22	-	-	-	-	-	-	-	-	-	-	-	-	51
3	1	3	-	-	-	-	-	-	-	-	-	-	-	-	4
4	0	0	-	-	-	-	-	-	-	-	-	-	-	-	0
5	80	0	-	-	-	-	-	-	-	-	-	-	-	-	80
<u>Polovina Cliffs</u>															
1	0	0	1	0	2	0	4	-	-	-	-	-	-	-	7
2	23	16	36	31	37	27	75	-	-	-	-	-	-	-	245
3	5	3	6	5	10	4	16	-	-	-	-	-	-	-	49
4	1	2	0	0	1	0	0	-	-	-	-	-	-	-	4
5	0	0	0	0	0	101	0	-	-	-	-	-	-	-	101
<u>Tolstoi</u>															
1	3	4	0	1	1	2	0	1	-	-	-	-	-	-	12
2	30	28	18	10	62	40	47	35	-	-	-	-	-	-	270
3	17	24	25	20	39	38	21	14	-	-	-	-	-	-	198
4	1	0	1	0	0	6	2	0	-	-	-	-	-	-	10
5	0	0	0	0	0	0	0	140	-	-	-	-	-	-	140
<u>Zapadni Reef</u>															
1	7	0	-	-	-	-	-	-	-	-	-	-	-	-	7
2	45	18	-	-	-	-	-	-	-	-	-	-	-	-	63
3	25	16	-	-	-	-	-	-	-	-	-	-	-	-	41
4	0	0	-	-	-	-	-	-	-	-	-	-	-	-	0
5	0	38	-	-	-	-	-	-	-	-	-	-	-	-	38
<u>Little Zapadni</u>															
1	1	2	4	7	2	1	-	-	-	-	-	-	-	-	17
2	12	14	33	38	37	32	-	-	-	-	-	-	-	-	166
3	8	21	29	26	20	15	-	-	-	-	-	-	-	-	119
4	1	0	1	0	10	0	-	-	-	-	-	-	-	-	12
5	3	0	0	0	0	33	-	-	-	-	-	-	-	-	36
<u>Zapadni<sup>5/</sup></u>															
1	0(0)	2	4	2	4	4	3	0	-	-	-	-	-	-	19
2	31(0)	52	43	63	34	24	43	6	-	-	-	-	-	-	296
3	24(0)	38	33	33	29	35	27	6	-	-	-	-	-	-	225
4	0(0)	0	2	0	7	3	0	0	-	-	-	-	-	-	12
5	0(186)	0	0	0	0	0	0	228	-	-	-	-	-	-	414

1/ Class 1 Shoreline - Full-grown males about age 10 and older without females but apparently with established territories at the high tide mark.

Class 2 Territorial without females - Full-grown males about age 10 and older without females but with established territories on the rookery.

Class 3 Territorial with females - Full-grown males about age 10 and older with females and established territories on the rookery.

Class 4 Back fringe - Full-grown and partly grown males about age 7 and older, without females and without territories, that are found along the inland fringe of the rookery.

Class 5 Hauling ground - Full-grown and partly grown males about age 7 and older, without females, that are found on traditional hauling grounds.

Class 3 males were formerly called harem bulls, and Classes 1, 2, 4, and 5 were collectively called idle bulls.

2/ Numbers in parentheses are the adult males counted in Kitovi Amphitheater.

3/ No numbered sections.

4/ Numbers in parentheses are the adult males counted on the second point south of Sea Lion Neck.

5/ Numbers in parentheses are the adult males counted on Zapadni Point Reef.

Table A-6. ---Adult male seals counted, by class<sup>1/</sup> and rookery section, St. Paul Island, 10-11 July 1971

Rookery <sup>2/</sup> and class of male	Section														Total
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	
-----Number-----															
<u>Reef</u>															
1	2	8	4	1	3	4	0	3	1	1	1	-	-	-	28
2	5	15	5	4	5	2	10	7	5	4	8	-	-	-	70
3	67	84	70	42	58	54	49	66	59	55	32	-	-	-	636
4	1	1	0	0	0	0	0	3	1	0	0	-	-	-	6
5	0	0	0	0	118	0	0	0	0	0	29	-	-	-	147
<u>Vostochni</u>															
1	1	1	0	1	1	0	0	0	3	4	0	1	3	0	15
2	4	2	2	4	4	9	5	5	2	3	4	4	4	6	58
3	42	36	30	24	23	69	32	48	58	35	44	52	61	27	581
4	0	0	0	0	0	1	4	1	1	0	1	0	0	0	8
5	125	0	0	30	0	29	0	0	0	0	0	37	0	0	221
<u>Polovina Cliffs</u>															
1	0	1	1	2	0	1	4	-	-	-	-	-	-	-	9
2	1	2	3	6	6	7	10	-	-	-	-	-	-	-	35
3	34	22	34	37	60	40	106	-	-	-	-	-	-	-	333
4	2	3	1	2	1	0	0	-	-	-	-	-	-	-	9
5	0	0	0	0	0	58	4	-	-	-	-	-	-	-	62
<u>Zapadni Reef</u>															
1	1	2	-	-	-	-	-	-	-	-	-	-	-	-	3
2	9	1	-	-	-	-	-	-	-	-	-	-	-	-	10
3	59	33	-	-	-	-	-	-	-	-	-	-	-	-	92
4	1	1	-	-	-	-	-	-	-	-	-	-	-	-	2
5	4	24	-	-	-	-	-	-	-	-	-	-	-	-	28

1/ For description of classes, see table A-5 or glossary.

2/ Adult males were counted on selected rookeries only.

Table A-7. --Adult male seals counted, by class<sup>1/</sup> and rookery section, St. George Island, 24-29 June 1971

Rookery and class of male	Section						Total
	1	2	3	4	5	6	
	-----Number-----						
<u>Zapadni</u>							
1	3	2	0	-	-	-	5
2	50	69	23	-	-	-	142
3	38	50	25	-	-	-	113
4	0	0	0	-	-	-	0
5	73	0	4	-	-	-	77
<u>South</u>							
1	4	7	7	-	-	-	18
2	38	53	47	-	-	-	138
3	49	63	51	-	-	-	163
4	0	0	0	-	-	-	0
5	78	0	0	-	-	-	78
<u>North</u>							
1	2	5	3	3	2	1	16
2	6	28	28	25	15	36	138
3	32	56	51	69	33	53	294
4	0	5	0	0	2	7	14
5	40	21	0	0	0	14	75
<u>East Reef<sup>2/</sup></u>							
1	-	-	-	-	-	-	0
2	-	-	-	-	-	-	42
3	-	-	-	-	-	-	30
4	-	-	-	-	-	-	1
5	-	-	-	-	-	-	20
<u>East Cliffs</u>							
1	1	2	-	-	-	-	3
2	32	50	-	-	-	-	82
3	34	40	-	-	-	-	74
4	0	0	-	-	-	-	0
5	93	7	-	-	-	-	100
<u>Staraya Artil</u>							
1	2	0	-	-	-	-	2
2	66	42	-	-	-	-	108
3	59	11	-	-	-	-	70
4	0	0	-	-	-	-	0
5	83	0	-	-	-	-	83

<sup>1/</sup> See table A-5 or glossary for a description of the classes of adult male seals.

<sup>2/</sup> No numbered sections.

Table A-8 . --Adult male seals counted, by class<sup>1/</sup> and rookery section, St. George Island, 13-14 July 1971

Rookery and class of male	Section						Total
	1	2	3	4	5	6	
-----Number-----							
<u>Zapadni</u>							
1	1	0	0	-	-	-	1
2	9	12	24	-	-	-	45
3	60	108	21	-	-	-	189
4	0	0	0	-	-	-	0
5	70	0	0	-	-	-	70
<u>South</u>							
1	7	4	2	-	-	-	13
2	11	6	15	-	-	-	32
3	99	83	65	-	-	-	247
4	0	0	0	-	-	-	0
5	72	0	0	-	-	-	72
<u>North</u>							
1	0	3	3	3	2	0	11
2	2	3	2	4	3	15	29
3	61	77	76	89	32	79	414
4	0	4	1	5	2	6	18
5	17	0	0	0	0	23	40
<u>East Reef<sup>2/</sup></u>							
1	-	-	-	-	-	-	2
2	-	-	-	-	-	-	12
3	-	-	-	-	-	-	80
4	-	-	-	-	-	-	0
5	-	-	-	-	-	-	15
<u>East Cliffs</u>							
1	10	3	-	-	-	-	13
2	2	2	-	-	-	-	4
3	80	80	-	-	-	-	160
4	0	0	-	-	-	-	0
5	32	8	-	-	-	-	40
<u>Staraya Artil</u>							
1	3	0	-	-	-	-	3
2	20	33	-	-	-	-	53
3	106	39	-	-	-	-	145
4	0	0	-	-	-	-	0
5	61	0	-	-	-	-	61

<sup>1/</sup> See table A-5 or glossary for a description of the classes of adult male seals.

<sup>2/</sup> No numbered sections.

Table A-9. -- Adult male seals counted, by rookery,  
Pribilof Islands, Alaska, June 1971

Island and rookery	Date	Class of adult male <sup>1/</sup>					Total
		1	2	3	4	5	
		-----Number-----					
<u>St. Paul Island</u> June							
Lukanin	26	6	22	58	-	54	140
Kitovi	26	8	96	136	-	51	291
Reef	21	33	522	110	4	229	898
Gorbatch	24	8	193	136	5	213	555
Ardiguen	21	-	46	24	-	40	110
Morjovi	25	13	133	124	2	160	432
Vostochni	25	17	330	254	4	194	799
Little Polovina	21	2	88	14	4	17	125
Polovina	21	4	51	4	-	80	139
Polovina Cliffs	21	7	245	49	4	101	406
Tolstoi	24	12	269	198	9	140	628
Zapadni Reef	25	7	63	41	-	38	149
Little Zapadni	25	17	166	119	12	33	347
Zapadni	26	19	296	225	12	414	966
Total		153	2,520	1,492	56	1,764	5,985
<u>Sea Lion Rock</u>							
Sivutch	26	43	205	225	-	316	789
Subtotal		196	2,725	1,717	56	2,080	6,774
<u>St. George Island</u>							
Zapadni	29	5	142	113	-	77	337
South	29	18	138	163	-	78	397
North	29	16	138	294	14	75	537
East Reef	24	-	42	30	1	20	93
East Cliffs	24	2	82	74	-	100	258
Staraya Artil	29	2	108	70	-	83	263
Total		43	650	744	15	433	1,885
Grand total		239	3,375	2,461	71	2,513	8,659

<sup>1/</sup> See table A-5 or glossary for a description of the classes of adult male seals.

Table A-10. --Adult male seals counted, by rookery,  
Pribilof Islands, Alaska, July 1971

Island and rookery	Date	Class of adult male <sup>1/</sup>					Total
		1	2	3	4	5	
		-----Number-----					
<u>St. Paul Island</u> <sup>2/</sup>							
Reef	11	28	70	636	6	147	887
Vostochni	10	15	58	581	8	221	883
Polovina Cliffs	10	9	35	333	9	62	448
Zapadni Reef	10	3	10	92	2	28	135
Total		55	173	1,642	25	458	2,353
<u>St. George Island</u>							
Zapadni	13	1	45	189	-	70	305
South	13	13	32	247	-	72	364
North	13	11	29	414	18	40	512
East Reef	14	2	12	80	-	15	109
East Cliffs	14	13	4	160	-	40	217
Staraya Artil	13	3	53	145	-	61	262
Total		43	175	1,235	18	298	1,769
Grand total		98	348	2,877	43	756	4,122

<sup>1/</sup> See table A-5 or glossary for a description of the classes of adult male seals.

<sup>2/</sup> The adult males were counted on selected rookeries only.

Table A-11. --Harem and idle male seals counted in mid-July,  
Pribilof Islands, Alaska, 1961-71

Year	St. Paul Island		St. George Island		Both islands	
	Harem	Idle	Harem	Idle	Harem	Idle
	----Number----		----Number----		----Number----	
1961	11,163	11,791	2,843	2,489	14,006	14,280
1962	10,332	9,109	2,342	2,650	12,674	11,759
1963	9,212	7,650	2,071	1,890	11,283	9,540
1964	9,085	7,095	1,989	1,489	11,074	8,584
1965	8,553	5,616	1,917	1,113	10,470	6,729
1966	7,974	5,839	1,974	1,017	9,948	6,856
1967	<u>1</u> /7,230	<u>1</u> /4,439	1,646	1,268	8,876	5,707
1968	<u>1</u> /6,176	<u>1</u> /3,100	1,748	1,283	7,924	4,383
1969	<u>2</u> /5,928	<u>2</u> /2,535	1,457	677	7,385	3,212
1970	4,945	1,666	1,466	1,277	6,411	2,943
1971	<u>3</u> /4,200	<u>3</u> /1,900	1,235	534	5,435	2,434

1/ Harem and idle males on St. Paul Island were counted on Reef, Lukanin, Kitovi, Tolstoi, and Zapadni Reef Rookeries in 1967, and on Reef, Zapadni Reef, Vostochni, and Morjovi Rookeries in 1968, then extrapolated to produce counts representing all the rookeries.

2/ Includes harem and idle males counted on Sivutch Rookery (Sea Lion Rock).

3/ Harem and idle males on St. Paul Island were counted on Reef, Vostochni, Polovina Cliffs, and Zapadni Reef Rookeries in 1971. Estimates of total number were made based on these counts, the counts on all rookeries in June, and counts made on all rookeries in 1970.

Table A-11. --Harem and idle male seals counted in mid-July, Pribilof Islands, Alaska, 1967-71

Year	St. Paul Island		St. George Island		Both Islands	
	Harem	Idle	Harem	Idle	Harem	Idle
1967	11,183	14,701	2,843	2,489	14,006	14,280
1968	10,352	9,109	2,742	2,650	12,674	11,759

Table A-12. --Dead seal pups counted, by rookery sections, Pribilof Islands, Alaska, 20 August to 3 September 1971

Island and rookery	Section														Total
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	
-----Number-----															
<u>St. Paul Island</u>															
Morjovi <sup>1/</sup>	1,106	646	556	954	754	757	-	-	-	-	-	-	-	-	4,773
Vostochni	569	324	494	431	425	1,865	692	851	470	204	250	373	936	396	8,280
Little Polovina	609	598	-	-	-	-	-	-	-	-	-	-	-	-	1,207
Polovina Cliffs	429	495	517	590	1,083	854	1,477	-	-	-	-	-	-	-	5,445
Polovina	660	320	-	-	-	-	-	-	-	-	-	-	-	-	980
Ardiguen <sup>2/</sup>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	373
Gorbatch	832	684	375	103	161	250	-	-	-	-	-	-	-	-	2,405
Reef	407	579	357	323	517	308	573	403	233	259	144	-	-	-	4,103
Kitovi <sup>3/</sup>	531	67	482	509	265	-	-	-	-	-	-	-	-	-	1,854
Lukanin	570	654	-	-	-	-	-	-	-	-	-	-	-	-	1,224
Tolstoi	286	372	468	253	563	1,009	1,040	1,156	-	-	-	-	-	-	5,147
Little Zapadni	237	445	676	803	620	442	-	-	-	-	-	-	-	-	3,223
Zapadni Reef	480	193	-	-	-	-	-	-	-	-	-	-	-	-	673
Zapadni	369	852	1,509	1,847	767	450	691	267	-	-	-	-	-	-	6,752
Total															46,439
<u>St. George Island</u>															
North	503	133	416	327	281	202	-	-	-	-	-	-	-	-	1,862
Zapadni	304	165	133	-	-	-	-	-	-	-	-	-	-	-	602
South	173	184	99	-	-	-	-	-	-	-	-	-	-	-	456
East Reef <sup>2/</sup>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	144
East Cliffs <sup>4/</sup>	494	-	-	-	-	-	-	-	-	-	-	-	-	-	494
Staraya Artil	1,152	510	-	-	-	-	-	-	-	-	-	-	-	-	1,662
Total															5,220
Grand total															51,659

<sup>1/</sup> Includes dead pups counted on point south of Sea Lion Neck.

