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Fur Seal Investigations, 1981

Edited by
Patrick Kozloff

November 1982

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ABSTRACT

Northern fur seal research in 1981 was conducted on the Pribilof Islands, Alaska; on San Miguel Island, California, and nearby Castle Rock; and in the Bering Sea.

Experimental afternoon harvests, designed to increase the take of northern fur seal males, ages 2 to 5 years, resulted in no significant increases.

Preliminary comparisons in the weight, length and growth layers of maxillary canine teeth from 3-year-old male fur seals harvested over a period of 20 years indicate that changes have taken place in the growth of fur seals over time. While some of these temporal changes have probably been brought about by variability in the abiotic environment, there is evidence indicating that biotic factors are also involved. Specifically, the changes in growth seem to be related in some way to the abundance of the fur seal population.

Preliminary analyses of data concerning body length and tooth size in 3-year-old male fur seals suggest that the average body size of northern fur seals tends to increase as their populations decrease.

Unlike adult, territorial males, juvenile and senescent males cannot terminate estrus with a single copulation but nevertheless can impregnate females, suggesting that ovulation is spontaneous rather than induced.

The growth of the northern fur seal population on Castle Rock appears to be stabilizing in contrast to the continued growth of the Adams Cove colony.

Observations of northern fur seals migrating from the Pribilof Islands were consistent with known general trends but did not provide new information on the distribution and movements of adult males.

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INTRODUCTION

The research summarized in this report was conducted or completed during 1981. It is work carried out by United States scientists, primarily those of the National Marine Mammal Laboratory, Seattle, Washington. Such research and reports fulfill, in part, the United States' obligations under the Interim Convention on the Conservation of North Pacific Fur Seals. This particular report serves as the United States' contribution to the 25th Annual Meeting of the Standing Scientific Committee of the North Pacific Fur Seal Commission (Ottawa, Canada, April 1982) which produces its own report to the Commission.

The United States, Canada, Japan, and the USSR cooperatively carry out research on the northern fur seal, Callorhinus ursinus, on land and at sea under an Interim Convention on the Conservation of North Pacific Fur Seals. Japan and Canada, two parties to the Convention without fur seal breeding grounds, share skins from fur seals taken by the USSR and United States in return for not hunting the animals at sea.

The Pribilof Islands of St. Paul (Figure 1), St. George (Figure 2), and Sea Lion Rock (Figure 1 - Sivutch) are host to 80% of the total estimated population of 1,800,000 northern fur seals, with most of the remainder accounted for by the USSR on the rookeries of Robben Island, Commander Islands, and several Kuril Islands. Two additional colonies containing a few thousand northern fur seals breed on U. S. owned San Miguel Island and nearby Castle Rock off southern California (Figure 3).

Approximately 25,000 male fur seals are currently harvested each year from the hauling grounds of 14 rookeries on St. Paul Island, and 350 are taken annually on St. George Island for local use as food. A moratorium on the harvest from the hauling grounds of five rookeries on St. George Island was imposed beginning in 1973 to permit research on a population as it reverts to its natural state. Fur seals are not harvested on San Miguel Island, Castle Rock, Ardiguen Rookery of St. Paul Island, South Rookery of St. George Island, or on Sea Lion Rock. However, some of the young male seals from the latter three places are known to haul out elsewhere and may be subjected to harvesting. There are four extinct rookeries on St. Paul Island (Figure 1) and one on St. George Island (Figure 2).

Terms having special meanings in fur seal research are described in the glossary, as are English translations of names given to some of the rookeries by the Russians when they discovered the Pribilof Islands.

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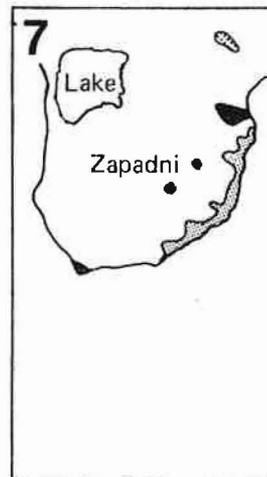
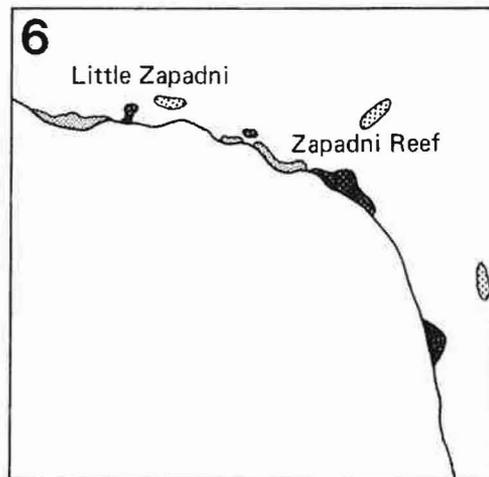
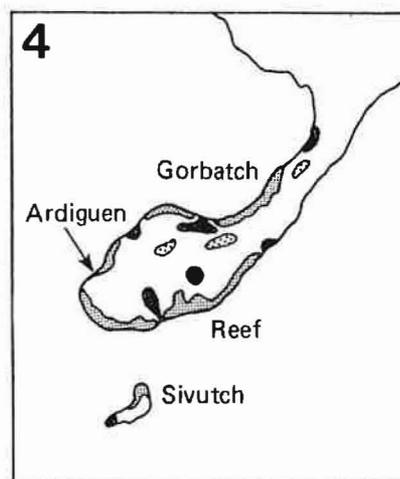
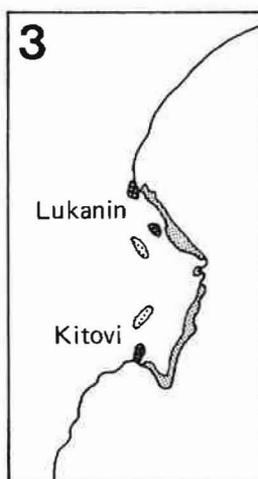
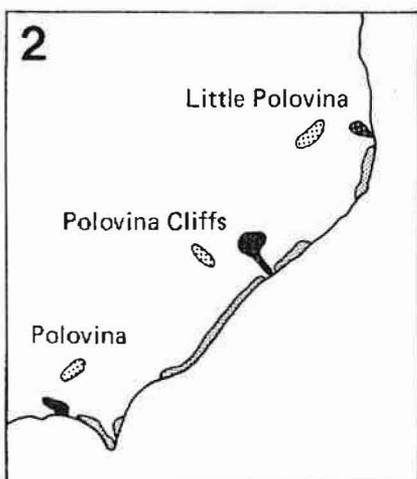
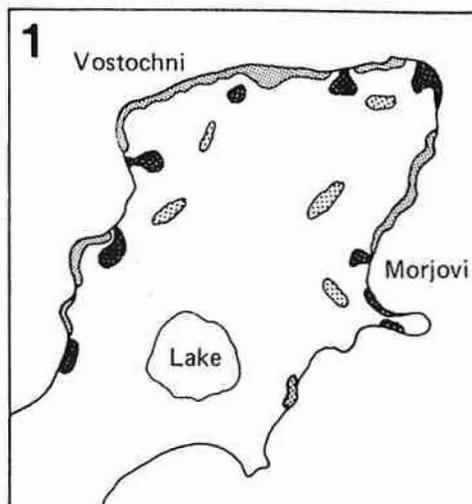
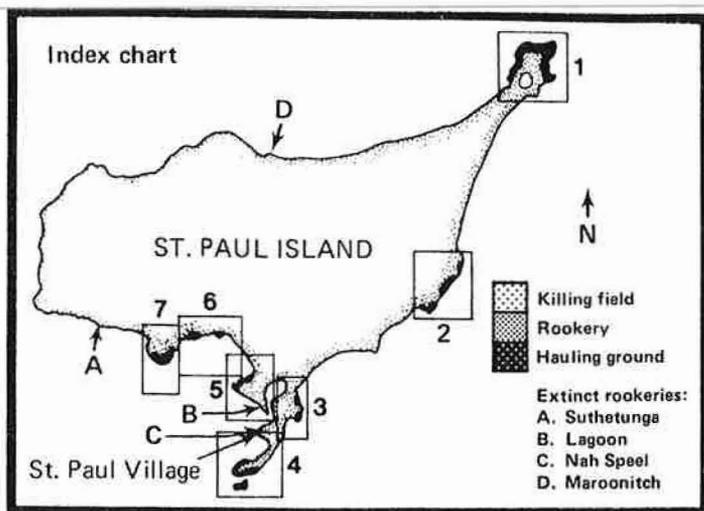


Figure 1.--Location of northern fur seal rookeries (present and extinct), hauling grounds, and harvesting areas, St. Paul Island, Alaska.