<sup>2/</sup> No numbered sections.

<sup>3/</sup> Includes 151 dead pups counted in Kitovi Amphitheater.

<sup>4/</sup> Count of dead pups counted on sections 1 and 2 combined.

Table A-14. -- Mean weights of untagged and unmarked seal pups about 1 September, St. Paul Island, 1957-71

(Number in parentheses show sample size)

Table A-13. -- Dead seal pups counted, <sup>1/</sup> by rookery, Pribilof Islands, Alaska, 1962-71

Island and rookery	Year									
	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971
	-----Number-----									
<u>St. Paul Island</u>										
Morjovi	4,881	2,348	1,830	2,649	1,686	1,072	2,285	734	1,618	4,773
Vostochni	8,565	5,057	3,404	4,214	2,785	1,969	4,195	1,711	3,330	8,280
Little Polovina	2,121	923	631	1,132	449	233	509	200	337	1,207
Polovina Cliffs	2,957	2,160	1,097	2,856	809	825	1,616	836	1,636	5,445
Polovina	1,880	1,237	783	1,176	312	319	487	327	475	980
Ardiguen	225	141	102	459	160	90	118	112	75	373
Gorbatch	1,373	2,431	1,549	3,123	1,593	874	1,446	823	974	2,405
Reef	7,897	5,688	3,000	7,664	3,562	2,008	3,064	1,365	2,221	4,103
Kitovi	2,081	881	462	2,202	406	522	755	652	679	1,854
Lukanin	660	546	402	1,126	432	240	597	460	401	1,224
Tolstoi	3,004	3,274	2,614	3,955	3,425	2,251	3,315	2,778	3,580	5,147
Little Zapadni	2,399	2,580	1,101	2,461	1,634	1,098	1,781	798	1,386	3,223
Zapadni Reef	598	718	425	723	451	380	685	177	308	673
Zapadni	6,627	4,614	4,172	5,384	3,710	2,195	4,445	2,306	3,561	6,752
Counted total	45,268	32,598	21,572	39,124	21,414	14,076	25,298	13,279	20,581	46,439
Estimated oversight 5%	2,263	1,630	1,079	1,956	1,071	704	1,265	664	1,029	2,322
Total	47,531	34,228	22,651	41,080	22,485	14,780	26,563	13,943	21,610	48,761
<u>St. George Island</u>										
North	2,242	2,525	792	1,854	1,561	971	1,567	444	866	1,862
Zapadni	1,740	704	446	1,263	1,196	578	1,197	260	636	1,058
East	504	502	272	676	764	201	824	187	522	638
Staraya Artil	1,435	1,041	767	1,186	1,152	770	1,055	640	1,243	1,662
Counted total	5,921	4,772	2,277	4,979	4,673	2,520	4,643	1,531	3,267	5,220
Estimated oversight 5%	296	239	114	249	234	126	232	76	163	261
Total	6,217	5,011	2,391	5,228	4,907	2,646	4,875	1,607	3,430	5,481
<u>Pribilof Islands counted total<sup>2/</sup></u>	51,189	37,370	23,849	44,103	26,087	16,596	29,941	14,810	23,848	51,659
Estimated oversight 5%	2,559	1,869	1,193	2,205	1,305	830	1,497	740	1,192	2,583
Total	53,748	39,239	25,042	46,308	27,392	17,426	31,438	15,550	25,040	54,242

<sup>1/</sup> The dead pups are counted after 15 August each year; most mortality has occurred by that date.

<sup>2/</sup> Not included in the total are 2,228 dead pups counted on Sea Lion Rock (Sivutch) in 1966.

Table A-14. --Mean weights of untagged and unmarked seal pups about 1 September, St. Paul Island, 1957-71

Year	Sex	
	Males	Females
	Kg.	Kg.
1957	8.7 (391)	7.7 (351)
1958	11.4 (127)	9.9 (121)
1959	9.4 (444)	8.1 (386)
1960	9.8 (372)	9.1 (363)
1961	8.5 (381)	8.0 (466)
1962	9.2 (300)	8.2 (300)
1963	8.9 (300)	8.0 (300)
1964	9.1 (300)	7.7 (300)
1965	9.5 (300)	8.2 (300)
1966	9.6 (300)	8.4 (300)
1967	10.2 (400)	9.0 (400)
1968	9.6 (400)	8.3 (400)
1969	9.8 (400)	8.6 (400)
1970	10.2 (400)	9.0 (400)
1971	9.4 (400)	8.1 (400)
Mean 1957-71	9.5 (5,215)	8.4 (5,187)

Table A-15. --Primary diagnoses of causes of death among 486 pups, by 7-day periods, St. Paul Island, 30 June to 15 August 1971

Cause of death	To 4 July	5-11 July	12-18 July	19-25 July	26 July to 1 Aug.	2-8 Aug.	9-15 Aug.	Total
-----Number-----								
Malnutrition	0	3	14	8	82	19	30	156
Hookworm disease	0	0	12	67	59	44	19	201
Microbial infection	2	6	8	9	3	0	2	30
Trauma	0	4	2	4	0	1	0	11
Perinatal complex	0	0	12	3	0	0	0	15
Miscellaneous	5	4	4	4	0	0	0	17
Undetermined	1	13	9	7	3	0	0	33
<b>Total</b>	<b>8</b>	<b>30</b>	<b>61</b>	<b>102</b>	<b>147</b>	<b>64</b>	<b>51</b>	<b>463</b>
Unsuitable for examination	6	8	3	1	4	1	0	23
<b>Total</b>	<b>14</b>	<b>38</b>	<b>64</b>	<b>103</b>	<b>151</b>	<b>65</b>	<b>51</b>	<b>486</b>
Advanced post mortem degeneration	7	9	3	2	5	2	0	28

Table A-16. ---Seal pups marked by freeze branding, St. Paul Island, 1966-70

Year	Rookery	Marks or symbols used	Seals effectively marked ---Number---	Location of marks
1966	Zapadni Reef	S or ∞ <sup>1/</sup>	40 (♂♂ and ♀♀)	Dorsal surface of front flipper (manus)
1966	Zapadni Reef	---do.---	40 (♂♂ and ♀♀)	Dorsal surface of forearm (antebrachium)
1967	Zapadni Reef	T, H, L, or F <sup>2/</sup>	115 (♂♂ and ♀♀) <sup>3/</sup>	Do.
1969	Reef	Bar (-) and angle (<) numbering system <sup>4/</sup>	192♂♂ and 183♀♀	Dorsal surface of left forearm (antebrachium) and head
1969	Gorbatch	-----do.-----	200♂♂ and 200♀♀	Do.
1970	Reef	-----do.-----	245♂♂ and 189♀♀	Dorsal surface of right forearm (antebrachium) and head
1970	Gorbatch	-----do.-----	246♂♂ and 218♀♀	Do.

<sup>1/</sup> For photographs of branded animals, see Fur Seal Investigations, 1966, Marine Mammal Biological Laboratory, Seattle, Wash.

<sup>2/</sup> For photograph of a branded animal, see Fur Seal Investigations, 1967, Marine Mammal Biological Laboratory, Seattle, Wash.

<sup>3/</sup> In addition, 16 adult females were freeze branded on Kitovi Rookery with letter "U" and "S" instruments on the forearm, shoulder, chest, and rump.

<sup>4/</sup> For system of identification symbols used, see Fur Seal Investigations, 1969, Marine Mammal Biological Laboratory, Seattle, Wash.

Table A-17. --Seal pups tagged and marked, Pribilof Islands, Alaska, 1962-71

Year	Series	St. Paul	St. George	Location of tag	Checkmarks or marks
		Island	Island		
		-----Number-----			
1962	O 1-10000		9,980	Right front flipper	"V" notch near tip right front flipper
	O 10001-50000	39,928		-----do.-----	Do.
1963	P 1-5000		4,993	Left front flipper	Tip of left front flipper sliced off
	P 5001-25000	19,978		-----do.-----	Do.
1964	Q 1-5000		4,993	Right front flipper	Tip of right front flipper sliced off
	Q 5001-25000	19,998		-----do.-----	Do.
1965	R 1-10000	10,000		Left front flipper	"V" notch near tip left front flipper
	Marked	10,007		Not tagged	"V" notch near tip right front flipper
	Marked	10,080		---do.---	Tip of 1st digit (big toe) on right hind flipper sliced off
1966	S 1-2500		2,499	Left front flipper	Tip of left front flipper sliced off
	S 2501-12500	10,000		Right front flipper	Tip of 2d digit on right hind flipper sliced off
	Marked	9,578		Not tagged	Tip of 3d digit on right hind flipper sliced off
	Marked		2,503	---do.---	Tip of 2d digit on left hind flipper sliced off
1967	T 9-2500		2,492	Right front flipper	Tip of right front flipper sliced off
	T 5001-15000	9,980		-----do.-----	Do.
1968	U 1-2500		2,475	Left front flipper	"V" notch near tip left front flipper
	U 2501-12500	9,200		-----do.-----	Do.
1969	Marked	20,000		Not tagged	Tip of 1st digit (big toe) on left hind flipper sliced off
	Marked		5,000	---do.---	Tip of 1st digit (big toe) on right hind flipper sliced off
1970	Marked	20,030		Not tagged	Tip of 2d digit on left hind flipper sliced off
	Marked		5,000	---do.---	Tip of 2d digit on right hind flipper sliced off
1971	Marked	19,995		Not tagged	Tip of 3d digit on left hind flipper sliced off
	Marked		5,000	---do.---	Tip of 3d digit on right hind flipper sliced off

Table A-18. --Record of tags applied<sup>1/</sup> to male seals selected as yearlings and as 2-year-olds on the basis of body length or size, St. Paul Island, 1961-63 and 1965-71

Age category and year	Tag series	Tag number	Effective tags <sup>2/</sup> Number
<u>Yearlings<sup>3/</sup></u>			
1961	M	1-2000	754
1962	N	50001-51000	929
1963	O	50001-51000	799
1965	1R	1-1000	991
1966	1S	20001-21500	1,495
1967	1T	1-1500	835
1968	1U	20001-21500	714
<u>Age 2</u>			
1966	2S	30001-31500	1,483
1967	2T	1-1500	1,220
1968	2U	30001-31500	1,495
<u>Ages 1-2</u>			
1969	1V	1-3431	3,419
1970	1W	1-4000	3,779
1971	1Y	1-4000	3,992

<sup>1/</sup> Each seal was double tagged; one tag was attached at the hairline of each front flipper. Before 1971, seals with tags that had been attached at ages 3-4 months or at ages 1-2 years were given an additional tag.

<sup>2/</sup> Total number of seals tagged within the series.

<sup>3/</sup> Male and female seals were intentionally tagged in 1961, 1962, 1963, and 1965. From 1966 to 1971, only male seals were selected for tagging.

Table A-19. --Record of 198 male seals marked as pups in 1969 and 1970 and given 1Y-series tags at ages 1 and 2 years, St. Paul Island, 20 September to 8 October 1971

U. S. A. tags and marks <sup>1/</sup>						
<u>LH1</u>	<u>LH1</u>	<u>LH1</u>	<u>LH1</u>	<u>LH1</u>	<u>RH1</u>	<u>LH2</u>
5	594	1207	1927	2993	306	49
42	603	1294	1928	3029	439	72
80	607	1304	1930	3061	669	91
81	623	1342	1983	3068	713	196
167	625	1358	1994	3074	754	325
169	649	1382	2037	3087	1325	351
192	655	1393	2047	3114	1388	493
195	693	1408	2120	3117	1414	1062
198	700	1410	2151	3167	1656	1436
203	741	1433	2268	3214	1855	1816
208	810	1478	2288	3257	1882	2520
218	813	1514	2348	3291	2294	2757
245	839	1563	2358	3370	2713	2805
273	845	1579	2378	3381	3007	3014
284	855	1583	2387	3410	3185	3027
291	889	1619	2428	3466	3269	3592
339	914	1630	2464	3501	3331	3959
343	918	1647	2503	3519		
346	933	1648	2510	3538		
347	956	1657	2549	3574		
378	959	1660	2613	3578		
392	971	1661	2627	3579		
393	985	1710	2728	3658		
406	1006	1716	2754	3680		
426	1017	1737	2766	3711		
494	1022	1743	2780	3730		
499	1023	1761	2822	3769		
505	1024	1774	2827	3789		
540	1041	1784	2861	3797		
542	1044	1811	2905	3886		
548	1093	1869	2908	3914		
560	1112	1881	2919	3965		
579	1168	1915	2980			

<sup>1/</sup> Seals with mark (LH2) applied in 1970 and marks (LH1 and RH1) applied in 1969 were given two 1Y-series tags at ages 1 and 2 years, respectively. The marks are defined as follows: LH2=tip of second digit of left hind flipper sliced off, LH1 and RH1=tip of first digit of left and right hind flipper, respectively, sliced off. These seals had never been marked with tags as pups.

Table A-20. --Record of 3, 992 male seals tagged at estimated ages 1 and 2 years, St. Paul Island, September and October 1971

Date	Area	Tag number (1Y-series)	Effective tags <sup>1/</sup> Number
<u>Sept.</u>			
20	English Bay Sands	1-300	299
21	English Bay Sands	301-400	100
21	Northeast Point	401-600	200
27	Northeast Point	601-700	100
24	English Bay Sands	701-800	100
22	Northeast Point	801-900	99
23	English Bay Sands	901-1100	200
27	English Bay Sands	1101-1400	300
27	Northeast Point	1401-1500	100
29	Northeast Point	1501-1600	99
28	English Bay Sands	1601-1800	200
29	English Bay Sands	1801-2000	199
30	English Bay Sands	2001-2300	299
<u>Oct.</u>			
1	Northeast Point	2301-2500	199
1	English Bay Sands	2501-2600	100
4	English Bay Sands	2601-2900	300
5	English Bay Sands	2901-3100	200
6	Northeast Point	3101-3400	300
7	English Bay Sands	3401-3700	300
8	English Bay Sands	3701-4000	298
	Total		3, 992

<sup>1/</sup> Total number of seals tagged within the series.