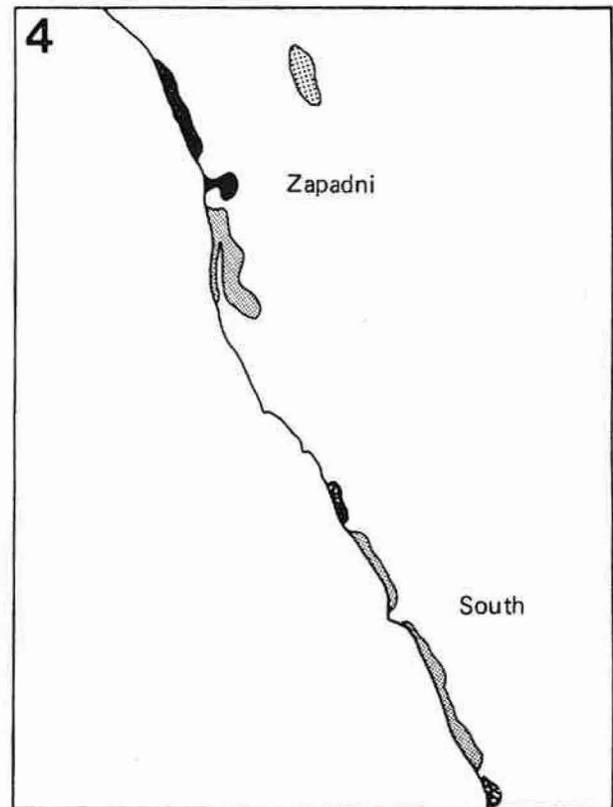
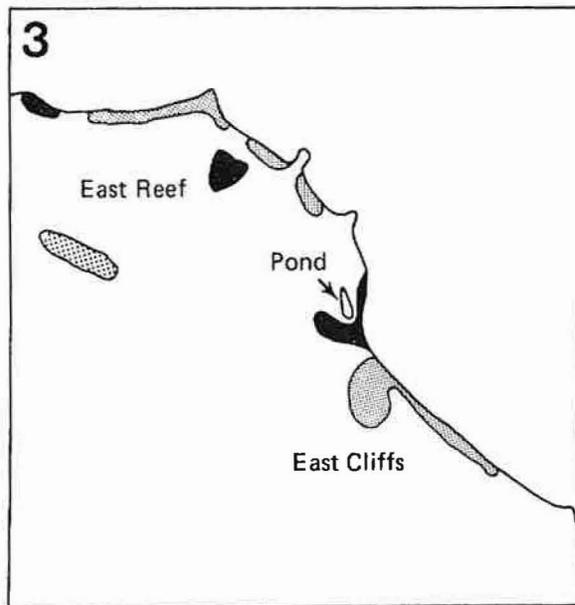
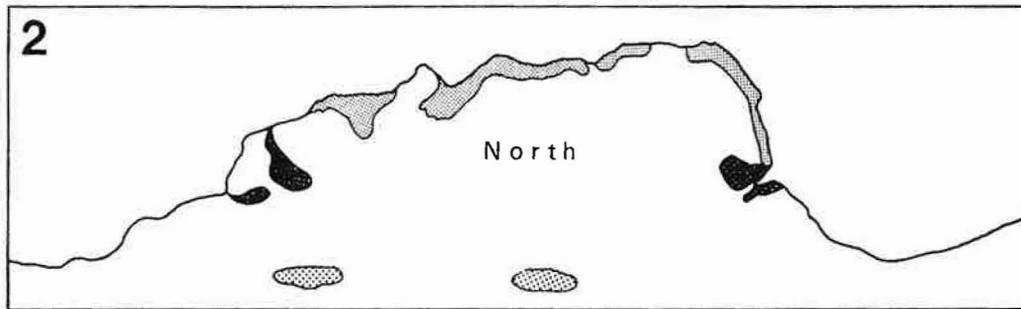
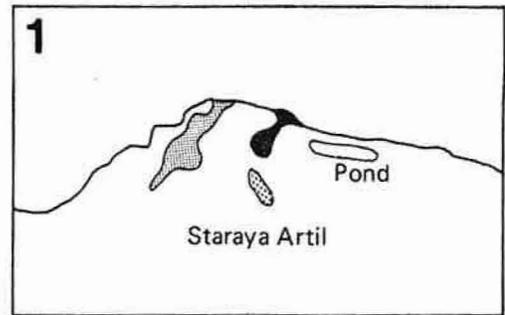
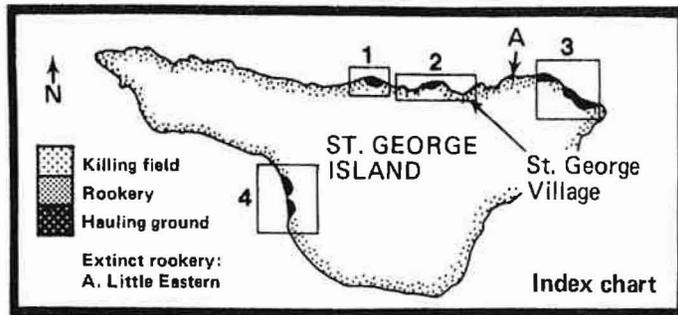


Figure 2.--Location of northern fur seal rookeries (present and extinct), hauling grounds, and harvesting areas, St. George Island, Alaska.

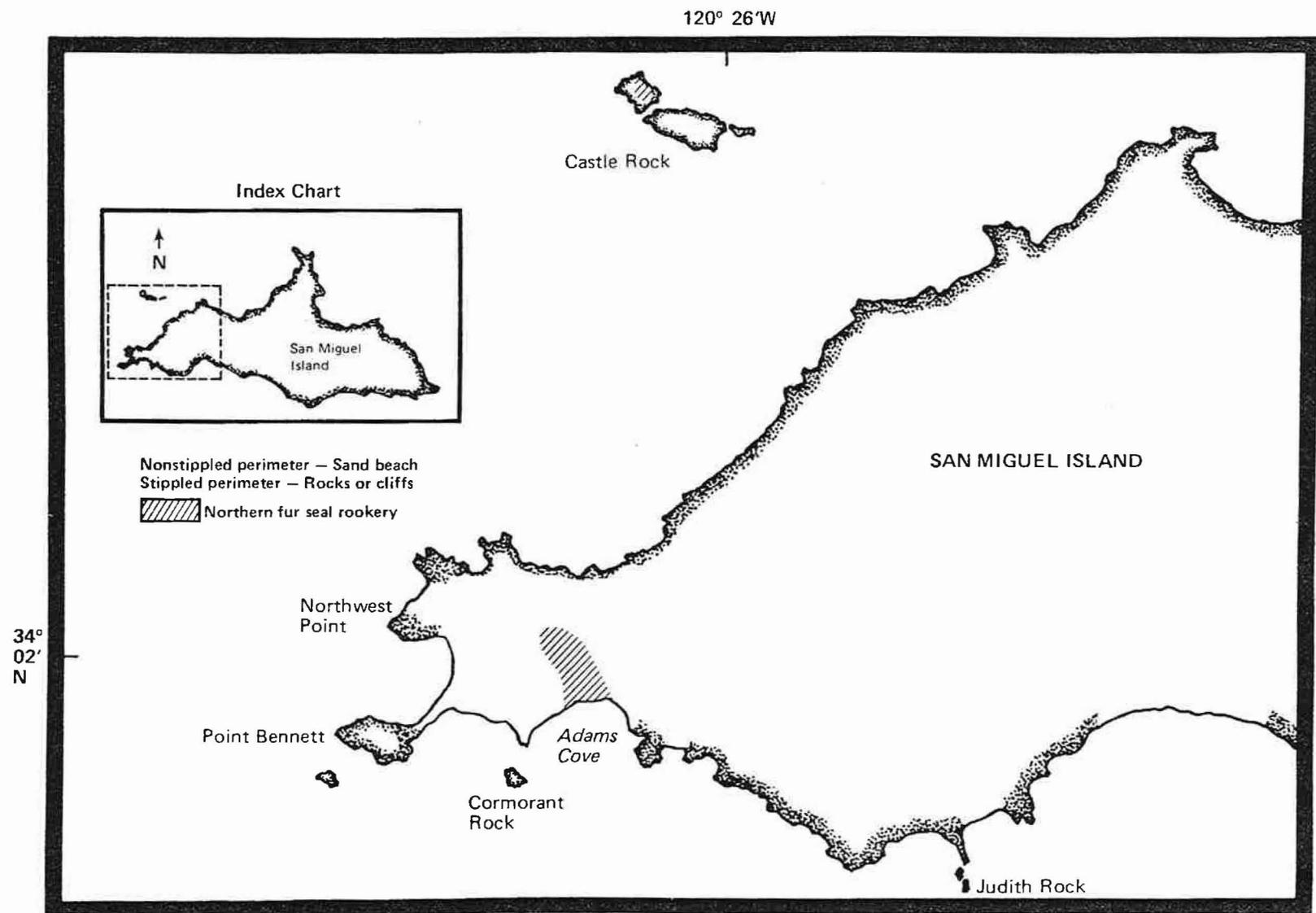


Figure 3.--Location of northern fur seal breeding colonies, San Miguel Island, California.

PART I. POPULATION ASSESSMENT, PRIBILOF ISLANDS

In accordance with the provisions of the Interim Convention on Conservation of North Pacific Fur Seals, the National Marine Mammal Laboratory monitors the status of the fur seal herd on the Pribilof Islands through the collection of specific kinds of information on population size, age and sex composition, estimates of natural mortality, and seals given metal tags or other marks. Information is also gathered by personnel of the Pribilof Island Program^{1/} on the number of seals appearing in the commercial harvest on St. Paul Island entangled in fishing net fragments and in other debris.

Population Parameters

Herd elements monitored on the Pribilof Islands in 1981 included 1) age and sex composition of seals harvested on St. Paul Island, 2) number and sex of seals taken for food on St. George Island, 3) number of live adult males and pups, and 4) number of dead pups and older seals.

Age and Sex Composition of Seals Harvested

Males.--All male seals with a body length of 49 inches (124.5 cm) or less from tip of tail to tip of nose appearing in the drives from the hauling grounds on St. Paul Island were harvested from 23 June to 31 July. The age composition of these animals was determined from a 20% sample of maxillary canine teeth collected on each harvesting area (Appendix A, Table A-1). Seals were not harvested on Saturdays, Sundays, or 3 July, and seals identified as females were rejected.

Figure 4 shows the number of 3- and 4-year-old males taken in 1981, and the sizes of the year classes of male seals harvested since 1967 are shown in Figure 5 and Table 1. The age composition of males harvested on the Pribilof Islands since 1972 is shown in Table 2.