Table A-21. --Marked, tagged and lost-tag male seals recovered, by age,  
Pribilof Islands, Alaska, 23 June to 31 July 1971

Mark or tag series	Age Years	Marks or tags			Lost tags <sup>1/</sup>			Grand total Number
		St. Paul Island	St. George Island	Total	St. Paul Island	St. George Island	Total	
		-----Number-----			-----Number-----			
Hind flipper (LH1) <sup>2/</sup>	2	25	10	35	-	-	-	35
Hind flipper (RH1) <sup>2/</sup>	2	11	10	21	-	-	-	21
U	3	169	20	189	103	11	114	303
T	4	213	60	273	150	4	154	427
S	5	11	10	21	42	10	52	73
Hind flipper (RH3) <sup>2/</sup>	5	38	4	42	-	-	-	42
Hind flipper (LH2) <sup>2/</sup>	5	11	10	21	-	-	-	21
Hind flipper (RH1) <sup>2/</sup>	6	14	2	16	-	-	-	16
Front flipper (RFV) <sup>2/</sup>	6	1	-	1	-	-	-	1
R	6	4	-	4	5	-	5	9

<sup>1/</sup> Seals that had lost their tags but were recognized by a marked flipper.

<sup>2/</sup> Seals not tagged but marked by removing part of a flipper--tip of first digit left hind flipper (LH1), tip of first digit right hind flipper (RH1), tip of third digit right hind flipper (RH3), tip of second digit left hind flipper (LH2), V-notch right front flipper on leading edge near tip (RFV).

Table A-82. --Tag recoveries <sup>1/</sup> from male seals that had been selected and tagged as yearlings and as 2-year-olds in previous years, Pribilof Islands, Alaska, 1971

Year tagged and tag series	Age when:		Total both islands Number
	Tagged	Recovered	
	Years	Years	
1967			
1T	1	5	10
1T	<sup>2/</sup> Unknown		2
1968			
1U	1	4	39
1U	2	5	6
1U	Unknown		2
1969			
1V	1	3	70
1V	2	4	457
1V	3	5	10
1V	4	6	1
1V	Unknown		40
1970			
1W	1	2	9
1W	2	3	631
1W	3	4	52
1W	4	5	1
1W	Unknown		47
1967			
2T	1	5	1
2T	2	6	7
1968			
2U	1	4	4
2U	2	5	34
2U	3	6	1
2U	Unknown		1

<sup>1/</sup> In addition to the seals listed, 136 males on St. Paul Island and 21 on St. George Island that had lost both tags were taken.

<sup>2/</sup> The tags were recovered but age could not be determined because the flippers or the heads were separated from the carcasses during the skin-stripping process.

Table A-23. --Soviet tags recovered in the United States kill of fur seals,  
Pribilof Islands, Alaska, 23 June to 31 July 1971

Island and date	Tag number	Age Years	Sex	Island of tagging	Rookery of recovery
<u>St. Paul Island</u>					
13 July	AB-1931	3	M	Bering	Northeast Point
15 July	AM-2356	3	M	Medny	Polovina
10 July	AM-6596	3	M	Medny	Reef
30 July	AM-6700	3	M	Medny	Zapadni
16 July	AM-7009(1W-1785, lost)	3	M	Medny	Zapadni
30 July	AM-8380	3	M	Medny	Zapadni
21 July	AM-9521, AM-9522	3	M	Medny	Zapadni
22 July	AM-9659	3	M	Medny	Northeast Point
26 June	X-30456	4	M	Medny	Reef
23 July	X-31753	4	M	Medny	Tolstoi-Zapadni Reef
26 July	X-31798	4	M	Medny	Zapadni
26 June	X-32941	4	M	Medny	Tolstoi
31 July	X-33078	4	M	Medny	Northeast Point
21 July	X-34527	4	M	Medny	Zapadni
26 June	X-36393	4	M	Medny	Reef
28 July	X-37457	4	M	Medny	Reef
26 June	Y-33306	5	M	Medny	Tolstoi
10 July	Y-34799	5	M	Medny	Reef
10 July	Y-34800	5	M	Medny	Reef
<u>St. George Island</u>					
30 July	AB-1769	3	M	Bering	Zapadni
2 July	AM-5143	3	M	Medny	East
26 July	AM-9545, AM-9546	3	M	Medny	North
30 July	X-30297, X030298	4	M	Medny	North
19 July	X-32491	4	M	Medny	North

Table B-1 .--List of chart units occupied by a research vessel off Washington, 8-31 March 1971, showing hours in unit, seals seen per hour, and number of seals seen and collected<sup>1/</sup>

Square	Hours in unit Number	Seals seen per hour Number	Seals	
			Seen Number	Collected Number
V86-H43	0.2	0.0	0	0
V86-H44	4.2	1.4	6	1
V86-H45	5.3	1.6	9	2
V86-H46	3.0	1.3	4	0
V86-H47	0.6	0.0	0	0
V87-H44	0.2	0.0	0	0
V87-H45	6.7	1.7	12	1
V87-H46	6.5	3.8	25	2
V88-H45	3.7	7.5	28	2
V88-H46	12.9	4.1	53	13
V88-H47	1.6	0.6	1	0
V89-H45	0.1	0.0	0	0
V89-H46	9.9	4.7	47	8
V89-H47	3.9	3.3	13	3
V89-H48	1.2	0.8	1	1
V90-H44	0.4	0.0	0	0
V90-H45	1.8	1.1	2	1
V90-H46	4.2	3.0	13	4
V90-H47	3.2	3.7	12	3
V90-H48	1.5	1.3	2	0
V91-H47	5.3	6.0	32	4
V91-H48	12.8	8.2	106	31
V92-H46	1.5	2.0	3	0
V92-H47	8.7	4.3	38	12
V92-H48	2.6	1.9	5	4
V93-H46	1.1	0.0	0	0
V93-H47	2.0	1.0	2	1
V93-H48	1.4	0.0	0	0
V94-H46	1.0	0.0	0	0
V94-H47	1.0	0.0	0	0
V94-H48	2.6	2.3	6	2

<sup>1/</sup> See footnote at end of table.

Table B-1. --List of chart units occupied by a research vessel off Washington, 8-31 March 1971, showing hours in unit, seals seen per hour, and number of seals seen and collected<sup>1/</sup> --Continued

Square Number	Hours in unit Number	Seals seen per hour Number	Seals	
			Seen Number	Collected Number
V95-H46	0.4	0.0	0	0
V95-H47	0.8	0.0	0	0
V95-H48	1.3	0.7	1	0
V96-H47	0.8	0.0	0	0
V96-H48	0.9	0.0	0	0
V96-H49	0.3	0.0	0	0
V97-H47	0.1	0.0	0	0
V97-H48	0.8	1.2	1	0
V97-H49	0.8	3.7	3	0
V97-H50	0.3	0.0	0	0
V98-H47	0.3	0.0	0	0
V98-H48	0.6	0.0	0	0
V98-H50	1.0	1.0	1	0
V98-H51	0.4	0.0	0	0
V99-H47	0.6	0.0	0	0
V99-H48	0.7	0.0	0	0
V99-H51	1.4	0.7	1	1
V100-H48	0.4	0.0	0	0
V100-H49	0.8	0.0	0	0
V100-H50	0.8	0.0	0	0
V100-H51	1.0	0.0	0	0

<sup>1/</sup> The base chart is USCGS No. 5052. The sides of each unit are 10 minutes of latitude by 10 minutes of longitude. The units are located by a system of vertical column and horizontal row numbers. Vertical column numbering begins at the lower right corner of chart (fig. 10) and horizontal row numbering begins at the lower left corner.

<sup>1/</sup> See footnote at end of table.

Table B-2 . --List of chart units occupied by a research vessel off Washington, 1-30 April 1971, showing hours in unit, seals seen per hour, and number of seals seen and collected<sup>1/</sup>

Square	Hours in unit <u>Number</u>	Seals seen per hour <u>Number</u>	Seals	
			<u>Seen Number</u>	<u>Collected Number</u>
V85-H55	0.6	0.0	0	0
V85-H56	0.7	0.0	0	0
V86-H44	6.7	0.0	0	0
V86-H45	4.4	1.5	7	3
V86-H46	7.7	4.6	36	10
V86-H47	3.7	2.7	10	3
V86-H48	0.8	0.0	0	0
V86-H49	1.0	0.0	0	0
V86-H50	1.0	1.0	1	0
V86-H51	1.0	0.0	0	0
V86-H52	0.8	0.0	0	0
V86-H53	0.8	0.0	0	0
V86-H54	0.9	0.0	0	0
V86-H55	0.2	0.0	0	0
V86-H56	1.7	0.0	0	0
V87-H44	2.4	0.4	1	0
V87-H45	6.0	2.8	17	1
V87-H46	5.6	4.1	23	4
V87-H47	0.2	0.0	0	0
V87-H56	1.1	0.0	0	0
V88-H45	1.5	0.6	1	0
V88-H46	10.8	8.7	95	8
V88-H47	8.9	5.9	53	8
V88-H56	1.7	0.5	1	0
V89-H45	1.4	1.4	2	1
V89-H46	3.9	3.0	12	1
V89-H47	10.0	4.8	48	11
V89-H56	1.6	0.6	1	0
V90-H44	1.2	0.0	0	0
V90-H45	2.7	0.7	2	0
V90-H46	6.7	4.3	29	11

<sup>1/</sup> See footnote at end of table.

Table B-2 . --List of chart units occupied by a research vessel off Washington, 1-30 April 1971, showing hours in unit, seals seen per hour, and number of seals seen and collected<sup>1/</sup> --Continued

Square	Hours in unit Number	Seals seen per hour Number	Seals	
			Seen Number	Collected Number
V90-H47	8.3	3.9	33	10
V90-H48	2.9	3.1	9	5
V90-H49	1.2	0.0	0	0
V90-H54	1.0	0.0	0	0
V90-H55	1.5	0.0	0	0
V91-H46	1.2	0.0	0	0
V91-H47	2.7	2.2	6	3
V91-H48	2.4	2.9	7	6
V91-H49	1.1	0.0	0	0
V91-H50	1.1	0.0	0	0
V91-H51	0.2	0.0	0	0
V91-H52	1.1	0.0	0	0
V91-H53	1.2	0.0	0	0
V92-H46	1.2	7.5	9	0
V92-H47	3.0	1.6	5	2
V92-H48	3.0	2.3	7	3
V92-H49	1.3	0.7	1	1
V92-H51	0.2	0.0	0	0
V93-H47	3.0	4.3	13	4
V93-H48	0.2	0.0	0	0
V93-H49	1.2	0.8	1	1
V94-H47	1.3	3.0	4	1
V94-H48	0.6	0.0	0	0
V94-H49	0.7	1.4	1	0
V94-H50	1.2	0.8	1	0
V95-H48	1.4	0.7	1	1
V95-H50	1.3	1.5	2	1
V95-H51	0.3	3.3	1	0
V96-H47	0.5	0.0	0	0
V96-H48	0.2	0.0	0	0
V96-H49	1.6	1.2	2	0

<sup>1/</sup> See footnote at end of table.

Table B-2 . --List of chart units occupied by a research vessel off Washington, 1-30 April 1971, showing hours in unit, seals seen per hour, and number of seals seen and collected<sup>1/</sup> ---Continued

Square Number	Hours in unit Number	Seals seen per hour Number	Seals	
			Seen Number	Collected Number
V96-H51	1.5	1.3	2	0
V97-H48	2.8	0.0	0	0
V97-H49	0.2	0.0	0	0
V97-H51	1.5	1.3	2	0
V98-H47	0.1	0.0	0	0
V98-H48	3.9	0.5	2	1
V98-H49	3.0	0.6	2	0
V98-H52	1.5	2.0	3	1
V99-H46	2.3	0.0	0	0
V99-H47	4.9	0.0	0	0
V99-H48	4.5	0.2	1	1
V99-H49	5.0	0.0	0	0
V99-H50	5.8	0.8	5	1
V99-H51	4.2	2.1	9	5
V99-H52	2.9	5.5	16	5
V99-H53	0.8	1.2	1	0
V100-H49	0.5	0.0	0	0
V100-H50	0.9	1.1	1	0
V100-H51	0.2	0.0	0	0
V100-H52	5.7	4.9	28	8
V100-H53	2.0	0.5	1	0
V100-H54	3.5	1.4	5	1

<sup>1/</sup> The base chart is USCGS No. 5052. The sides of each unit are  $\bar{10}$  minutes of latitude by 10 minutes of longitude. The units are located by a system of vertical column and horizontal row numbers. Vertical column numbering begins at the lower right corner of chart (fig. 11) and horizontal row numbering begins at the lower left corner.

Table B-3 .--List of chart units occupied by a research vessel off Washington, 1-27 May 1971, showing hours in unit, seals seen per hour, and number of seals seen and collected<sup>1/</sup>

Square	Hours in unit Number	Seals seen per hour Number	Seals	
			Seen Number	Collected Number
V86-H44	4.9	0.0	0	0
V86-H45	3.4	0.0	0	0
V86-H46	3.8	0.0	0	0
V87-H44	2.0	0.0	0	0
V87-H45	13.2	2.3	31	13
V87-H46	4.5	1.5	7	2
V87-H47	1.0	1.0	1	0
V87-H48	1.1	1.8	2	2
V87-H49	1.0	2.0	2	1
V87-H50	0.8	0.0	0	0
V87-H51	0.8	1.2	1	0
V87-H52	1.2	0.8	1	0
V87-H53	1.0	0.0	0	0
V87-H54	0.9	1.1	1	1
V87-H55	0.8	0.0	0	0
V87-H56	1.0	0.0	0	0
V87-H57	0.8	0.0	0	0
V87-H58	0.2	0.0	0	0
V88-H45	11.6	4.1	48	18
V88-H46	12.3	2.7	34	16
V88-H47	2.3	0.8	2	0
V88-H48	1.0	0.0	0	0
V88-H49	0.9	0.0	0	0
V88-H50	1.1	0.0	0	0
V88-H51	0.8	0.0	0	0
V88-H52	1.0	1.0	1	1
V88-H53	1.6	0.6	1	0
V88-H54	0.8	0.0	0	0
V88-H55	0.8	0.0	0	0
V88-H56	1.1	0.9	1	0
V88-H57	1.0	0.0	0	0

<sup>1/</sup> See footnote at end of table.