On St. Paul Island, three experimental afternoon harvests, beginning at 1:30 p.m., were conducted on the harvesting areas of Polovina and Little Polovina Rookeries on 23 June and on 10 and 17 July to determine if the number of males taken could be increased (Appendix A, Table A-1). The same size restrictions used during other harvest days, which began between 6:00 and 6:30 a.m., were applied. The timing of the experimental harvests resulted from past behavioral observations of subadult males on St. George Island which indicated that peak numbers of fur seals of these age classes (2-5 yr) occur on shore between 1:00 and 5:00 p.m.

However, the anticipated increase in the number of seals taken did not occur, possibly because the drives were made on hot afternoons. Furthermore, the seals present were more alert and difficult to herd together than during morning harvests, resulting in larger numbers

^{1/} U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, 7600 Sand Point Way N.E., BIN C15700, Seattle, WA 98115.

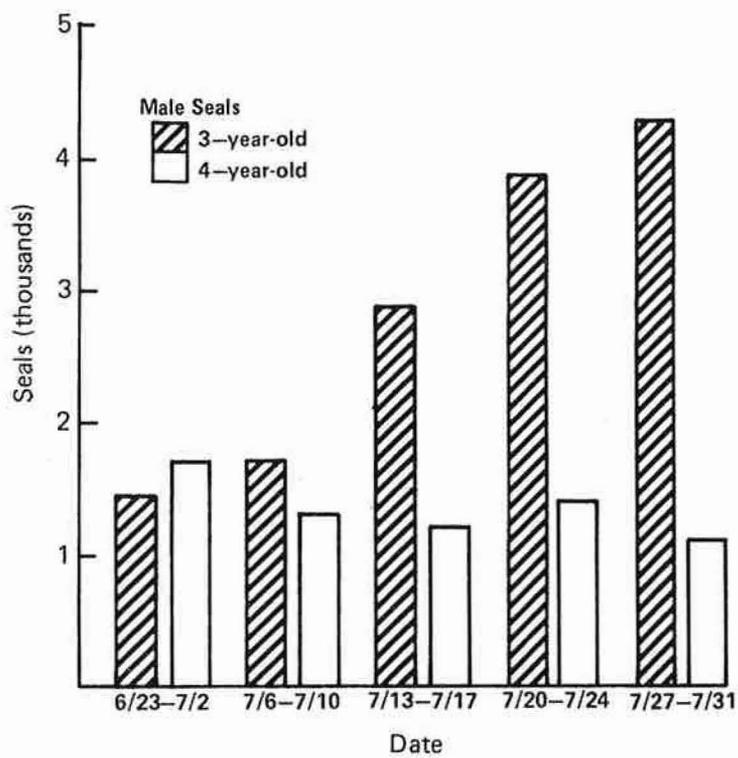


Figure 4.--Number of 3- and 4-year-old male northern fur seals harvested, St. Paul Island, Alaska, 23 June to 31 July 1981.

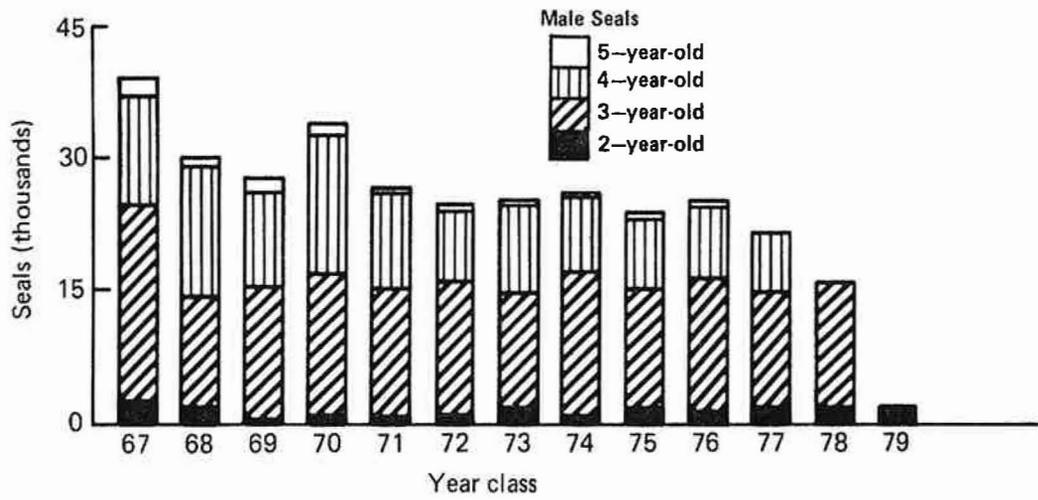


Figure 5.--Size of the male northern fur seal harvest by year class, St. Paul Island, Alaska, 1967-79.

TABLE 1.--Harvest of male northern fur seals, by age group, St. Paul Island, Alaska, 1967-79 year classes.^{1/}

Year class	Age group				Total harvested
	2	3	4	5	
-----Number of seals-----					
1967	2,640	22,176	12,503	2,185	39,504
1968	1,725	12,888	14,932	721	30,266
1969	323	15,024	10,800	1,631	27,778
1970	916	16,337	15,533	1,402	34,188
1971	577	14,652	10,768	722	26,719
1972	1,025	15,186	8,050	707	24,968
1973	1,642	13,397	9,421	598	25,058
1974	893	16,476	8,955	470	26,794
1975	1,783	13,752	7,918	725	24,178
1976	1,479	15,245	8,183	651	25,558
1977 ^{2/}	2,051	13,157	6,714	-	21,922
1978 ^{2/}	2,180	14,224	-	-	16,404
1979 ^{2/}	2,284	-	-	-	2,284
Total	19,518	182,514	113,777	9,812	325,621
Mean	1,501	15,210	10,343	981	28,501 ^{3/}

^{1/} Includes only 2- to 5-year-olds taken during the harvest of male seals. From 1967 through 1975 year classes, 395 6-year-olds were harvested.

^{2/} Incomplete returns.

^{3/} 1977, 1978, and 1979 year classes not included.

TABLE 2.--Age classification of male northern fur seals harvested, Pribilof Islands, Alaska, 1972-81.

Year of harvest	St. Paul Island						St. George Island ^{1/}					
	Age group					Total harvested	Age group					Total harvested
	2	3	4	5	6		2	3	4	5	6	
	-----Number of seals-----											
1972	916	15,024	14,932	2,185	53	33,110	57	1,442	2,125	559	21	4,204
1973	577	16,337	10,800	721	22	28,457	-	-	-	-	-	-
1974	1,025	14,652	15,533	1,631	135	32,976	-	-	-	-	-	-
1975	1,642	15,186	10,768	1,402	95	29,093	-	-	-	-	-	-
1976	893	13,397	8,050	722	19	23,081	-	-	-	-	-	-
1977	1,783	16,476	9,421	707	9	28,396	-	-	-	-	-	-
1978	1,479	13,752	8,955	598	45	24,829	-	-	-	-	-	-
1979	2,051	15,245	7,918	470	18	25,702	-	-	-	-	-	-
1980	2,180	13,157	8,183	725	33	24,278	-	-	-	-	-	-
1981	2,284	14,224	6,714	651	19	23,892	-	-	-	-	-	-

^{1/} No commercial fur seal harvest on St. George Island, Alaska, 1973-81.

escaping into the sea. Although the results of our observations during the experiment are preliminary and inconclusive, it appears that for a variety of reasons, afternoon harvesting will not become a routine part of the harvesting strategy.

On St. George Island, 348 male seals were taken for food from 7 July to 21 August without restrictions on the size or sex of the animals. The seals harvested were from the east hauling ground of North Rookery. The ages of the seals were not determined but most were likely 2- and 3-year-olds, as were those taken in the 1980 subsistence harvest.

Females.--A few young females through 4 years of age are inadvertently taken during the commercial harvest of males on St. Paul Island and during the harvest for food on St. George Island because of their similarities in size and whisker color (vibrissae) with 3-year-old males. In 1981, a total of 36 females on St. Paul Island and 2 on St. George Island were harvested. The maxillary canine teeth and reproductive organs of most of those taken on St. Paul Island were collected for age and reproductive studies.

Living Adult Male Seals Counted

In 1981, 9,123 adult male fur seals (bulls) were counted on St. Paul Island from 10 to 17 July; 3,118 were counted on St. George Island from 17 to 19 July (Appendix A, Tables A-2 and A-3). Appendix A, Table A-4 lists the number of adult males counted on the Pribilof Islands in mid-July since 1972. Figure 6 illustrates the relative location of the different classes of adult males on a typical fur seal rookery-hauling ground complex.

Dead Seals Counted That Were Older Than Pups

The rookeries and adjacent beaches of the Pribilof Islands were surveyed for dead seals older than pups from 31 August to 3 September on St. Paul Island and from 14-18 August on St. George Island. A total of 83 females and 44 males were found on St. Paul Island; St. George Island had totals of 61 and 12, respectively. Canine teeth of the animals were collected wherever possible for studies of age at death. Table 3 lists the number of these seals found dead on the Pribilof Islands since 1965.

Dead Pups Counted

In 1981, 6,798 dead fur seal pups were counted on all rookeries of St. Paul Island during 17-25 August; counts on St. George Island from 14 to 18 August totaled 2,025 (Appendix A, Table A-5). The number of dead pups counted on St. Paul and St. George Islands since 1972 is given in Appendix A, Table A-20.