Table B-3 . --List of chart units occupied by a research vessel off Washington, 1-27 May 1971, showing hours in unit, seals seen per hour, and number of seals seen and collected<sup>1/</sup>--Continued

Square	Hours in unit Number	Seals seen per hour Number	Seals	
			Seen Number	Collected Number
V88-H58	1.2	1.6	2	0
V88-H59	1.0	2.0	2	1
V88-H60	1.0	1.0	1	0
V88-H61	1.3	0.7	1	0
V88-H62	1.3	0.0	0	0
V88-H63	0.8	1.2	1	1
V88-H64	0.8	0.0	0	0
V88-H65	0.7	1.4	1	0
V89-H45	0.4	0.0	0	0
V89-H46	12.3	4.1	51	18
V89-H47	3.0	0.3	1	1
V89-H73	1.2	0.0	0	0
V89-H74	1.2	0.0	0	0
V89-H75	0.9	1.1	1	0
V89-H76	0.7	0.0	0	0
V89-H77	0.9	0.0	0	0
V89-H78	1.0	3.0	3	1
V89-H79	1.0	2.0	2	2
V89-H80	1.3	0.0	0	0
V89-H81	0.9	2.2	2	2
V89-H82	0.8	0.0	0	0
V89-H83	2.7	1.4	4	1
V90-H44	0.7	0.0	0	0
V90-H45	1.9	0.5	1	0
V90-H46	7.3	3.2	24	14
V90-H47	7.4	2.5	19	7
V90-H48	1.1	4.5	5	0
V90-H67	0.1	0.0	0	0
V90-H68	1.1	0.0	0	0
V90-H69	0.9	0.0	0	0
V90-H70	0.2	0.0	0	0

<sup>1/</sup> See footnote at end of table.

Table B-3 .--List of chart units occupied by a research vessel off Washington, 1-27 May 1971, showing hours in unit, seals seen per hour, and number of seals seen and collected<sup>1/</sup>--Continued

Square Number	Hours in unit Number	Seals seen per hour Number	Seals	
			Seen Number	Collected Number
V90-H79	0.5	2.0	1	0
V90-H80	1.0	1.0	1	1
V90-H81	0.9	0.0	0	0
V90-H82	0.8	0.0	0	0
V90-H83	0.9	0.0	0	0
V91-H45	1.0	1.0	1	0
V91-H46	4.1	0.4	2	0
V91-H47	5.4	0.7	4	0
V91-H48	2.5	2.4	6	1
V91-H70	0.8	0.0	0	0
V91-H71	0.8	2.5	2	0
V91-H72	1.0	0.0	0	0
V91-H73	0.2	0.0	0	0
V91-H77	0.3	6.6	2	1
V91-H78	1.3	3.8	5	1
V91-H79	0.8	5.0	4	1
V92-H46	1.2	0.0	0	0
V92-H47	9.5	1.4	14	5
V92-H73	0.8	0.0	0	0
V92-H74	1.1	0.0	0	0
V92-H75	0.7	0.0	0	0
V93-H47	2.7	0.0	0	0
V93-H48	2.6	1.1	3	0
V93-H49	1.0	0.0	0	0
V93-H75	0.5	0.0	0	0
V93-H76	0.8	0.0	0	0
V93-H77	1.1	1.8	2	0
V94-H46	0.8	0.0	0	0
V94-H47	0.9	0.0	0	0
V94-H48	2.5	0.8	2	0
V94-H49	2.7	0.0	0	0

<sup>1/</sup> See footnote at end of table.

Table B-3. --List of chart units occupied by a research vessel off Washington, 1-27 May 1971, showing hours in unit, seals seen per hour, and number of seals seen and collected<sup>1/</sup>--Continued

Square Number	Hours in unit Number	Seals seen per hour Number	Seals	
			Seen Number	Collected Number
V94-H50	0.5	2.0	1	1
V94-H77	0.2	0.0	0	0
V95-H50	2.8	0.3	1	0
V95-H51	0.7	0.0	0	0
V96-H51	1.9	1.0	2	1
V96-H52	1.8	0.0	0	0
V96-H53	0.8	1.2	1	1
V97-H51	2.1	0.0	0	0
V97-H52	2.0	4.0	8	0
V97-H53	1.6	1.2	2	0
V98-H51	1.6	0.6	1	0
V98-H52	2.8	6.4	18	7
V98-H53	1.3	0.7	1	1
V98-H54	0.3	0.0	0	0
V99-H51	1.6	2.5	4	2
V99-H52	4.4	2.7	12	7
V99-H53	2.2	1.8	4	0
V99-H54	3.4	0.8	3	0
V100-H52	4.0	2.2	9	2
V100-H53	2.9	1.3	4	1
V100-H54	1.4	1.4	2	0

<sup>1/</sup> The base chart is USCGS No. 5052. The sides of each unit are 10 minutes of latitude by 10 minutes of longitude. The units are located by a system of vertical column and horizontal row numbers. Vertical column numbering begins at the lower right corner of chart (fig. 12) and horizontal row numbering begins at the lower left corner.

Table B-4 .--Number of seals seen, and number seen per boat-hunting day, by 10-day periods, <sup>1/</sup> off Washington, 8 March to 27 May 1971

Period	Boat-hunting days <sup>2/</sup>	Total seals seen	Seals seen per boat-hunting day	Seals seen per 10-day interval
	Number	Number	Number	Percent
8-10 Mar.	1.00	16	16.0	1.2
11-20 Mar.	6.75	280	41.5	21.2
21-31 Mar.	4.00	131	32.8	9.9
1-10 Apr.	5.00	262	52.4	19.8
11-20 Apr.	7.00	129	18.4	9.8
21-30 Apr.	6.75	129	19.1	9.7
1-10 May	9.00	193	21.4	14.6
11-20 May	5.00	140	28.0	10.6
21-27 May	<u>6.00</u>	<u>43</u>	<u>7.2</u>	<u>3.2</u>
Total	50.50	1,323	26.2	100.0

<sup>1/</sup> The first and last periods were less than 10 days.

<sup>2/</sup> A boat-hunting day is a day in which a vessel is used for 8 hours or more; units of boat-hunting days are 0.25, 0.50, 0.75, and 1.00.

Table B-5 .--Number of seals collected, and number collected per boat-hunting day, by 10-day periods,<sup>1/</sup> off Washington, 8 March to 27 May 1971

Period	Boat-hunting days <sup>2/</sup> Number	Seals collected			Seals collected per boat-hunting day	
		Males	Females	Total	Number	Percent
		Number	Number	Number		
8-10 Mar.	1.00	0	3	3	3.0	0.8
11-20 Mar.	6.75	10	57	67	9.9	19.0
21-31 Mar.	4.00	3	23	26	6.5	7.3
1-10 Apr.	5.00	4	45	49	9.8	13.9
11-20 Apr.	7.00	5	26	31	4.4	8.8
21-30 Apr.	6.75	2	40	42	6.2	11.9
1-10 May	9.00	14	46	60	6.7	17.0
11-20 May	5.00	12	49	61	12.2	17.3
21-27 May	<u>6.00</u>	<u>3</u>	<u>11</u>	<u>14</u>	<u>2.3</u>	<u>4.0</u>
Total	50.50	53	300	353	6.8	100.0

<sup>1/</sup> The first and last periods were less than 10 days.

<sup>2/</sup> A boat-hunting day is a day in which a vessel is used for 8 hours or more; units of boat-hunting days are 0.25, 0.50, 0.75, and 1.00.

Table B-6 .--Total seals sighted, collected, wounded and lost, and killed and lost between California and the Bering Sea, 1958-71

Year	Total seals sighted <sup>1/</sup> Number	Sighted seals					
		Collected		Wounded and lost		Killed and lost	
		Number	Percent	Number	Percent	Number	Percent
1958	7,024	1,503	21.4	302	4.3	255	3.6
1959	5,919	1,548	26.2	316	5.3	286	4.8
1960	6,287	1,495	23.8	271	4.3	241	3.8
1961	3,415	1,352	40.0	176	5.2	124	3.6
1962	6,111	1,483	24.3	178	2.9	133	2.2
1963	5,790	1,355	23.4	202	3.5	143	2.5
1964	2,864	883	30.8	97	3.4	68	2.4
1965	1,627	419	27.8	50	3.1	45	2.8
1966	2,704	444	16.4	78	2.9	67	2.5
1967 <sup>2/</sup>	897	132	14.7	27	3.0	22	2.5
1968 <sup>3/</sup>	2,587	830	32.1	66	2.6	104	4.0
1969	1,136	334	29.4	41	3.6	42	3.7
1970	1,983	405	20.4	78	3.9	69	3.5
1971	1,323	353	26.7	44	3.3	63	4.8
Total	49,667	12,536	25.2	1,926	3.9	1,662	3.3

<sup>1/</sup> Not all seals sighted are hunted.

<sup>2/</sup> Includes 16 days during November and December 1966.

<sup>3/</sup> Includes 25 days during November and December 1967.

Table B-7 .--Total seals shot, percentage collected, wounded and lost, and killed and lost between California and the Bering Sea, 1958-71

Year	Total seals shot Number	Seals shot					
		Collected		Wounded and lost		Killed and lost	
		Number	Percent	Number	Percent	Number	Percent
1958	2,060	1,503	73.0	302	14.6	255	12.4
1959	2,150	1,548	72.0	316	14.7	286	13.3
1960	2,007	1,495	74.5	271	13.5	241	12.0
1961	1,652	1,352	81.8	176	10.7	124	7.5
1962	1,794	1,483	82.7	178	9.9	133	7.4
1963	1,700	1,355	79.7	202	11.9	143	8.4
1964	1,048	883	84.3	97	9.3	68	6.4
1965	514	419	81.5	50	9.7	45	8.8
1966	589	444	75.4	78	13.2	67	11.4
1967 <sup>1/</sup>	181	132	72.9	27	14.9	22	12.2
1968 <sup>2/</sup>	1,000	830	83.0	66	6.6	104	10.4
1969	417	334	80.1	41	9.8	42	10.1
1970	552	405	73.4	78	14.1	69	12.5
1971	460	353	76.7	44	9.6	63	13.7
Total	16,124	12,536	77.8	1,926	11.9	1,662	10.3

<sup>1/</sup> Includes 16 days during November and December 1966.

<sup>2/</sup> Includes 25 days during November and December 1967.

Table B-8 .--Number of seals per group among 1,323 seals sighted off Washington, 8 March to 27 May 1971

Number of seals in group	Seals		
	Group Number	Number	Percent
1	528	528	39.9
2	158	316	23.9
3	81	243	18.4
4	32	128	9.7
5	12	60	4.5
6	5	30	2.3
8	1	8	0.6
10	1	10	0.7
Total	818	1,323	100.0

1/ includes (age 12, May) seal with no weight.

Table B-9 . -- Monthly mean lengths of pregnant female seals collected pelagically by the United States off Washington, 8 March to 27 May 1971

Age Years	March		April		May		Combined length		
	Seals Number	Mean length Cm.	Seals Number	Mean length Cm.	Seals Number	Mean length Cm.	Seals Number	Mean Cm.	Standard deviation Cm.
5	2	122.0	2	119.5	2	117.5	6	119.7	4.84
6	6	121.7	7	120.3	5	120.8	18	120.9	4.06
7	7	120.0	9	123.9	4	123.2	20	122.4	5.82
8	6	124.2	5	123.6	1	125.0	12	124.0	6.80
9	2	119.5	1	125.0	3	122.3	6	121.8	4.07
10	2	119.0	6	126.3	6	125.5	14	124.9	5.55
11	4	130.7	1	126.0	3	127.7	8	129.0	3.38
12	5	125.4	5	126.6	$\frac{1}{3}$	123.0	$\frac{1}{13}$	125.3	4.40
13	4	131.5	4	128.2	-	-	8	129.9	5.33
14	1	127.0	1	120.0	-	-	2	123.5	-
15	-	-	2	123.0	-	-	2	123.0	-
16	1	120.0	-	-	1	127.0	2	123.5	-
18	-	-	3	132.0	-	-	3	132.0	-
20	-	-	1	125.0	-	-	1	125.0	-
22	<u>1</u>	126.0	<u>-</u>	-	<u>-</u>	-	<u>1</u>	126.0	-
Total	41		47		$\frac{1}{28}$		$\frac{1}{116}$		

1/ Includes (age 12, May) seal with no weight.

Table B-10. --Monthly mean weights of pregnant female seals collected pelagically by the United States off Washington, 8 March to 27 May 1971

Age Years	March		April		May		Combined weight		
	Seals Number	Mean weight Kg.	Seals Number	Mean weight Kg.	Seals Number	Mean weight Kg.	Seals Number	Mean Kg.	Standard deviation Kg.
5	2	32.5	2	34.5	2	31.0	6	32.7	2.80
6	6	31.3	7	31.9	5	36.2	18	32.9	3.89
7	7	33.1	9	35.8	4	38.5	20	35.4	3.35
8	6	33.2	5	32.6	1	42.0	12	33.7	5.37
9	2	33.0	1	36.0	3	38.3	6	36.2	3.25
10	2	33.0	6	38.3	6	44.8	14	40.4	5.26
11	4	41.3	1	38.0	3	40.0	8	40.4	4.93
12	5	38.6	5	41.4	1/2	44.5	1/12	40.7	4.96
13	4	41.5	4	43.0	-	--	8	42.2	4.56
14	1	40.0	1	41.0	-	-	2	40.5	-
15	-	-	2	38.0	-	-	2	38.0	-
16	1	40.0	-	-	1	52.0	2	46.0	-
18	-	-	3	44.3	-	-	3	44.3	-
20	-	-	1	46.0	-	-	1	46.0	-
22	1	42.0	-	-	-	-	1	42.0	-
Total	41		47		1/27		1/115		

1/ Does not include (age 12, May) seal with weight missing.