CLASSES OF BULLS

- 2. TERRITORIAL WITHOUT FEMALES 
- 3. TERRITORIAL WITH FEMALES 
- 5. HAULING GROUND 

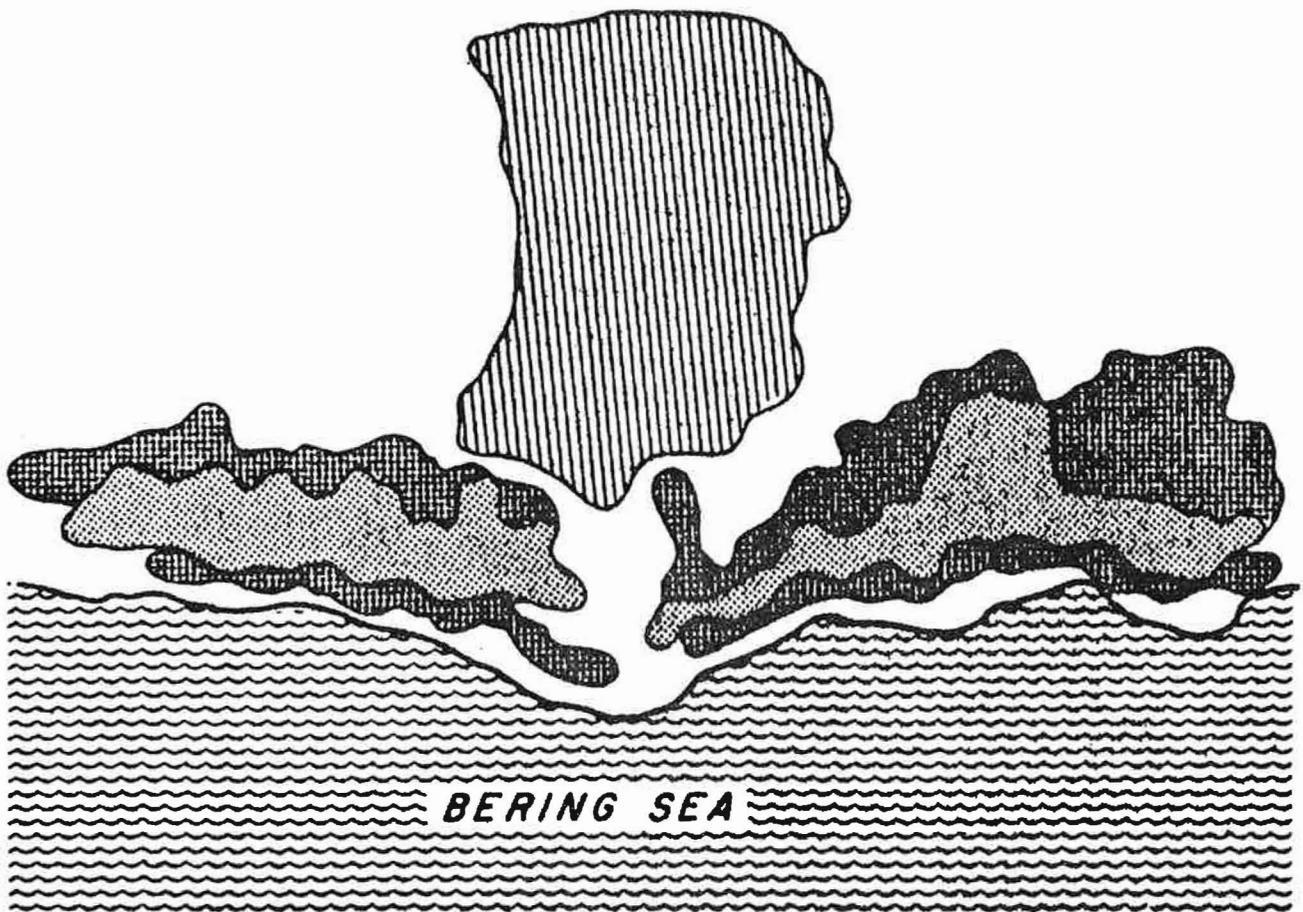


Figure 6. --General composition of a typical fur seal rookery.

TABLE 3.--Number of dead northern fur seals counted that were older than pups, Pribilof Islands, Alaska, 1965-81. A dash indicates no data.

Year	St. Paul Island		St. George Island		Total	
	Males	Females	Males	Females	Males	Females
1965	158	-	-	-	158	-
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
1972	46	111	22	30	68	141
1973	61	65	7	30	68	95
1974	33	30	4	15	37	45
1975	92	99	-	-	92	99
1976	46	64	-	-	46	64
1977	60	69	-	-	60	69
1978	57	87	-	-	57	87
1979	56	66	<u>-1/</u>	<u>-1/</u>	56	66
1980	102	117	14	65	116	182
1981	44	83	12	61	56	144

1/ A total of 70 dead fur seals of both sexes that were older than pups were counted on the rookeries of St. George Island.

Number of Pups Born

St. Paul Island.--The total number of pups alive at the time of shearing and its standard error were estimated as in 1980. From the mean estimate from both sampling periods (Table 4) and the mid-July count of harem males (Appendix A, Table A-3), we compute the ratio of live pups to bulls on the sample rookeries. Following the procedure in the 1980 Report of Fur Seal Investigations^{2/}, we compute the estimate of the ratio of live pups to breeding males for the four sample rookeries and estimate total numbers of pups born by multiplying the estimated ratio by total numbers of breeding males on all rookeries and adding the count of dead pups as follows:

Rookery	Number of pups	Number of breeding males	Ratio pups/bulls	\bar{r}^a	r^{*b}
Vostochni	30,752	922	33.35	34.19	32.72
Zapadni	21,890	615	35.59	33.08	36.04
Polovina Cliffs	14,399	471	30.57	34.77	30.99
Polovina	<u>3,678</u>	<u>83</u>	<u>44.31</u>	33.39	35.12
Total	70,719	2,091	33.82		

where \bar{r} is the ratio of pups to bulls on all but the particular sample rookery, and

$$r^* = 4r - 3\bar{r} \text{ where } r = \frac{70,719}{2,091} = 33.82.$$

The estimate of the ratio of pups to bulls is

$$\hat{R} = 1/4 \sum_{j=1}^4 r^*(j) = 33.72,$$

$$\text{and } \hat{\text{Var}}(\hat{R}) = \frac{\sum r^*(j)^2 - 4\hat{R}^2}{12} = 1.317.$$

Thus, an estimate of a 95% confidence interval for the ratio of live pups to harem males is

$$33.72 \pm (2.776) \sqrt{1.317} \text{ or}$$

$$33.72 \pm 3.19.$$

The total number of harem males counted on all rookeries of St. Paul Island is 5,120 (Appendix A, Table A-3).

^{2/} P. Kozloff (ed.). Fur seal investigations, 1980. NWAFC Processed Rep. 81-2, 96 p. Natl. Mar. Mammal Lab., Northwest and Alaska Fish. Cent., Natl. Mar. Fish. Serv., NOAA, 7600 Sand Point Way N. E., Seattle, WA 98115.

TABLE 4.--Estimated number of northern fur seal pups in 1981 at times of shearing and birth on four rookeries of St. Paul Island, Alaska. Pups were sheared 1-4 August; sampling periods 1 and 2 were 14 and 18-19 August, respectively.

Item	R o o k e r y				Total
	Vostochni	Zapadni	Cliffs	Polovina	
No. pups sheared	3,842	2,552	2,037	350	8,781
No. 25-pup samples					
Period 1	239	200	161	44	-
Period 2	236	179	129	33	-
No. sheared pups counted					
Period 1	757	539	551	104	-
Period 2	727	568	472	79	-
Total no. pups counted ^{1/}					
Period 1	5,975	5,000	4,025	1,100	-
Period 2	5,900	4,475	3,225	825	-
Estimated no. pups alive ^{2/}					
Period 1 sampling	30,325	23,673	14,880	3,702	72,580
Period 2 sampling	31,180	20,106	13,918	3,655	68,859
Mean, both periods	30,752	21,890	14,399	3,678	70,719
No. dead pups counted	889	1,451	463	89	2,892
Estimated no. pups born ^{3/}	31,641	23,341	14,862	3,767	73,611

^{1/} Number of samples X 25 = total number of sheared and unsheared pups.

^{2/} Estimated from $\hat{N} = MC/R$ (M = no. pups sheared, C = total no. pups counted, and R = no. sheared pups counted).

^{3/} Sum of dead pups counted and mean estimate of pups alive at times of sampling.

Thus, the total numbers of pups at shearing = 172,646 \pm 16,311
 (with 95% confidence interval);
 counted number of dead pups = 6,798; and
 total number of pups born = 179,444 \pm 16,311
 (with approximately 95% confidence interval).

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St. George Island.--The number of pups born in 1981 is listed in Table 5. This estimate is based on shearing-sampling procedures as used in the past and as applied to all rookeries.

Mark Recoveries

During the commercial harvest of male northern fur seals on St. Paul Island, 34 males marked as pups on Bering and Medny Islands in 1977, 1978, and 1979 by the Soviet Union were recovered. In addition, one seal marked on Medny Island as a pup in 1978 was recovered during the subsistence harvest on St. George Island. Appendix A, Table A-6 lists the number of Soviet tags recovered by the United States in 1981.

Seals Entangled in Net Fragments and Other Materials

Summarized in Table 6 is a record of entanglement among northern fur seals appearing in the commercial harvest on St. Paul Island in 1981. Samples of the entangling debris were collected for future study. The number of entangled northern fur seals appearing in harvest since 1967 is given in Appendix A, Table A-7.

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TABLE 5.--Estimated number of northern fur seal pups in 1981 at times of shearing and birth on St. George Island, Alaska. Pups were sheared 6-9 August and sampled 10 August. A dash indicates data were not collected.