Table B-11. --Monthly mean lengths of nonpregnant female seals collected pelagically by the United States off Washington, 8 March to 27 May 1971

Age Years	March		April		May		Combined length		
	Seals Number	Mean length Cm.	Seals Number	Mean length Cm.	Seals Number	Mean length Cm.	Seals Number	Mean length Cm.	Standard deviation Cm.
1	2	74.0	8	75.0	11	77.5	21	76.2	3.35
2	1	89.0	4	92.5	9	92.2	14	92.1	5.17
3	6	97.8	16	99.6	17	101.2	39	100.0	3.55
4	15	110.0	14	109.1	27	109.3	56	109.4	5.15
5	5	112.0	7	113.4	6	110.0	18	111.9	4.09
6	2	116.5	4	116.0	2	117.5	8	116.5	4.04
7	-	-	2	124.0	1	131.0	3	126.3	-
8	1	127.0	1	129.0	1	122.0	3	126.0	-
9	3	125.0	2	122.5	-	-	5	124.0	4.12
10	3	129.0	-	-	1	130.0	4	129.2	-
11	1	131.0	-	-	1	134.0	2	132.5	-
12	2	131.5	1	129.0	-	-	3	130.7	-
14	-	-	1	121.0	-	-	1	121.0	-
15	-	-	2	129.0	-	-	2	129.0	-
16	1	119.0	-	-	-	-	1	119.0	-
17	-	-	2	129.0	-	-	2	129.0	-
Total	42		64		76		182		

Table B-12. --Monthly mean weights of nonpregnant female seals collected pelagically by the United States off Washington, 8 March to 27 May 1971

Age Years	March		April		May		Combined weight		
	Seals Number	Mean weight Kg.	Seals Number	Mean weight Kg.	Seals Number	Mean weight Kg.	Seals Number	Mean weight Kg.	Standard deviation Kg.
1	2	6.0	8	8.1	11	10.6	21	9.2	2.02
2	1	13.0	4	14.2	9	13.1	14	13.4	1.99
3	6	14.8	16	17.2	17	18.7	39	17.5	2.08
4	15	21.9	14	21.9	27	22.8	56	22.3	2.69
5	5	23.4	7	25.4	6	25.0	18	24.7	3.34
6	2	22.5	4	26.5	2	26.5	8	25.5	2.73
7	-	-	2	29.0	1	33.5	3	30.5	-
8	1	37.0	1	35.0	1	35.0	3	35.7	-
9	3	32.0	2	32.0	-	-	5	32.0	4.69
10	3	37.3	-	-	1	37.0	4	37.2	-
11	1	42.0	-	-	1	40.0	2	41.0	-
12	2	39.5	1	40.0	-	-	3	39.7	-
14	-	-	1	30.0	-	-	1	30.0	-
15	-	-	2	38.5	-	-	2	38.5	-
16	1	36.0	-	-	-	-	1	36.0	-
17	-	-	2	38.5	-	-	2	38.5	-
Total	42		64		76		182		

Table B-12. --Monthly mean weights of nonpregnant female seals collected pelagically by the United States off Washington, 8 March to 27 May 1971

Table B-13. --Monthly mean lengths of male seals collected pelagically by the United States off Washington, 8 March to 27 May 1971

Age Years	March		April		May		Combined length		
	Seals Number	Mean length Cm.	Seals Number	Mean length Cm.	Seals Number	Mean length Cm.	Seals Number	Mean length Cm.	Standard deviation Cm.
1	3	77.3	2	82.5	15	81.4	20	80.9	3.39
2	5	94.2	3	92.3	9	97.7	17	95.7	5.12
3	2	99.0	1	106.0	3	107.0	6	104.2	4.92
4	3	120.0	5	114.2	2	118.0	10	116.7	7.29
Total	13		11		29		53		

-	32.7	3	35.0	1	35.0	1	37.0	1	8
9	35.0	2	-	-	35.0	2	35.0	3	9
-	37.2	4	37.0	1	-	-	37.2	2	10
-	41.0	2	40.0	1	-	-	42.0	1	11
-	39.7	3	-	-	40.0	1	39.2	2	12
-	30.0	1	-	-	30.0	1	-	-	14
-	38.2	2	-	-	38.2	2	-	-	15
-	36.0	1	-	-	-	-	36.0	1	16
-	38.2	2	-	-	38.2	2	-	-	17
		18		16		14		42	Total

Table B-14. --Monthly mean weights of male seals collected pelagically by the United States off Washington, 8 March to 27 May 1971

Age Years	March		April		May		Combined weight		
	Seals Number	Mean weight Kg.	Seals Number	Mean weight Kg.	Seals Number	Mean weight Kg.	Seals Number	Mean Kg.	Standard deviation Kg.
1	3	8.3	2	11.5	15	11.0	20	10.7	1.66
2	5	14.8	3	16.0	9	15.4	17	15.9	2.29
3	2	19.5	1	22.0	3	23.0	6	21.7	2.07
4	3	22.7	5	27.0	2	31.5	10	26.6	4.65
Total	13	16.0	11	19.5	29	19.7	53	18.5	3.1

1 Mean weight for seven seals only.

Table B-15. --Monthly mean lengths and weights of fur seal fetuses collected pelagically by the United States off Washington, 8 March to 27 May 1971

Period	Male			Female		
	Fetuses Number	Mean length Cm.	Mean weight Kg.	Fetuses Number	Mean length Cm.	Mean weight Kg.
8-10 Mar.	1	36.0	1.1	2	30.5	0.8
11-20 Mar.	12	37.9	1.4	13	38.0	1.2
21-31 Mar.	9	39.5	1.6	4	39.7	1.5
1-10 Apr.	8	41.1	1.7	13	40.5	1.5
11-20 Apr.	7	47.6	2.4	4	46.0	2.1
21-30 Apr.	7	49.1	2.7	8	46.7	<sup>1/</sup> 2.4
1-10 May	6	52.7	3.3	7	46.1	2.4
11-20 May	5	55.8	4.0	8	52.5	3.2
21-27 May	-	-	-	2	57.0	4.0

<sup>1/</sup> Mean weight for seven seals only.

Table B-16. --Reproductive condition of female fur seals collected pelagically by the United States off Washington, 8 March to 27 May 1971

Age Years	Nulliparous			Primiparous			Multiparous			Total		
	Ovulated			Nonpregnant		Pregnant	Nonpregnant		Pregnant			
	Yes	No	Total	Yes <sup>1/</sup>	No	Total	Yes <sup>1/</sup>	No	Total			
	Number											
<u>March</u>												
1	-	2	2	-	-	-	-	-	-	2		
2	-	1	1	-	-	-	-	-	-	1		
3	-	6	6	-	-	-	-	-	-	6		
4	-	15	15	-	-	-	-	-	-	15		
5	-	4	4	1[1-A]	-	1	2	-	-	7		
6	1	1	2	-	-	-	1	-	-	8		
7	-	-	-	-	-	-	-	-	-	7		
8	-	-	-	-	-	-	1	1	1	7		
9	-	-	-	1	-	1	-	2	2	5		
10	-	-	-	2[1-A]	-	2	-	1	1	5		
11	-	-	-	-	-	-	-	1	1	5		
12	1	-	1	-	-	-	-	1	1	7		
13	-	-	-	-	-	-	-	-	-	4		
14	-	-	-	-	-	-	-	-	1	1		
16	-	-	-	-	-	-	1	-	1	2		
22	-	-	-	-	-	-	-	-	1	1		
Total	2	29	31	4[2-A]	-	4	4	6	1	7	37	83
<u>April</u>												
1	-	8	8	-	-	-	-	-	-	-	8	
2	-	4	4	-	-	-	-	-	-	-	4	
3	-	16	16	-	-	-	-	-	-	-	16	
4	-	14	14	-	-	-	-	-	-	-	14	
5	-	7	7	-	-	-	2	-	-	-	9	
6	2	2	4	-	-	-	4	-	-	3	11	
7	1	-	1	1	-	1	2	-	-	7	11	
8	-	-	-	-	-	-	1	1	1	4	6	
9	-	-	-	1	-	1	-	1	-	1	3	
10	-	-	-	-	-	-	-	-	-	6	6	
11	-	-	-	-	-	-	-	-	-	1	1	
12	-	-	-	-	-	-	-	1	1	5	6	
13	-	-	-	-	-	-	-	-	-	4	4	
14	-	-	-	-	-	-	-	1	1	1	2	
15	-	-	-	-	-	-	-	2[1-A]	-	2	4	
17	-	-	-	-	-	-	-	1	1	2	2	
18	-	-	-	-	-	-	-	-	-	3	3	
20	-	-	-	-	-	-	-	-	-	1	1	
Total	3	51	54	2	-	2	9	6[1-A]	2	8	38	111
<u>May</u>												
1	-	11	11	-	-	-	-	-	-	-	11	
2	-	9	9	-	-	-	-	-	-	-	9	
3	-	17	17	-	-	-	-	-	-	-	17	
4	-	27	27	-	-	-	-	-	-	-	27	
5	1	5	6	-	-	-	2	-	-	-	8	
6	1	1	2	-	-	-	1	-	-	4	7	
7	-	1	1	-	-	-	-	-	-	4	5	
8	-	-	-	-	-	-	-	1	1	1	2	
9	-	-	-	-	-	-	-	-	-	3	3	
10	-	-	-	-	-	-	-	1	1	6	7	
11	-	-	-	-	-	-	-	1	1	3	4	
12	-	-	-	-	-	-	-	-	-	3	3	
16	-	-	-	-	-	-	-	-	-	1	1	
Total	2	71	73	-	-	-	3	-	3	3	25	104

1/ The nonpregnant ovulated columns include seals that aborted a conceptus (indicated [number-A] thus).

Table B-17. --Pregnancy rates of female seals collected pelagically by the United States off Washington, 8 March to 27 May 1971

Table B-17. --Pregnancy rates of female seals collected pelagically by the United States off Washington, 8 March to 27 May 1971

Age Years	March			April			May			Combined data	
	Seals Number	Pregnant Number	Percent	Seals Number	Pregnant Number	Percent	Seals Number	Pregnant Number	Percent	Mar. -May Pregnant Percent	1958-71 pelagic collections Pregnant Percent
3	6	-	0.0	16	-	0.0	17	-	0.0	0.0	0.3
4	15	-	0.0	14	-	0.0	27	-	0.0	0.0	3.0
5	7	2	28.6	9	2	22.2	8	2	25.0	25.0	37.9
6	8	6	75.0	11	7	63.6	7	5	71.4	69.2	71.9
7	7	7	100.0	11	9	81.8	5	4	80.0	87.0	80.0
8	7	6	85.7	6	5	83.3	2	1	50.0	80.0	85.8
9	5	2	40.0	3	1	33.3	3	3	100.0	54.5	89.2
10	5	2	40.0	6	6	100.0	7	6	85.7	77.8	88.2
11	5	4	80.0	1	1	100.0	4	3	75.0	80.0	88.5
12	7	5	71.4	6	5	83.3	3	3	100.0	81.2	87.7
13	4	4	100.0	4	4	100.0	-	-	-	100.0	86.2
14	1	1	100.0	2	1	50.0	-	-	-	66.7	83.2
15	-	-	-	4	2	50.0	-	-	-	50.0	82.1
16	2	1	50.0	-	-	-	1	1	100.0	66.7	80.0
17	-	-	-	2	-	0.0	-	-	-	0.0	67.7
18	-	-	-	3	3	100.0	-	-	-	100.0	67.7
20	-	-	-	1	1	100.0	-	-	-	100.0	49.2
22	1	1	100.0	-	-	-	-	-	-	100.0	35.7

The pregnant females indicated (number-A) (see)

## Appendix C

## PERSONS ENGAGED IN FUR SEAL RESEARCH IN 1971

<u>Name</u>	<u>Field work schedule</u>		<u>Affiliation</u>	<u>Work</u>
	<u>Start</u>	<u>Finish</u>		
<u>Pribilof Islands</u>				
<u>Permanent employees</u>				
Patrick Kozloff	25 May	19 Oct.	Marine Mammal Biological Lab.	Seal research, general
Ancel M. Johnson	1 June	9 June	-----do.-----	Do.
George Y. Harry, Jr.	16 June	30 June	-----do.-----	Laboratory Director
Alton Y. Roppel	11 Aug.	18 Aug.	-----do.-----	Seal research, general
Mark C. Keyes	22 June	28 July	-----do.-----	Seal research, mortality
Raymond E. Anas	29 June	14 July	-----do.-----	Seal research, general
	27 July	18 Aug.	-----do.-----	Do.
Lavrenty Stepetin	10 Aug.	18 Aug.	-----do.-----	Do.
	When needed		St. Paul Island resident	
<u>Temporary employees</u>				
Dionsey Bourdukofsky	25 May	19 Oct.	St. Paul Island resident	Seal research, general
Terrell C. Newby	16 June	18 Aug.	Student, U. of Wash.	Do.
Peter A. Dzikiewicz	22 June	18 Aug.	Cornell U. (leave of absence)	Do. and tourist guide
Ronald G. Pletnikoff	23 June	31 Aug.	Student, Southwestern College, Winfield	Seal research, general
Anthony Philemonoff	23 June	15 Sept.	Student, Anchorage Community College	Do.
Perfenia Pletnikoff, Jr.	23 June	22 Sept.	-----do.-----	Do.
William B. McGuire	29 June	18 Aug.	Student, U. of Calif. Davis	Seal research, mortality
<u>Pelagic Investigations</u>				
<u>Permanent employees</u>				
Hiroshi Kajimura	1 Mar.	17 May	Marine Mammal Biological Lab.	Seal research, general
Allen Wolman	1 Mar.	17 May	-----do.-----	Do.
Clifford H. Fiscus	28 Mar.	28 May	-----do.-----	Do.
	17 Aug.	7 Sept.		On San Miguel Island

PERSONS ENGAGED IN FUR SEAL RESEARCH IN 1971

Name	Field work schedule		Affiliation	Work
	Start	Finish		
<u>Temporary employees</u>				
Robert E. Atkinson	1 Mar.	28 May	Marine Mammal Biological Lab.	Seal research, general
Richard O. Larson	1 Mar.	28 May	-----do.-----	Do.
<u>Permanent employees</u>				
Allen Wolman	1 Mar.	17 May	Biological Lab.	Do.
Clifford H. Fiscus	28 Mar.	28 May	-----do.-----	Do.
On San Miguel Island	17 Aug.	7 Sept.		
<u>Politic investigations</u>				
William B. McGuire	29 June	18 Aug.	Student, U. of Calif.	Seal research, mortality
Peter A. Pletnikoff	23 June	21 Sept.	Community College	Do.
Ronald G. Pletnikoff	23 June	31 Aug.	Student, Winfield College, Anchorage	Seal research, mortality
Peter A. Dakiewicz	22 June	18 Aug.	Cornell U. (leave of absence)	tourist guide
Terrill C. Newby	16 June	18 Aug.	Student, U. of Wash.	Do.
Dionsey Bourdukoulsky	25 May	19 Oct.	St. Paul Island resident	Seal research, general
<u>Temporary employees</u>				
Lavrenty Stepetin	When needed		St. Paul Island resident	Do.
Raymond E. Anas	10 Aug.	18 Aug.	-----do.-----	Seal research, mortality
Mark C. Keyes	29 June	14 July	-----do.-----	Seal research, general
Alton Y. Roppel	22 June	28 July	-----do.-----	Seal research, general
George Y. Harry, Jr.	16 June	30 June	-----do.-----	Laboratory Director
Angel M. Johnson	1 June	9 June	-----do.-----	Do.

## Appendix D

FUR SEAL, Callorhinus ursinus, AND NORTHERN  
(STELLER) SEA LION, Eumetopias jubatus, OBSERVATIONS  
SOUTH OF THE WESTERN ALEUTIAN ISLANDS

by  
Clifford H. Fiscus

## INTRODUCTION

Reports made in the 1890's by pelagic sealers indicated the possible abundance of northern fur seals south of the western Aleutian Islands during their spring migration.

Since a survey of the area had not been made for northern fur seals by the Marine Mammal Biological Laboratory (MMBL), I joined the R/V George B. Kelez as an observer on 15 May 1970 at Adak, Alaska. Data on northern sea lions was also recorded. The Kelez was on a scheduled research cruise for the Ocean Distribution, Migrations, and Abundance of Salmon Program of the former Seattle Biological Laboratory (now the Northwest Fisheries Center) of the National Marine Fisheries Service, in the area bounded by latitudes 48° N and 52° N, and longitudes 174° W and 174° E. Their objective was to study the distribution and movements of salmon just before and during the early part of the Japanese mothership salmon fishery in the area. The latitudinal and longitudinal boundaries include part of the area where pelagic sealers suggested an abundance of northern fur seals before 1900. In this report, the region described above is referred to as the survey area, and northern fur seals and northern sea lions as seals and sea lions, respectively.

## ACKNOWLEDGMENTS

I wish to thank Gerald B. Collins, Director of the Seattle Biological Laboratory in 1970, and Robert French, Program Leader of the Ocean Distribution, Migrations, and Abundance of Salmon Investigations, for allowing me to take part in this cruise. The assistance of Richard Bakkala and Robert Carlson, members of the program, and Captain Roy Robeck of the Kelez, his officers, and crew was appreciated.

## OBSERVATIONS OF SEALS AND SEA LIONS

Historical records of seal sightings and oceanographic conditions south of the western Aleutians follow:

Townsend (1899) assembled the records of 123 pelagic sealing vessels made on voyages from 1883 to 1897. His data showing the location of sealing in the North Pacific Ocean and Bering Sea indicated that some sealers operated in the survey area during July, August, and September (limited to 1 day in each of the last 2 months).

Captain Bissett<sup>1/</sup> (p. 38), who reported on the distribution of seals and their migrations in the 1880-1900 period, stated "A large bank exists probably 150-200 miles south of Attu Island extending from the meridian of Attu to the 180th. The extent of this bank, north and south, is evidently very great. There is evidence from the color of the water and the flocks of sea birds that there must be soundings at no very great depth in the large area. This seems to be a herding for young bulls principally and a few of the smaller cows. I have crossed the bank many times. The area was well known to most of the old sealers that visited the Japan and Copper Island sealing grounds and we crossed it diagonally on our return from Copper Island to Cape Flattery. It was the general opinion of the sealer that the herd was a part of the Copper Island herd."

In 1936, the Coast Guard Cutter Chelan (see footnote 1; p. 46) ran several lines of soundings through the area: "The object of sounding south of the Aleutians to find and develop a bank reported south of Attu by an 'old time sealer' as a herding place for young bull seals. The report stated that the shoal was known to most of the older sealers who visited Japan and Copper Island and that it was crossed diagonally when returning from the Commander Islands and to Cape Flattery. The Chelan failed to find such a bank, but instead, learned that the Aleutian Trough is much narrower, closer to the islands, and deeper than hitherto supposed. There is reason for believing also that it extends further west than at present shown."

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<sup>1/</sup> Report of oceanographic cruise of U. S. Coast Guard Cutter Chelan in Bering Sea and Bering Strait, 1934, F. A. Zeusler, Captain. Processed report, U. S. Coast Guard, 1 June 1936. In files of Marine Mammal Biological Laboratory, Seattle, Wash.

Felix Favorite (1969) explained that the change in water color sometimes encountered in this area, first noted by Captain Bissett, is actually a westward intrusion of coastal water from the Gulf of Alaska.

Waters rich in microplankton and macroplankton attract concentrations of birds, seals, and other marine life, including salmon. (The stomachs of many salmon caught during this cruise contained euphausiids and several contained squids (Gonatidae).) The conditions of discolored water and concentrations of birds, seals, and other marine mammals commonly encountered on fishing banks and river and estuarine outfalls is usually indicative of shallow water. Before the advent of the modern fathometer, mariners used the appearance of water and other natural signs as a guide to depth. The hand lead was not regularly cast deeper than necessary to assure safety of the vessel.

Captain F. A. Zeusler (see footnote 1) with the help of Captain Bissett prepared a chart entitled "Monthly travel of the seal herds." They show seals south of the western Aleutian Islands in June and again in September.

The center of the area surveyed (lat. 50° N, long. 180°) is about 1,100 km equidistant from the Commander and Pribilof Islands groups (the major breeding grounds of seals) (Fig. D-1). In recent years, tag recoveries from seals collected on the breeding grounds and at sea in the western and eastern North Pacific Ocean and in the Bering Sea since 1958 have shown that seals of different origins intermingle at sea and on land. Captain Bissett's opinion that seals found here were from the Copper Island herd cannot be verified.

Salmon fishing stations of the Kelez, the approximate daily tracklines between stations, and the location of seal and sea lion sightings are shown in figure D-2. Table D-1 lists these data and additional information relevant to the cruise.

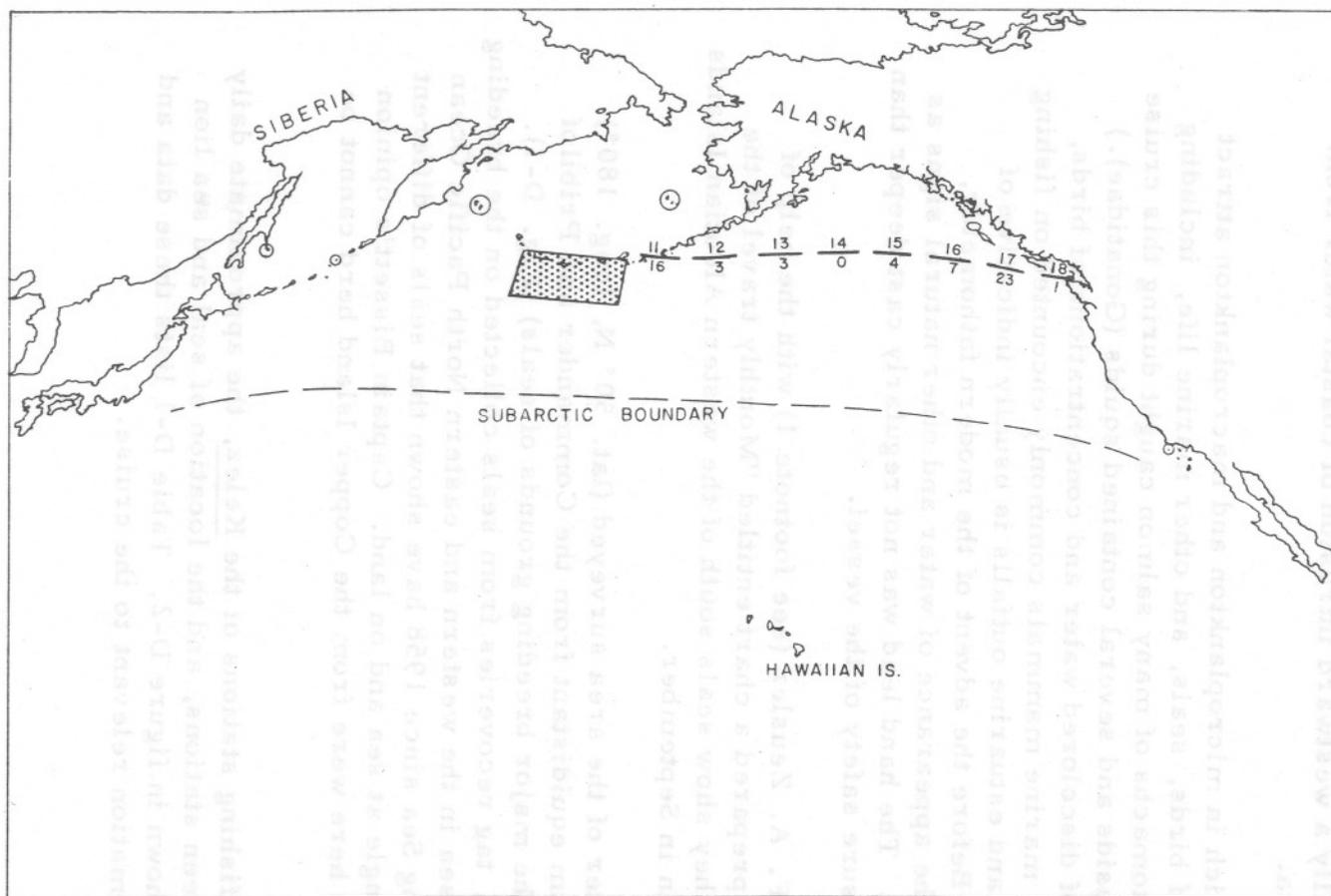


Figure D-1. --North Pacific Ocean: Waters north of subarctic boundary are frequented by the northern fur seal. Home islands are circled, from left to right, Robben Island, several small colonies in the Kuril Islands group, Commander Islands, Pribilof Islands, and a small colony at San Miguel Island. The general area where the R/V George B. Kelez operated from 16 May to 9 June 1970 is shaded (see fig. D-2 for details). The approximate daily runs 11-18 June 1970 are shown, the date is above and the number of seals sighted below the line indicating the days run.

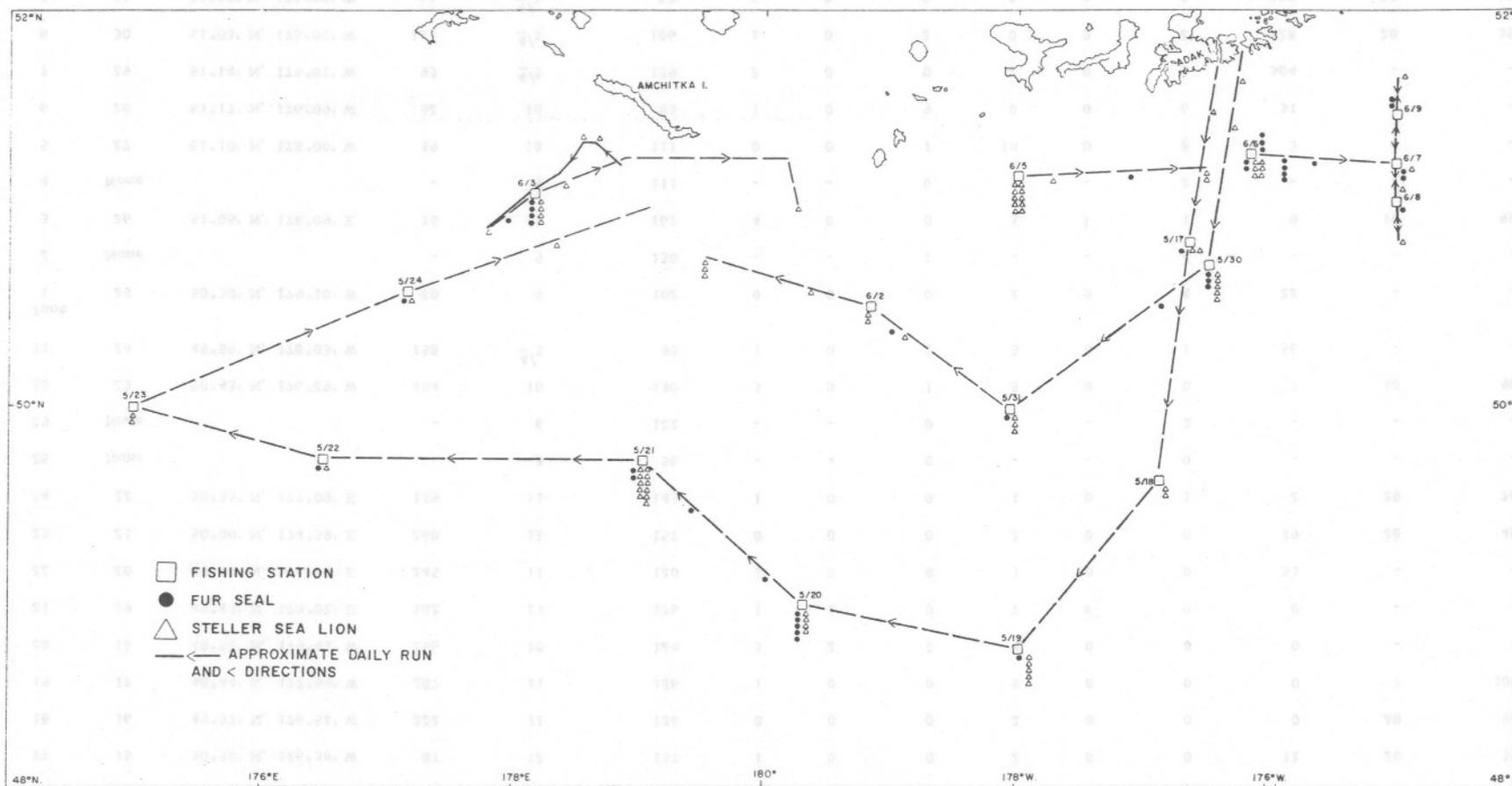


Figure D-2. --Area where R/V George B. Kelez operated 16 May to 9 June 1970. Haul date is given for each fishing station. Approximate locations where fur seals, Callorhinus ursinus, and northern sea lions, Eumetopias jubatus, were sighted are shown.

Table D-1. --Fur seals (*Callorhinus ursinus*) and northern sea lions (*Eumetopias jubatus*) seen 16 May to 9 June 1970 from the R/V George B. Kelez during a salmon research cruise

Date	Set number	Set location Latitude Longitude		Distance from nearest land Km.	Hours of observation <sup>1/</sup>	Distance run during day Km	Fur seals			Northern sea lions			Salmon				
							Observations at station		Observations between stations	Observations at station		Observations between stations	Catch	Decoys			
							Am <sup>2/</sup>	Pm <sup>3/</sup>		Am <sup>2/</sup>	Pm <sup>3/</sup>			Fished	Loss		
							-----Number-----			-----Number-----			-----Number-----		Percent		
May																	
16	None			-	5	100	-	-	0	-	-	1	-	-	-	-	-
17	15	50°50' N, 176°38' W		87	12	137	1	0	0	2	0	0	12	20		35	
18	16	49°37' N, 176°52' W		222	11	126	0	0	0	2	0	0	0	20		95	
19	17	48°44' N, 177°59' W		287	11	126	1	0	0	5	0	0	0	7		100	
20	18	48°58' N, 179°41' W		256	10	124	3	2	2	4	0	0	0	-		-	
21	19	49°43' N, 179°02' E		182	13	176	1	1	0	7	4	0	0	-		-	
22	20	49°44' N, 176°29' E		245	11	120	1	0	0	1	0	0	53	-		-	
23	21	50°00' N, 174°59' E		260	12	157	0	0	0	2	0	0	19	20		45	
24	22	50°35' N, 177°09' E		139	11	143	1	0	0	1	0	1	2	20		70	
25	None			-	3	56	-	-	0	-	-	0	-	-		-	
29	None			-	6	122	-	-	0	-	-	2	-	-		-	
30	23	50°43' N, 176°29' W		104	10	130	3	0	1	5	0	0	1	10		90	
31	24	49°59' N, 178°03' W		158	<u>4/3</u>	93	1	0	1	3	0	1	56	-		-	
June																	
1	25	50°30' N, 179°10' W		80	9	102	0	0	0	2	0	4	22	-		-	
2	None			-	9	130	-	-	1	-	-	4	-	-		-	
3	26	51°05' N, 178°09' E		70	11	167	4	0	0	3	1	1	0	18		95	
4	None			-	8	111	-	-	0	-	-	2	-	-		-	
5	27	51°10' N, 178°00' W		39	10	111	0	0	1	10	0	8	3	-		-	
6	28	51°17' N, 176°09' W		52	10	83	1	0	9	0	0	6	31	-		-	
7	29	51°14' N, 175°01' W		93	<u>4/3</u>	139	2	0	0	1	0	1	304	-		-	
8	30	51°03' N, 175°01' W		111	<u>4/3</u>	106	1	0	2	0	0	2	128	20		35	
9	31	51°29' N, 175°00' W		61	<u>4/2</u>	82	0	0	0	0	0	0	379	20		15	

<sup>1/</sup> Includes haul time.  
<sup>2/</sup> Am. of haul day.  
<sup>3/</sup> Pm. of day net set.  
<sup>4/</sup> No regular watch maintained.