Item	R o o k e r y						Total
	South	Zapadni	East Cliffs	East Reef ^{1/}	Staraya Artil	North	
No. pups marked							
Sheared	1,087	574	726	120	696	1,852	5,055
Tagged	-	-	-	759	-	-	759
No. 25-pup samples							
Sheared	114	65	97	21	85	223	-
Tagged	-	-	-	20	-	-	-
No. marked pups counted							
Sheared	569	239	397	66	344	781	-
Tagged	-	-	-	171	-	-	-
Total no. pups counted ^{2/}							
Sheared	2,850	1,625	2,425	525	2,125	5,575	-
Tagged	-	-	-	500	-	-	-
Estimated no. pups alive							
Shearing ^{3/}	5,445	3,903	4,435	955	4,299	13,220	32,257
Tagging ^{3/}	-	-	-	2,219	-	-	2,219
Pups/harem bull	-	-	1,651 ^{4/}	-	-	-	1,651
No. dead pups counted	177	186	402	74	376	810	2,025
Estimated no. pups born ^{5/}	5,622	4,089	6,488	3,248	4,675	14,030	38,152

^{1/} A portion of East Reef Rookery's live pup population was estimated by marking the pups there with tags then sampling for marked to unmarked ratios.

^{2/} Number of samples X 25 = total number of marked and unmarked pups.

^{3/} Estimated from $\hat{N} = MC/R$ (M = no. pups marked, C = total no. pups counted, and R = no. marked pups counted).

^{4/} Estimated on an unsurveyed area of the rookery from the ratio of live pups per live adult male with a harem on the surveyed area.

^{5/} Sum of dead pups counted and estimated number of pups alive.

TABLE 6.--Male northern fur seals entangled in fishing debris and other materials, U. S. commercial harvest of northern fur seals, St. Paul Island, Alaska, 29 June to 31 July 1981.^{1/}

Date	Rookery ^{2/}	Number of males harvested	Number of entangled males observed on killing field					Percent of harvest	Number of entangled pelts observed in processing plant ^{5/}
			Harvestable ^{3/}		Oversized ^{4/}		Total		
			Nets	Bands	Nets	Bands			
June 29	NEP	883	2	1	0	0	3	0.34	6
30	ZAP,TZR	959	2	0	0	0	2	0.21	6
July 1	POL,L-K	719	1	0	0	0	1	0.14	1
2	REEF	789	1	1	0	0	2	0.25	2
6	ZAP	833	4	2	0	1	7	0.84	7
7	TZR,L-K	418	3	0	0	0	3	0.72	4
8	NEP	974	3	2	0	0	5	0.51	7
9	REEF	775	2	0	0	0	2	0.26	3
10	POL	363	1	0	0	0	1	0.28	2
13	ZAP	858	3	1	0	0	4	0.47	5
14	TZR,L-K	1,107	0	2	0	0	2	0.18	2
15	NEP	887	4	0	0	0	4	0.45	7
16	REEF	1,113	1	1	0	0	2	0.18	8
17	POL	499	2	0	0	0	2	0.40	6
20	ZAP	1,957	7	4	0	0	11	0.56	12
21	TZR,L-K	815	3	1	1	0	5	0.61	8
22	NEP	1,217	1	5	0	0	6	0.49	9
23	POL	473	0	1	0	0	1	0.21	2
24	REEF	1,592	3	0	1	0	4	0.25	7
27	ZAP	1,288	1	2	1	0	4	0.31	8
28	TZR	788	2	1	0	0	3	0.38	6
29	NEP	1,511	3	1	0	0	4	0.26	11
30	POL,L-K	1,090	8	0	0	0	8	0.73	9
31	REEF	1,884	5	10	0	0	15	0.80	8
Total		23,792	62	35	3	1	101 ^{6/}	0.42	146

^{1/} This table does not include 100 seals taken during a preseason trial afternoon harvest on 23 June; no entangled seals were observed.

^{2/} See footnote 1 in Appendix A, Table A-1 for explanation of rookery areas.

^{3/} Seals with a body length of 49 inches (124.5 cm) or less from tip of tail to tip of nose.

^{4/} Seals larger than the harvestable size of 49 inches (124.5 cm) from tip of tail to tip of nose. These seals were taken because of the presence of nets or bands around their necks.

^{5/} Those pelts observed to have marks, scars, or tears due to prior entanglement. In some cases, the seals recorded as entangled during the harvest may not have been tallied in the processing plant due to the loss of identifying tags or to unapparent entanglement marks on the pelt.

^{6/} Does not include one entangled female fur seal taken 28 July.

Studies of Tooth Size and Growth

Since 1949, canine teeth of harvested fur seals have been collected and assigned ages by scientists studying the fur seal population of the Pribilof Islands. The ages of northern fur seals can be determined by counting the growth layers of dentine in canine teeth that have been sectioned longitudinally (Kubota et al. 1961). In addition, comparisons in the areas of annual growth layers in canine teeth can be used to obtain a relative measure of body growth (Klevezal' 1980). Significant differences in these annual growth layers for fur seals of different cohorts may also reflect major changes in the environment (i.e., food availability and/or climatic severity) in which these animals live.

The purpose of this study was to compare the weights, lengths, and growth layers of canine teeth from 3-year-old bachelors harvested over a period of 20 years. Three groups of 15 canine teeth were sampled from the 1951, 1961, and 1971 cohorts. The teeth were weighed and measured for maximum longitudinal length. The teeth were then half-sectioned along the longitudinal axis by grinding on a lapidary wheel, polished, and etched (decalcified) in 10% formic acid for 5 hours. The etching process produced a series of "valleys" and "ridges" in the annual growth layers of the sectioned surface of the teeth (Pierce and Kajimura 1980). This surface was rubbed gently with pencil lead so that graphite touched only the raised portions of the growth layers, thus highlighting the "ridges". The series of "ridges" for each tooth was then replicated by pressing the tooth on transparent tape (Scotch 310).^{3/}

The replica was taped onto a sheet of white paper and then photographed through a variable power dissecting scope.^{4/} The photographs were enlarged to 8 x 10 glossy black and white prints, and the areas of the annual growth layers were calculated with a digitizing tablet.^{5/}

Analyses of variance of the data from these three cohorts showed that:

1. The tooth weights were not significantly different, although $W_{51} < W_{61} < W_{71}$ (W_i is the weight of i year class).
2. The tooth lengths were not significantly different, although like the weights, $L_{51} < L_{61} < L_{71}$ (L_i is length of i year class).
3. The total area of all growth layers for the 1951 cohort was significantly less ($p < 0.95$) than the other two cohorts; the 1961 and 1971 cohorts were not significantly different from each other.

^{3/} Reference to trade names does not imply endorsement by the National Marine Fisheries Service, NOAA.

^{4/} Courtesy of Jack LaLanne, Northwest and Alaska Fish. Cent., Natl. Mar. Fish. Serv., NOAA, 2725 Montlake Blvd. E., Seattle, WA 98112.

^{5/} Courtesy of Greg Small; see footnote 4 for affiliation.

4. The fractional area of tooth growth during the first year of life for the 1961 cohort was significantly smaller ($p < 0.99$) than for the 1971 cohort and that of the 1971 cohort was significantly smaller than for the 1951 cohort.
5. The fractional area of tooth growth during the second year of life for the 1951 cohort was significantly less ($p < 0.99$) than that of the 1961 and 1971 cohorts, whereas differences between the 1961 and 1971 cohorts were not significant.
6. The fractional area of tooth growth during the third year of life was not significantly different among the cohorts.
7. The fractional area of tooth growth for the combined first and second years of life was not significantly different among the cohorts.

Some of these differences can probably be related to the "quality" of the environment in which these fur seals lived; however, additional comparisons of other cohorts and larger samples are needed before this information can be interpreted accurately.

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A Preliminary Analysis of Growth in Northern Fur Seals

Scheffer (1955) reported that subadult male fur seals measured during the 1940's and 1950's were smaller in body size than those measured from 1913 to 1919 when the herd was much smaller. These data form the cornerstone for Scheffer's hypothesis that average body size tends to decrease as populations become more dense. A preliminary analysis of more recent data concerning growth is presented here, consisting of an examination of body length and a study of the size of teeth in 3-year-old males taken in the commercial harvest on St. Paul Island.

Body Length

To determine if the mean body length of male fur seals has changed recently, we examined historical data concerning the length of 3-year-old males taken in the annual harvest. Statistical treatment of these data showed that the mean body length of tagged 3-year-old males screened for commercial size was significantly less ($\alpha = 0.05$) in 1960 than in 1952 on St. Paul Island. Commercial harvest length limits were comparable for the two seasons. Measurements in 1952 were made with calipers, whereas in 1960, seals were measured on a cradle. The latter method is considered more reliable, but while the caliper is more variable, there is no indication of a systematic bias toward over or under measurement of the animals. The herd was larger in 1952 than in 1960, but the number of adult males in the years of birth for these year classes (1949 and 1957) was slightly larger in 1957 than in 1949.

Figure 7 presents mean body lengths for untagged 3-year-old males measured on a cradle during the third week of July 1962-71. The length limits were comparable each year for this part of the season. Mean body length increased over this period while the herd size declined. The herd was also declining when considering the years of birth of the measured animals (1959 through 1968).

In contrast, data collected on two rookeries (Tolstoi-Zapadni Reef and Zapadni) early to mid-July during 1962-63 and 1979 show no change in the mean size of 3-year-old males measured on a cradle. The maximum length limit was smaller during the 1979 season thus providing a downward length bias. The population size was somewhat smaller in 1979 than during 1962-63 as it was for the years of birth of the measured animals (1976 and 1959-60).

The above results may be compared with other previous work. Bigg (Kajimura et al. 1979)^{6/} compared growth rates of female fur seals ages 5 to 12 years taken during three periods of pelagic research in 1958-74.