Two seals were collected during the voyage while the gear was hauled. Data for each are:

	Seal 1 <sup>2/</sup>	Seal 2
Collection number	3775	3776
Date	31 May 1970	3 June 1970
Age and sex	10-year-old female	3-year-old male
Length	119 cm	126 cm
Weight	39 kg	26 kg
Reproductive condition	Multiparous pregnant (Fetus--male, length 62 cm, weight 5100 g)	

Data on stomach contents for these seals are given in the section of this report on "Food and Feeding."

Seals were not abundant in the area during the survey, but were sighted at 12 of the 17 stations fished. The largest number seen at the fishing gear on one day was four and during a day's run between stations, nine. Sea lions, sighted at 14 of 17 stations, were more numerous than seals. The largest number seen on one day was 10 while the gear was hauled and 8 while running between stations. Distance from the nearest land (i. e., possible sea lion hauling grounds) did not seem to alter the number of sea lions; they were as abundant at offshore as at inshore stations.

Sighted seals and sea lions were closely observed and notes made of size and sex when possible. Male seals were definitely identified. The presence of male seals in the area had first been mentioned by Captain Bissett (see footnote 1). Seven adult or at least half-grown males, seven adult females, and nine immature seals were sighted at fishing stations when nets or longline gear were set or hauled, and 17 seals, age and sex undetermined, were sighted on runs between stations. Nineteen male sea lions, 29 medium-size males or adult or younger females, and 5 small sea lions, probably yearlings, were sighted at fishing stations when nets or longline gear were set or hauled, and 33 sea lions, age and sex undetermined, were sighted between stations.

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<sup>2/</sup> Seal had been tagged as a pup with No. M-48939, 1 September 1960, Northeast Point Rookery, St. Paul Island, Alaska.

The Ocean Distribution Program of the Seattle Biological Laboratory fished in the survey area during part of the 1969 season.<sup>3/</sup> Seals and sea lions sighted when the net was hauled each morning were recorded by the biologist in charge. The Kelez fished nine stations 2-11 June 1969: 6 seals at 5 stations and 19 sea lions at 7 stations were seen. The R/V Miller Freeman<sup>4/</sup> and the Kelez fished 39 stations from 3 July through 15 August 1969. In July, 9 seals were seen at 11 of 27 stations fished, plus an unknown number sighted at two stations where exact counts were not made. Sixteen sea lions were seen at 16 of the 27 stations, plus those sighted at 8 stations where numbers were not recorded. Twelve stations were fished 3-15 August: three seals at two stations were seen, as was a single sea lion at one and those at two stations where numbers were not recorded.

Max Thompson<sup>5/</sup> accompanied the Kelez as an observer from 30 September through 19 October 1965. Part of this cruise was in or near the area surveyed in 1970. Although his principal interest was in birds, Thompson also recorded sightings of marine mammals. Between 1 and 9 October he sighted five seals, three of them small in size, and three sea lions in or near the survey area.

In summary, seals have been sighted in the survey area south of the western Aleutian Islands from May through October. Although we have no reports of large numbers of seals in the area, seasonal concentrations are still a possibility. Seals are attracted to gill nets and longline gear, making accurate counts possible from research vessels.

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<sup>3/</sup> Ocean Distribution Program, Seattle Biological Laboratory, daily field records. Catch by mesh size and net direction, cruises 46 and 47.

<sup>4/</sup> National Marine Fisheries Service vessel, Northwest Fisheries Center (formerly Seattle Biological Laboratory).

<sup>5/</sup> Field log, at sea--Aleutians, R/V George B. Kelez, cruise 16, Adak to 41° N, 173° E.

Seals are probably more numerous in the survey area during spring and early summer than in other seasons. Mature and half-grown males are present at this time and may winter here. A few immature animals of both sexes are probably present throughout the year. Females pass through the area during migration.

Sea lions are more abundant in the survey area than seals, at least in the vicinity of the high seas salmon fishery. In May and June 1970 twice as many sea lions as seals were sighted during fishing operations. The number of sea lions found offshore in the survey area has probably increased since the advent of the commercial high seas gillnet and longline fishery for salmon, although we have no records that prove or disprove this statement.

Kenyon and Rice (1961) counted sea lions of the western Aleutian Islands from the air between 19 and 27 May 1959. Their estimates were: Near Islands, 15,410; Rat Islands, 8,450; Delarof Islands, 6,600; and the Andreanof Islands, 14,170. Palmer C. Sekora (Wilderness Studies, Bureau of Sport Fisheries and Wildlife, Anchorage, Alaska, pers. comm., 1970) counted 18,375 sea lions on the Near Islands during the summer of 1970, an increase of about 3,000 animals over the count obtained by Kenyon and Rice in 1959.

#### Seal Observations--Amukta Pass to Cape Flattery

The Kelez departed Adak, Alaska, at 1500 on 10 June, entered the North Pacific Ocean through Amukta Pass the morning of 11 June, and passed Cape Flattery, Wash., about 1400 on 18 June, arriving at Seattle, Wash., at 0700 on 19 June.

A seal watch was maintained during most daylight hours, with the assistance of watch officers and crewmen on the bridge. The approximate daily run, day of month, and the number of seals sighted are shown in figure D-1. Seals were sighted each day except 14 June. More seals were sighted on the first and next to last days of the voyage than on other days. On 11 June, 16 seals were sighted between 1300 and 2200 as the Kelez ran an easterly course from 13 km south of Yunaska Island east to about 37 km south of Cape Sagak on the southwestern end of Umnak Island. On 17 June, 23 seals were sighted between about 315 km west of Cape Scott to about 167 km west of Estevan Point, Vancouver Island.

The numbers and locations of seals seen on this voyage and on a cruise made by Fiscus, Baines, and Kajimura in 1963 (1965) between Cape Flattery and Unimak Pass were similar. Seals were most abundant on the first and last days of the voyage in 1963 as the vessels approached or crossed the continental slope and shelf.

A comparison of seals seen per hour was made between the two crossings. We discounted the records of 18 June 1970, because most of that day's run was made on the continental shelf as the Kelez crossed La Perouse Bank and passed Cape Flattery. The number of seals seen per hour were remarkably similar. Data for the first and last days of 1970 and 1963 are: Aleutian end--1970, 1.1; 1963, 0.8; Cape Flattery end--1970, 1.3; 1963, 0.8. During intervening days in both years, seals seen per hour varied from 0.0 to 0.5. The crossing required 9 days in 1963 and 8 in 1970.

Some information on the ages of seals seen was obtained by recording color of the vibrissae when possible. In general, the vibrissae of seals of both sexes are black to about age 4, mixed black and white at age 5, and white at age 6 and older. Fifty-seven seals were sighted during the crossing; the vibrissae color of 33 could not be determined, 7 were black, and 17 were white. Of the 24 seals whose vibrissae color was noted, 71 percent were mature animals of breeding age.

#### Food and Feeding

Salmon biologists obtain some measure of the degree of predation by marine animals and birds on gill netted fish by attaching decoys (salmon from previous catches) to the net when setting it in the evening and counting those remaining when the net is hauled the next morning. These data are shown in table D-1. (The annual reports of investigations by the International North Pacific Fisheries Commission contain more detailed information on this research.) Possible predators of gill net-caught fish include sea lions, seals, sharks, albatrosses, and sea gulls.

Dall porpoises (Phocoenoides dalli) were seen in the area but we obtained little evidence of their feeding on free-swimming or net-caught fish as large as mature salmon (body length 35-70 cm). To swallow these fish, porpoises would first have to break the salmon into smaller chunks. Mizue, Yoshida, and Takemura (1966) examined the stomach contents of 148 Dall porpoises taken by the Japanese commercial salmon fishing fleets in treaty areas between late May and early August in 1964 and 1965. They reported mostly squid and small amounts of fish and shrimps in the stomachs, and only one occurrence of salmon. They concluded that porpoises probably do not eat adult salmon with regularity.

Dall porpoises were observed near the net several times. Some porpoises avoided the net, but most would not change course to do so. The nets were of greenish colored nylon, 5 ply or less, and the mesh size varied from about 6 to 13 cm. No porpoises became entangled on this cruise, but their capture is not uncommon (Seattle Biological Laboratory Ocean Distribution Program field records). Porpoises are usually able to swim through the net, and probably become entangled only when they approach the net from an oblique angle. Wendell Peterson (Ocean Distribution Program, Biological Laboratory, Seattle, Wash., pers. comm.) reports that the entangled porpoises he has seen seemed to be caught by the tail flukes.

Sea lions and seals were observed swimming along the net, first down one side, then across and up the opposite side. Seals seemed more inclined to play about the net than the sea lions. For example, they would surface and repeatedly roll over the cork line or between it and the net, alternating this behavior with occasional periods of rest. Movements of the seals were slower and they were much less wary than were the sea lions. Sea lions were more aggressive than the seals, seemingly swimming up and down the net with purpose. On several occasions, three to six sea lions were observed "porpoising" along the nets as a group. The sea lion took fish in one bite, sometimes taking parts of the net. Sea lions often surfaced nearby to consume the fish, and if not harassed, they shook the fish into chunks small enough to swallow.

Sea lions, probably mostly males, remain in the area throughout the fishing season. It is possible that they are attracted to a fishing vessel by the sound of its engines and other noises associated with setting the gear. Tikhomirov (1964) asserted that sea lions are attracted to the noise of trawl winches of vessels engaged in the Bering Sea herring fishery. He stated "As the winch begins to turn, sea lions swim toward the vessel, dive to the trawl, and eat the herring." In any event, they usually appear along the net or near the vessel soon after the net is set.

Predation by birds was observed several times during the trip. Fish caught in the upper 50 cm of the net or on longline gear can be reached by albatrosses. On 22 May, as the net was hauled, I watched five Laysan Albatrosses (Diomedea immutabilis), one Black-legged Kittiwake (Rissa tridactyla), two Slender-billed Shearwaters (Puffinus tenuirostris) and two Leach's Petrels (Oceanodroma leucorhoa) tipping up and feeding on a salmon. The petrels could not reach the fish but were getting scraps that floated to the surface. When the fish were brought aboard we found that the birds had eaten about a 10-cm length of flesh to the vertebrae.

Personnel on salmon research cruises have saved for the MMBL dead seals that had become entangled in their gillnets. The stomach contents of these animals and those of seals collected by the MMBL near salmon fishing gear are shown in table D-2. The frequency of occurrence of food items in 11 seals was: squid (3 sp.) 10, salmon (2 sp.) 5, saury 3, Atka mackerel 3, Scopelosaurus harryi 2, and Alaska pollock 1. Although 6 of the 11 seals were taken out of the survey area (south of Unimak Pass or Unalaska Island in the eastern Aleutian Islands), the observations are included here so that all data available on the effect of these mammals on salmon fishing operations are consolidated within a single report.

The stomachs of many of the salmon taken during the cruise contained euphausiids (species undetermined). One squid, Gonatus fabricii, ML 295 mm, was taken in the net 8 June (set 30), and three squids (Berryteuthis magister, ML 70+, 85, 90 mm) were in the stomachs of salmon taken in the same set. One squid,

Table D-2. --Stomach contents of fur seals (*Callorhinus ursinus*) collected from vessels on research cruises

Identification number and date collected	Location of collection	Sex and age	Remarks	Total volume	Stomach contents		
					Food items	Frequency	
						Number	Percent
Lat. and long.	Cc.						
3775 31 May 1970	50°00' N 178°02' W	Female 10	Collected while gill net was hauled by R/V George B. Kelez	2,885	<i>Oncorhynchus gorbuscha</i>	4	50
					<i>Scopelosaurus harryi</i>	1	1
					<i>Onychoteuthis</i> sp.	1	Trace
					Gonatidae	2	10
					<i>Gonatus</i> sp.	14	10
					<i>Gonatopsis borealis</i>	25	29
3776 3 June 1970	51°05' N 177°52' E	Male 3	-----do.-----	150	<i>Pleurogrammus monopterygius</i>	2	10
					Gonatidae	15	60
					<i>Gonatopsis borealis</i>	3	30
None 10 June 1969	51°02' N 176°20' W	Male 3	-----do.-----	585	<i>Oncorhynchus gorbuscha</i>	1	100
					Gonatidae	4	Trace
None 8 Aug. 1969	51°00' N 176°22' W	Female 2	Caught in gill net R/V George B. Kelez	550	<i>Cololabis saira</i>	1	Trace
					<i>Scopelosaurus harryi</i>	3	25
					<i>Gonatopsis borealis</i>	9	75
US68-436 <sup>1/</sup> 6 June 1968	53°43' N 164°04' W	Female 15	Collected near Kelez while gill net was hauled by M/V New St. Joseph	4,015	<i>Oncorhynchus keta</i>	2	84
					<i>Pleurogrammus monopterygius</i>	4	1
					Unidentified fish	1	Trace
					Gonatidae	41	Trace
					<i>Gonatopsis borealis</i>	42	15
US68-437 <sup>1/</sup> 6 June 1968	53°43' N 164°04' W	Male 3	-----do.-----	1,635	<i>Theragra chalcogrammus</i>	3	30
					<i>Pleurogrammus monopterygius</i>	4	30
					Gonatidae	3	Trace
					<i>Berryteuthis magister</i>	5	40
820 <sup>1/</sup> 10 June 1968	53°15' N 164°50' W	Male 3	Caught in gill net of R/V George B. Kelez	2,460	Salmonidae	2	60
					Unidentified fish	2	Trace
					<i>Gonatopsis borealis</i>	34	40
None <sup>1/</sup> 21 Aug. 1966	52°00' N 167°00' W	Male 2	-----do.-----	1,375	<i>Cololabis saira</i>	19	98
					Gonatidae	55	Trace
					<i>Berryteuthis magister</i>	1	2
None <sup>1/</sup> 18 June 1965	53°18' N 166°10' W	Female 4	-----do.-----	-	Gonatidae	22	Trace
None <sup>1/</sup> 18 June 1965	53°18' N 166°10' W	Female 14	-----do.-----	500	<i>Oncorhynchus</i> sp.	1	100
None 26 Aug. 1963	51°16' N 176°34' W	Male 1	Caught in surface-towed trawl of R/V John N. Cobb	660	<i>Cololabis saira</i>	1	1
					<i>Berryteuthis magister</i>	3	99

<sup>1/</sup> Not in study area--south of Unalaska Island or Unimak Pass.