^{6/} H. Kajimura, R. H. Lander, M. A. Perez, A. E. York, and M. A. Bigg. 1979. Preliminary analysis of pelagic fur seal data collected by the United States and Canada during 1958-74. Unpubl. rep., 247 p. Natl. Mar. Mammal Lab., Northwest and Alaska Fish. Cent., Natl. Mar. Fish. Serv., NOAA, 7600 Sand Point Way N.E., Seattle, WA 98115. (Submitted to 22nd Annual Meeting of the North Pacific Fur Seal Commission).

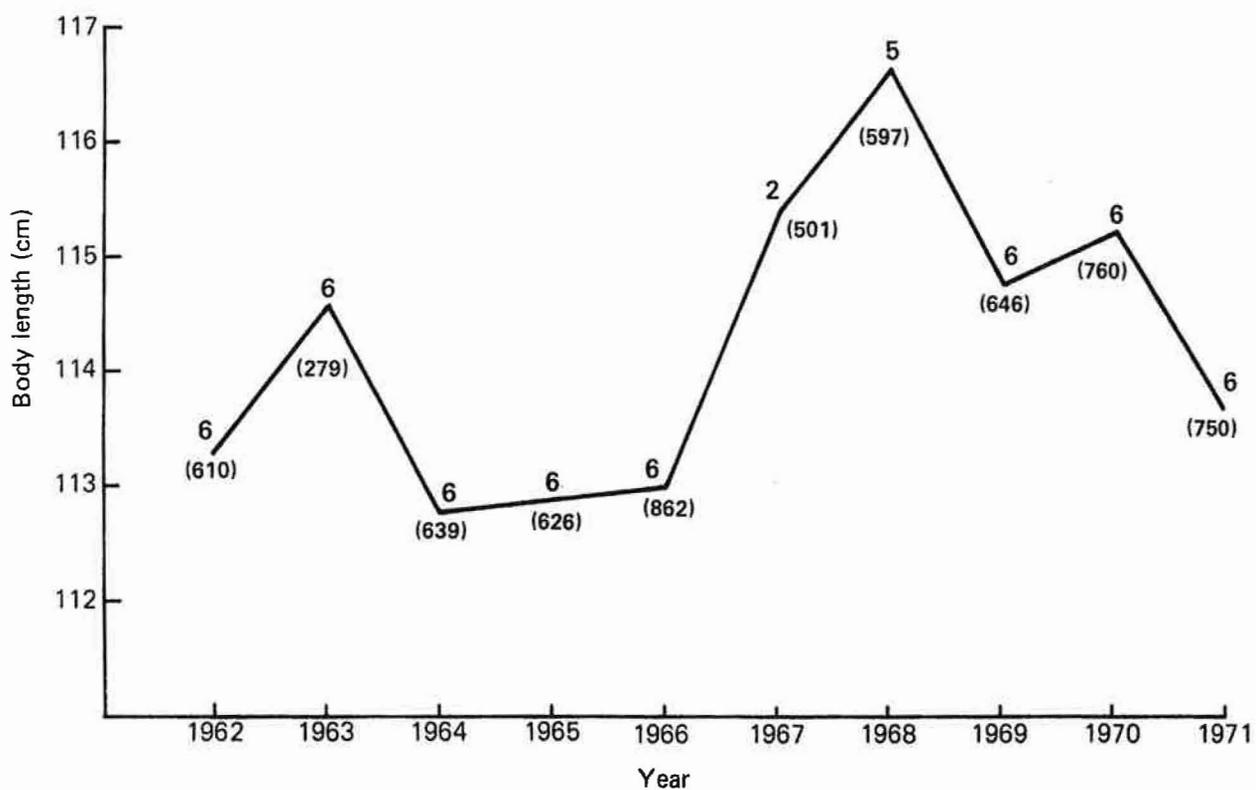


Figure 7.--Mean body length (cm) of 3-year-old male northern fur seals taken during the third week of July, St. Paul Island, Alaska, 1962-71. Numbers in parentheses are sample sizes and the single digit numbers indicate the number of rookeries sampled.

His data show the greatest growth rate for females from the 1969-74 period, a lesser rate during 1963-68, and the slowest rate from 1958 to 1962. The progression in increasing growth rates follows the general decline of the fur seal herd. For example, females 5 to 12 years old sampled during 1958-62 came from year classes 1946 to 1957, when the herd was at its largest in modern times. Females 5 to 12 years old taken from 1969 to 1974 were from year classes 1957 to 1969, a period when the herd went from its peak to its lowest point in recent history.

Analysis of Teeth

To make comparisons in canine tooth weight between year classes of fur seals, teeth collected from 3-year-old males taken in the commercial harvest were used. The 3-year-old age class was chosen because the size of this group and the weight of their canines should not be affected by changes in body length limits between seasons. In addition, as the largest proportion of animals taken in the harvest is typically 3-year-olds, the potential sample size is maximized. Before 1971, teeth from only 3 days in July (a day near the first, fifteenth, and thirtieth) were available. Teeth collected from the three samples in July were not pooled because of the growth which occurred in the 3-year-old class during the month. If the samples were pooled, the relative proportion from each period would have to be kept constant. To avoid any variability between rookeries and changes over time, teeth taken from Reef Rookery on or about 15 July from 1948 to 1979 were selected. No teeth were available from Reef Rookery in 1951, 1967-69, and 1970.

To evaluate the usefulness of tooth weight as an indicator of an animal's size, body length and tooth weight were subjected to regression analysis for 3-year-old males collected in 1980 from 21 to 25 July on St. Paul Island (from all rookeries except Lukanin and Kitovi). The relationship between length and tooth weight was significant ($\alpha = 0.05$), although there was a great deal of variability around the regression line ($r^2 = 0.14$). Much of this variability may be caused by the difficulty in obtaining true body lengths from animals as flexible as fur seals and because of difficulties inherent in collecting length data during the commercial harvest.

Individual 3-year-old male canine teeth were weighed to the nearest 0.01 g on a Centogram triple beam balance. Cracked teeth were weighed, but chipped or broken teeth were discarded.

Table 7 gives the sample size, mean weight, and standard deviation for each year when teeth were available from Reef Rookery on or about 15 July. The cumulative mean weight from 1948 to 1961 was 2.44 g for 316 teeth while from 1962 to 1979, it was 2.48 g for 958 teeth. The means from the two periods were significantly different at $\alpha = 0.10$. Table 8 presents a

TABLE 7.--Mean weights (g) and standard deviation of teeth of 3-year-old male northern fur seals, U. S. commercial harvest of northern fur seals, Reef Rookery, St. Paul Island, Alaska, July 1948-79.

Year	No. seals	Mean weight (g)	Standard deviation
1948	105	2.5301	0.3230
1949	29	2.4659	0.2320
1950	9	2.3300	0.3061
1952	8	2.2950	0.2849
1953	15	2.4333	0.2588
1954	14	2.3621	0.2711
1955	13	2.2600	0.1940
1956	27	2.3930	0.2918
1957	18	2.4250	0.2084
1958	30	2.3907	0.2731
1959	7	2.5257	0.2406
1960	24	2.4808	0.2640
1961	17	2.3300	0.3233
1962	22	2.4755	0.2927
1963	4	2.0825	0.1826
1964	58	2.5245	0.3297
1965	23	2.4830	0.2801
1966	34	2.5432	0.2674
1971	80	2.5073	0.3006
1972	77	2.5222	0.3405
1973	121	2.5229	0.3094
1974	95	2.4284	0.2918
1975	72	2.4872	0.2972
1976	78	2.4067	0.2782
1977	150	2.4715	0.3138
1978	80	2.4368	0.3648
1979	64	2.5250	0.3367

TABLE 8.--Mean weights (g) and standard deviation of teeth of 3-year-old male northern fur seals, U. S. commercial harvest of northern fur seals, St. Paul Island, Alaska, July 1948-79 (N=8 teeth/yr).^{1/}

Year	Mean weight (g)	Standard deviation
1948	2.4300	0.1456
1949	2.4313	0.2258
1950	2.3375	0.3263
1952	2.2950	0.2849
1953	2.5100	0.3066
1954	2.3175	0.3408
1955	2.1788	0.2052
1956	2.3375	0.3188
1957	2.4743	0.2544
1958	2.3375	0.3342
1959 ^{2/}	2.5263	0.2228
1960	2.4200	0.1794
1961	2.3338	0.2571
1962	2.4725	0.2660
1963 ^{3/}	-	-
1964	2.5875	0.3214
1965	2.5550	0.2163
1966	2.6075	0.1701
1971	2.6950	0.4046
1972	2.5513	0.2002
1973	2.5738	0.4328
1974	2.5175	0.1948
1975	2.7138	0.2044
1976	2.4663	0.3657
1977	2.4513	0.2407
1978	2.2438	0.2183
1979	2.5725	0.3298

^{1/} Samples were taken from harvested animals on or about 15 July to minimize the effect of time of year.

^{2/} Only seven teeth were available; the mean was taken as an eighth datum.

^{3/} Only four teeth were available.

subsampling of eight teeth from each year as above except 1963 which was deleted because only four teeth were available. As only seven teeth were available in 1959, the mean was taken as an eighth datum. A regression of tooth weight upon year had a significant positive slope ($\alpha = 0.05$). The regression equation ($y = 0.0063x - 9.94$) and the data are shown graphically in Figure 8.