Berryteuthis magister?, was found in the stomach of a king salmon, Oncorhynchus tshawytscha, taken 9 June (set 31). Forty-nine and ninety percent, respectively, of the food found in the stomachs of the two seals taken during this cruise were squid; they were all Gonatidae--species undetermined--and Gonatopsis borealis, except one beak (trace amount) of Onychoteuthis sp.

In summary, we suggest that the sea lion was the principal predator of salmon caught in gill nets or on longline gear in the survey area. Our attempts to collect sea lions were unsuccessful, but we did see them take fish from the net several times. Sea lions have been seen on the fishing grounds throughout the season.

The number of salmon taken from fishing gear by seals is probably quite small when compared to the number taken by sea lions. Although a few seals have been reported throughout the period during which the Japanese mothership fleet operates in the area west of 175° W, the greatest number have been seen in the survey area during the first half of the fishing season (May-June). Seals, like the Dall porpoise in this area, probably feed more extensively on squids and smaller fishes than on gill-netted salmon.

Sharks occur in the area, but because of insufficient data, their predation in this fishery can only be assumed. Feeding of albatrosses and other sea birds on gill-netted fish is insignificant.

In their study of the relationship between seals and the salmon fishery of the western North Pacific Ocean, Japanese biologists found that 1.7 percent of 409,000 salmon had been damaged to some extent; however, they also admitted uncertainty as to how much of the damage was caused by seals (North Pacific Fur Seal Commission, 1969).

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## Appendix E

## FUR SEALS AND FISH NETTING

by

Clifford H. Fiscus and Patrick Kozloff

Fur seals spend about 4 months each year on or near their home islands and about 8 months at sea, moving as far south as the coasts of California and central Japan in winter.

Fur seals at sea seem attracted to floating objects. Where abundant, the animals occasionally haul out on logs, and are seen in and near floating beds of kelp. Studies have shown that pelagic fishes tend to congregate beneath or near floating logs and debris on the open sea (1965, Biological Laboratory, Honolulu, Hawaii). Thus, masses of drifting kelp and other debris may hold concentrations of food fishes that attract fur seals, and also serve as comfortable resting places.

Before 1960, records of seals appearing on the Pribilof Islands entangled in the jetsam of the ocean were few. Wilke (correspondence dated 21 November 1969) states that "Net fragments have become increasingly common in recent years--since about 1964." Scheffer (1950) summarized reports of seals landing on the Pribilof Islands with various items around their necks during a 15-year period beginning about 1936 and ending in 1950. The most commonly reported item was rubber bands, apparently cut from tire innertubes (these bands have many uses aboard fishing vessels, for example, to hold rain pants snugly to the fishermen's rubber boots). Cord, string, and rawhide were reported occasionally. Scheffer surmised that some of these "collars" may have been placed around the necks of seals by fishermen. Between 1944 and 1948, 10 rubber rings were taken from the necks of seals on St. Paul Island. An Army official suggested to Scheffer that these rings may have been fragments of rubber bags used by the Japanese for aerial delivery of supplies in the western Aleutian Islands during World War II. The only report during this period of suspected net-caused damage was in 1943, when a few scarred animals were seen.

The development of synthetic fibers and their widespread use in making fish netting has added another floating material to the marine environment. During the 1960's fishing effort increased tremendously on all fishing grounds of the North Pacific Ocean and adjacent seas. Much of the netting used in these fisheries was made from synthetic fibers that float. Netting used in gillnet fisheries usually sinks, however, cork, wooden, plastic, or glass floats support these nets.

A common practice among fishermen of all nations, when repairing webbing at sea, is to remove the damaged sections and discard them into the sea. The seal's trait of investigating floating objects and swimming through and lying on top of drifting kelp can have serious consequences when it encounters a scrap of netting that floats or is otherwise suspended in the water. Discarded sections of netting are, therefore, a menace to marine mammals and fishes as long as they remain adrift.

The arrival of fur seals on their home islands with net fragments around their necks had created enough interest by 1966 that the situation was discussed briefly 13-17 February 1967 at the Tenth Annual Meeting of the North Pacific Fur Seal Commission (December 1967), in Washington, D. C. The Commissioners, at the suggestion of the Standing Scientific Committee of the Commission, decided that their respective countries would document the frequency of such occurrences, and attempt to discover and record the types and origin of fishing gear responsible.

The recommendations of the Commission were carried out during the 1967 season and a report of the findings was made at the Eleventh Annual Meeting of the Commission (October 1970) in Moscow 8-12 April 1968. The U.S.S.R. reported 45 net-entangled fur seals found on Robben Island, 7 on Bering Island, and 5 on Medny Island.

With some inconsistency, records of seals entangled in nets or other debris have been kept on St. Paul Island since 1966 and on St. George Island since 1970 (table E-1). The most reliable records given are for male seals taken in the commercial harvest<sup>1/</sup> and those tagged in autumn at ages 1 and 2 years. In these situations, the nets are removed from the animals, making it impossible to count an entangled seal more than once. Entangled seals noted during all other research operations may be counted more than once.

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<sup>1/</sup> Information supplied by Marine Mammal Resources Program, Seattle, Wash.

Table E-1. --Nets and other debris observed entangled around the necks of northern fur seals,  
Pribilof Islands, Alaska, 1966-71

Net-entangled seals <sup>1/</sup>	St. Paul Island						St. George Island	
	1966	1967	1968	1969	1970	1971	1970	1971
	-----Number-----						-----Number-----	
During commercial harvest of male seals	-	75	75	67	<sup>2/</sup> 101	<sup>3/</sup> 113	21	23
Size of harvest	-	42,727	36,349	32,621	36,197	27,242	5,924	4,553
Proportion entangled	-	0.17	0.21	0.21	0.26	0.29	0.35	0.51
During research operations								
Sampling	-	-	-	-	8	-	1	-
Shearing	-	-	-	-	9	-	1	-
Bull counts	-	-	-	-	11	4	1	-
Pup marking	-	5	-	-	9	10	3	5
Dead pup counts	-	-	-	-	11	-	1	-
Dead adult counts	-	-	-	-	5	12	-	-
Living adult female and pup counts	-	-	-	-	2	-	-	-
Tagging, males 1-4 years	22	70	50	-	113	64	-	-
Total	22	150	125	67	269	203	28	28

<sup>1/</sup> It is possible to count entangled seals more than once during most research operations, however, the data given for seals taken in the harvest or captured during tagging of males in ages 1-4 years are reliable because the nets were removed from these animals.

<sup>2/</sup> Includes 5 seals with plastic bands and 1 with clothing.

<sup>3/</sup> Includes 35 seals with plastic bands.





Figure E-1. --Fur seal captured ashore on St. Paul Island, Pribilof Islands, 7 October 1966, entangled in fragment of trawl webbing.



Figure E-2. --Fur seal entangled in trawl webbing, ashore on St. Paul Island, Pribilof Islands, fall 1967.

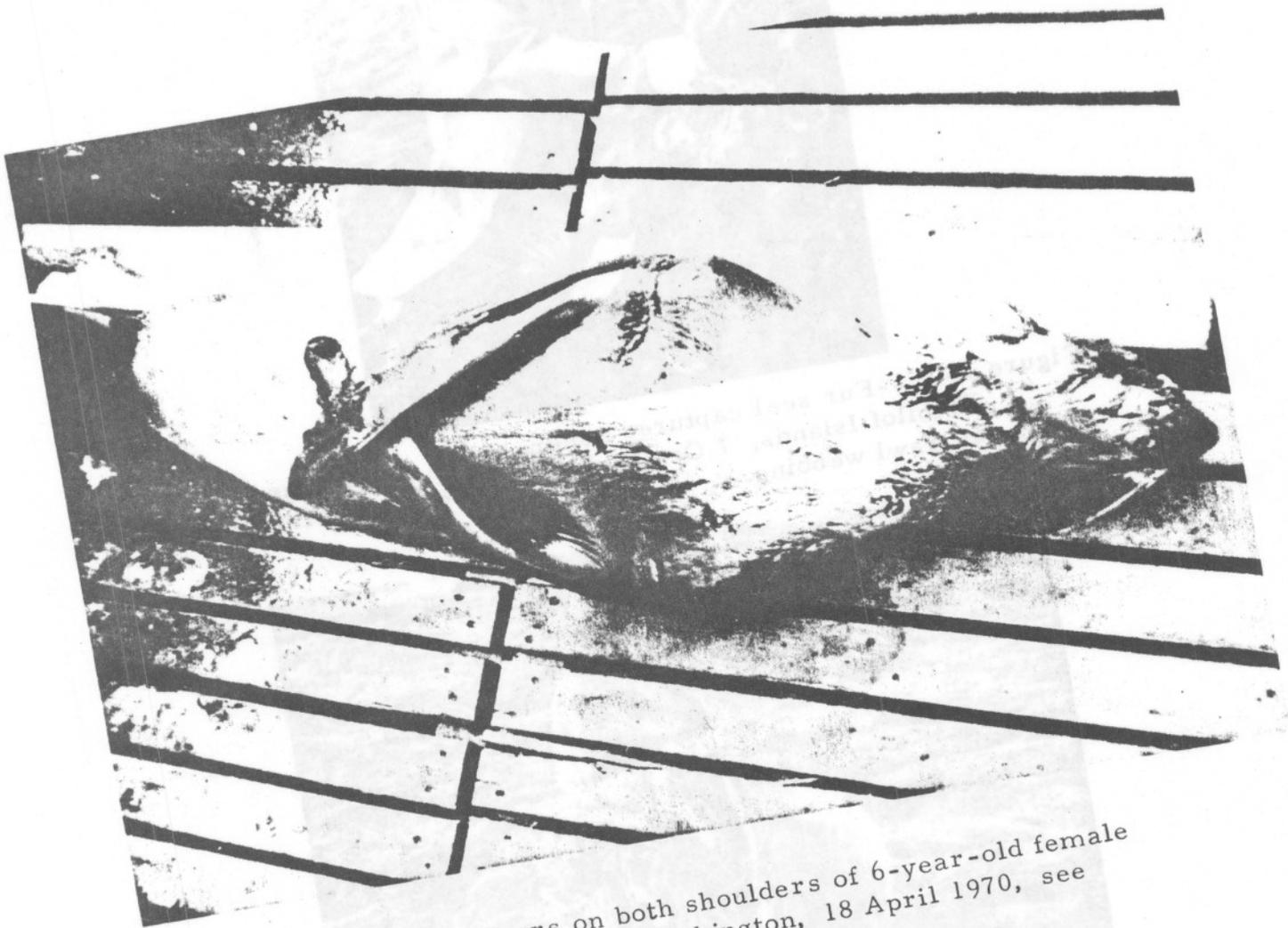


Figure E-3. --Net scars on both shoulders of 6-year-old female fur seal collected off Washington, 18 April 1970, see table E-2.

Figure E-2. --Fur seal entangled in trawl webbing, ashore on St. Paul Island, Pribilof Islands, fall 1967.

Table E-2. --Fur seals found away from their home islands entangled in fish netting

Date	Age	Sex	Location	Remarks
30 Jan. 1968	2	♀	At sea off Washington, lat. 48°26' N., long. 124°30' W.	Collected during pelagic research cruise entangled in trawl web.
21 Feb. 1970	6	♀	At sea south of eastern Aleutian Is., lat. 49°18' N., long. 157°44' W.	Dead from malnutrition, see table E-2.
18 Apr. 1970	6	♀	At sea off Washington	Collected during pelagic research cruise. Net entangled in trawl web.
31 Dec. 1970	1 or 2	♀	On beach north of Gearhart, Oregon	Found alive entangled in trawl web.
4 Aug. 1971	0	-	At sea south of Shumagin Islands, lat. 51°43' N., long. 157°44' W.	Seen near net as it was being hauled by personnel of MMS R/V George B. Kelez. Color of trawl web around seal's neck.

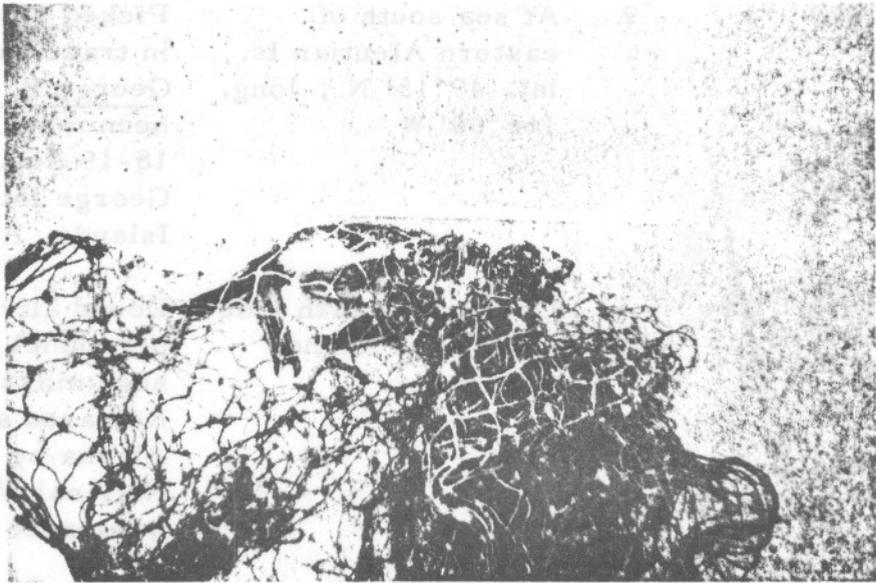


Figure E-4. --Fur seal recovered at sea 21 February 1970 entangled in trawl web. Dead from malnutrition, see table E-2.

Table E-2 .--Fur seals found away from their home islands  
entangled in fish netting

Date	Age	Sex	Location	Remarks
? Dec. 1967	1 or 2	♀	On beach near Seaside, Oregon	Found alive on an Oregon beach, recovered and kept at Seaside Aquarium
30 Jan. 1968	2	♀	At sea off Washington, lat. 46°56' N., long. 124°30' W.	Collected during pelagic research cruise entangled in trawl web.
21 Feb. 1970	1	♀	At sea south of eastern Aleutian Is., lat. 49°15' N., long. 165°00' W.	Picked up dead, entangled in trawl web by NMFS R/V <u>George B. Kelez</u> . Had been marked as a pup on 18-19 Aug. 1969, St. George Island, Pribilof Islands, Alaska.
29 Apr. 1970	1?	-	On beach, north side of Unimak Island, Alaska	Found alive by Coast Guard personnel, entangled in huge mass of trawl web. Released at Cold Bay, Alaska by Aleutian Islands National Wildlife Refuge personnel in good condition
18 Apr. 1970	6	♀	At sea off Washington, lat. 48°34' N., long. 125°14' W.	Collected during pelagic research cruise. Net scars (well healed) from entanglement. Seal either extricated herself or had been cut free.
31 Dec. 1970	1 or 2	♀	On beach north of Gearhart, Oregon	Found alive entangled in trawl web.
4 Aug. 1971	?	-	At sea south of Shumagin Islands, lat. 51°43' N, long. 157°44' W.	Seen near net as it was being hauled by personnel of NMFS R/V <u>George B. Kelez</u> . Collar of trawl web around seal's neck.

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