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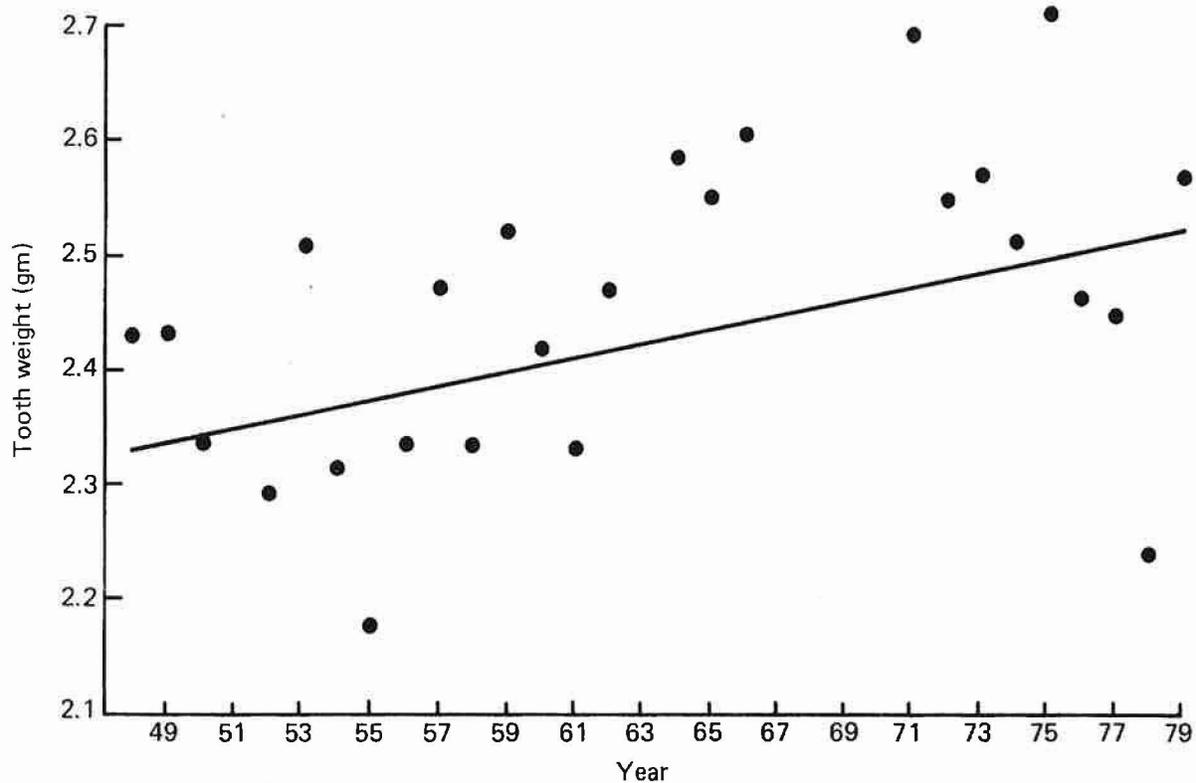


Figure 8.--Regression of tooth weight (gm) upon year, 1948-79, St. Paul Island, Alaska. Data from teeth collected during the harvest of 3-year-old male northern fur seals on or about 15 July (N=8 teeth/yr).

PART II. BEHAVIOR AND BIOLOGY, PRIBILOF ISLANDS

In 1981, the major effort of the behavior and biology task was to repeat baseline behavioral measures initially made in 1974 and 1975. In addition, further experiments were conducted on estrus in captive females, and time-depth recorders were placed on five females. A special study on energetics of milk production and transfer was conducted by contract scientists using radioactive tracers. Finally, 1,328 pups of both sexes were tagged for long-term study. The results of the diving and the energetic studies will be reported elsewhere.

Work Plan

Daily observations were made on East Reef and Zapadni Rookeries from 21 May to 1 August (approximately 550 worker h) to collect baseline behavioral data. Estrus experiments were conducted from 25 June to 26 July (approximately 450 worker h), and the study on energetics of milk production spanned 21 June to 19 August (approximately 1,200 worker h), with a follow-up study from 7 to 21 October (125 worker h). Permanent tags applied to fur seals in 1981 are listed in Table 9.

Trends in Herd Size and Composition

Neither the Zapadni nor East Reef study area is a reliable indicator of the population changes occurring on the remainder of St. George Island. Each year since 1977, the results of daily censuses of adult males and females on these two study sites have been reported as indices of population change. Past comparisons of these censuses against island-wide shearing-sampling estimates of pup numbers showed a discrepancy; census data indicated a faster rate of decline than did shearing-sampling estimates.

In 1981, counts of adult females on the portion of Zapadni Rookery used as a study site indicated a 79% decline from 1974. Shearing-sampling estimates of the entire Zapadni Rookery indicated only a 43% decline in pups born in 1973-81 (the island-wide decline by shearing-sampling was 37% during this period, Lander 1980; Part I this report). The censuses from the East Reef study site indicated a 45% decline in females; however, shearing-sampling estimates indicated an 8% increase from 1973 to 1981, the only rookery showing a net increase in this period. In conclusion, the population on the Zapadni study site is declining faster than the remainder of Zapadni Rookery and faster than the island as a whole. Furthermore, the East Reef study site population is declining, while the rookery that surrounds it is increasing. Therefore, neither site typifies population trends on the rest of the island. For that reason, censuses of these sites will no longer be reported annually.

TABLE 9.--Tags applied to northern fur seals for studies of behavior, St. George Island, Alaska, 1981.

Type and color of tag	Tag number	Age-sex class	Number of seals	Rookery
Plastic, green	99, 100	Male or female pup	15	East Reef
	205-209			
	214, 215			
	217, 220			
	221, 251			
253, 256				
Plastic, yellow	3573-3911	Male pup	339	East Reef
	3207-3572	Male pup	366	Zapadni
	3206	Adult male	1	East Reef
Plastic, white	1468-1786	Female pup	318	East Reef
	(less 1660)			
	1153-1467	Female pup	290	Zapadni
	(less 1201-1225)			
	576, 577	Adult female	1	Staraya Artil
	578-596	Adult female	34	East Reef
	(less 588)			
	1133-1135			
	1137-1140			
	1143-1152			
1660				

Estrus Studies

Studies in the 1975 and 1976 Report of Fur Seal Investigations ^{7/}, ^{8/} showed that if the females fail to copulate on day 5, 6, or 7 postpartum, then estrus lasts about 34 hours, and does not recur later that season. Therefore, no compensatory mechanisms exist to ensure high pregnancy rates if females miss mating in the postpartum estrus. What are the characteristics of this single estrus period that promote high pregnancy rates (exceeding 90% in some age classes)? These characteristics were investigated in a series of short experiments in 1980 and 1981. The major findings are summarized below.

The onset of estrus.--Females enter estrus rapidly with a conspicuous shift in behavioral responses to males. In 1976, 1980, and 1981, the onset of estrus was tested in 49 captive females by pairing them with captive males for 15-minute test periods while behavioral interactions were scored using a time-sampling procedure. Individual females were paired with males 1 to 4 times per day, starting on day 4 postpartum. In all, 39% of these females shifted from nonreceptive to fully receptive within a 15-minute test session with the male. Figure 9 shows the rapid temporal shift in the behavior of a typical female. Responses are graded from most receptive (top) to most nonreceptive (=aggressive, bottom), with total occurrences summed in blocks of time. Note that in minute 10 of the Estrus Onset Session, the female suddenly showed No Response, and Lordosis, which had not occurred previously. During the Copulation Session, almost all aggressive, evasive, or resistant responses were replaced by receptive responses.

The rapid change in female behavior resulting from contact with a male resembles the "Whitten effect" seen in other mammals (Whitten 1956). However, the effect of the male was limited in time; male-induced onset of estrus was never observed before day 4, nor after day 8 postpartum. Furthermore, 61% of the females entered estrus spontaneously, usually between test sessions with the male, indicating that male-induced estrus in fur seals is facultative rather than obligatory.

Minimum duration of estrus.--Coitus has a marked abbreviating effect on the duration of estrus. Observations on breeding areas showed that 85% of 144 marked females copulated only once per year. Therefore, the physical act of coitus terminates receptivity to further copulations for most females. However, the speed of this inhibition has not previously been measured. Nine females were paired in 15-minute sessions with a "test" male which was prevented from copulating by fitting the female with a vaginal shield attached to a harness. When each female showed

^{7/} Marine Mammal Division. 1976. Fur seal investigations, 1975. Unpubl. manusc., 115 p. Natl. Mar. Mammal Lab., Northwest and Alaska Fish. Cent., Natl. Mar. Fish. Serv., NOAA, 7600 Sand Point Way N. E., Seattle, WA 98115.

^{8/} Marine Mammal Division. 1977. Fur seal investigations, 1976. Unpubl. manusc., 92 p. Natl. Mar. Mammal Lab., Northwest and Alaska Fish. Cent., Natl. Mar. Fish. Serv., NOAA, 7600 Sand Point Way N. E., Seattle, WA 98115.

Figure 9.--Changes in female northern fur seal responses during estrus,
St. George Island, Alaska, 1981.

Female response category	Pre-estrus session (min 1-15)	50 min Estrus								Post-estrus session 1-15 (min)
		Estrus onset session (min)			Copulation session (min)				2 min	
		1-5	6-9	10-13	1-5	6-10	11-14	15-23		
Spontaneous ^{1/}	-	-	-	-	-	-	6	C	-	
Lordosis	-	-	-	2	5	9	3	O	-	
No Response	-	-	-	30	14	5	-	P	-	
								U		
Nose-to-nose	7	7	18	15	5	2	-	L	4	
								A		
Open Mouth Lunge	3	3	2	3	2	-	-	T	6	
Soft Bite	-	1	-	2	-	-	-	I	4	
Evade/Appease	12	4	6	1	-	-	-	O	20	
Aggression/Threat	-	-	-	-	-	1	-	N	2	

^{1/} Includes special estrus vocalizations, panting, and other behavior given in the absence of the male.

receptivity to the "test" male, she was immediately paired with a "stimulus" male in an adjacent cage and allowed to copulate. Immediately after the copulating male dismounted, the female was paired with the "test" male again to assess the effects of coitus on receptivity. The mean duration from dismount to pairing with the "test" male was only 3.4 min (SD=1.3). Seven of the nine females were nonreceptive to the "test" male at this time, one was partially receptive, and one was fully receptive (accepted mounting) for 32 hours post coitus. The speed of behavioral change after coitus was as rapid as at the onset, or faster, and is faster than for any other mammal measured to date.

Estrus may last only a few minutes each year if the female copulates. Five of the nine females above entered estrus by the "Whitten effect," so the onset time was known exactly. Four of the five females were rendered nonreceptive by coitus 5, 31, 41, and 50 minutes, respectively, after the onset. Receptivity in the fifth female continued for 32 hours. Figure 9 shows the rapid return to nonreceptive behavior only 2 minutes after coitus, and only 50 minutes after the onset of receptivity. There was no refractory period after the onset when coitus had no abbreviating effect.

Ability of nonterritorial males to terminate estrus.--Adult females are almost as receptive to nonterritorial males as to those on breeding territories. A total of 29 estrous females was paired with juvenile (16 pairings), peripheral (i.e., approximately 135 kg males--30 pairings), and senescent males (3 pairings) for 15-minute test sessions. Test scores showed that all females were fully receptive to their partners with two exceptions (one with a juvenile and one with a senescent male). Females are receptive to all adult, territorial males.

Despite female receptivity to them, nonterritorial males were not as effective at terminating estrus as were adult, territorial animals. In 17 copulations between females and juvenile (8), peripheral (7), and senescent (2) males, sexual receptivity ended abruptly in two cases, continued unchanged in 13 cases, and could not be assessed in 2 cases. This result (13/15=87% unterminated estrus) is a much higher failure rate than for adult males (22% failure in captives, 15% on rookeries). Other tests suggest that this difference between adult and all other males results from the diameter of the terminal bulb of the penis, combined with the pattern of pelvic thrusting. A "vaginal code" (Diamond 1969) can thus be inferred for Callorhinus.

Pregnancy and unterminated estrus.--Impregnation can occur independently of the female's receiving appropriate physical stimuli to terminate estrus abruptly. Of nine females that had unterminated estrus after copulation with juvenile or peripheral male partners in 1980, seven produced a pup in 1981. This finding shows that ovulation occurs independently from the coitus-induced, rapid termination of estrus, and may be further evidence that ovulation is

spontaneous rather than induced (Craig 1964; Bigg 1979^{9/}). This finding also shows that juvenile males of 45 kg size are highly fertile (contra Murphy 1970). Female receptivity to, and fecundity with, juvenile males has important implications for the colonization process and for the concept of optimum sex ratio.

Male copulation capability does not appear to limit pregnancy rates at the present sex ratio. Instead, the element of importance to optimum sex ratio appears to be male ability to detect estrous females from among nonestrous females present. Male detection of estrus appears to be enhanced by the following characteristics of estrus:

1. rapid and obvious shifts in female behavior from nonreceptive to receptive at the onset of estrus,
2. male-induced onset of estrus (the "Whitten effect") in some females,
3. equal female receptivity to all males,
4. brief precopulatory and copulatory intervals (i.e., a short "handling time" for each estrous female),
5. rapid termination of estrus by the act of coitus, resulting in rapid return to nonreceptive behavior, and
6. female departure to sea soon after coitus, which reduces the number of nonbreeders interfering with male detection of estrus.

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^{9/} M. A. Bigg. 1979. Studies on captive fur seals. Unpubl. rep., 35 p. Natl. Mar. Mammal Lab., Northwest and Alaska Fish. Cent., Natl. Mar. Fish. Serv., NOAA, 7600 Sand Point Way N. E., Seattle, WA 98115. (Submitted to the 22nd Annual Meeting of the North Pacific Fur Seal Commission).

PART III. POPULATION GROWTH, SAN MIGUEL ISLAND (Adams Cove and Castle Rock)

Adams Cove

Since its discovery in 1968, the northern fur seal colony at Adams Cove on the west end of San Miguel Island has been studied annually. During the 1981 field season, research activities included population monitoring, a pup tagging program, a pup mortality study in conjunction with a pup growth study, and a female feeding behavior study.

Population Information

The most important population information for the Adams Cove colony is summarized in Table 10. The 1981 field season did not commence until 9 June, at which time there were 4 large adult, territorial males, 3 small adult, territorial males, 36 subadult males (bachelors), 86 adult females, 23 live pups, and 1 dead pup present. In 1981, a total of 941 pups was born, representing an increase of 5% from 1980.

The total number of territorial males increased from 19 in 1980 to 21 in 1981. Three of these territorial males were known to be 6 years of age (tagged as pups in 1975). A maximum count of 95 bachelors was recorded on 10 August, representing an increase of 40% over a count of 68 in 1980.

The greatest number of adult females on land occurred on 1 July when 717 were counted.

Tagging Records and Program

Records have been kept of each tagged seal observed ashore in Adams Cove since 1968. Some of these tag resightings are of females that had been tagged as pups on either the Pribilof Islands, Commander Islands, or Robben Island (Appendix A, Table A-8), or as adult females and pups in Adams Cove on 20 July 1968 (Appendix A, Table A-9). Records have also been kept of sightings of adult females tagged on San Miguel Island in 1975 and 1979 (Appendix A, Tables A-10 and A-11).

The fur seal pup tagging program on San Miguel Island began in 1975, and the subsequent resightings of these tagged animals are shown in Appendix A, Table A-12.

In order to compare tag longevity (durability and retention) and long-distance identification, three different types of tags were used to mark 399 fur seal pups in 1981. On 28 and 30 July, 7 August, and 9 and 26 September, a total of 100 fur seal pups were double-tagged with pink Roto-tags (hard plastic), and of these, 47 were each given a check mark by removing the cartilaginous extension of the first digit on the right hind flipper (Appendix A, Table A-13).

TABLE 10.--Summary of some observations of the northern fur seal colony in Adams Cove, San Miguel Island, California, 1969-81.

Observation	1969	1970	1971	1972	1973	1974	1975
Season span							
Beginning date ^{1/}	16 May	23 May	15 May	16 May	9 May	20 May	19 May
Ending date	1 Oct.	20 Sept.	6 Sept.	7 Sept.	15 Aug.	9 Sept.	6 Sept.
First male	16 May	29 May	24 May	16 May	26 May	20 May	12 May
First female	27 May	28 May	25 May	22 May	17 May	20 May ^{2/}	19 May
First birth	6 June	28 May	31 May	22 May	7 June ^{3/}	27 May	27 May
Mean birth date	24 June	21 June	26 June	22 June	24 June	23 June	27 June
Total births	28	33	45	70	68	220	329
Total pup deaths	2	14	15	21	17	52	46
Total females (maximum counted and date) ^{4/}	175 23 Aug.	179 23 Aug.	274 2 Sept.	310 16 Aug.	394 4 Aug.	551 8 Sept.	563 24 Aug.
Total large adult males	4	2	4	6	6	6	10 ^{5/}
Total small adult males	4	4	6	7	5	6	6
Total bachelors ^{6/}	4	5	6	10+	6	8	7

Observation	1976	1977	1978	1979	1980	1981
Season span						
Beginning date ^{1/}	29 May	18 May	17 May	15 May	17 May	9 June
Ending date	14 Sept.	22 Sept.	9 Sept.	15 Sept.	23 Sept.	13 Sept.
First male	29 May ^{7/}	18 May ^{8/}	17 May ^{2/}	21 May	17 May ^{10/}	9 June ^{11/}
First female	29 May ^{7/}	18 May ^{8/}	17 May ^{12/}	16 May ^{13/}	23 May	9 June ^{11/}
First birth	29 May ^{9/}	29 May	30 May	28 May	24 May	9 June ^{11/}
Mean birth date	29 June	25 June ^{14/}	24 June	29 June	29 June	26 June
Total births	417	421	635	834	896	941
Total pup deaths	91	64	77	72	103	289
Total females (maximum counted and date) ^{4/}	495 14 July	681 26 Aug.	584 18 Aug.	702 25 Aug.	665 31 Aug.	717 1 July
Total large adult males	7	7	13 ^{6/}	11	9	10
Total small adult males	5	3	12 ^{15/}	13 ^{15/}	10	11
Total bachelors ^{6/}	11	7+	19	50	68	95

^{1/} Beginning and ending dates of continuous observations.

^{2/} May have arrived earlier.

^{3/} One still birth occurred on 19 May.

^{4/} A few 2-, 3-, and 4-year-old males may have been included because they are about the same size as adult females.

^{5/} Includes two males who arrived in late August and were not territorial (probably from Castle Rock).

^{6/} Subadult males about 104-127 cm in body length, tip of nose to tip of tail.

^{7/} Four males, nine females present 29 May--arrived prior to 29 May.

^{8/} Three males and 2 females present 18 May--arrived prior to 18 May.

^{9/} One pup present 29 May--born prior to 29 May.

^{10/} Two males present 17 May--arrived prior to 17 May.

^{11/} Seven males, 86 females, and 24 pups present 9 June--arrived prior to 9 June.

^{12/} Two females present 17 May--arrived prior to 17 May.

^{13/} Four females present 16 May--arrived prior to 16 May.

^{14/} Estimated from previous breeding season information.

^{15/} Includes six small adult males who were not territorial.

On 24 September, 100 fur seal pups were double-tagged with modified (rounded post) monel cattle ear tags, and 99 pups were double-tagged with green Riese-tags (flexible plastic) on 24 and 26 September. All pups tagged with monel and Riese-tags were given check marks in the same manner described above (Appendix A, Tables A-14 and A-15).

On 1 May, four bachelor fur seals were double-tagged with white Roto-tags (Appendix A, Table A-16), and eight parturient female fur seals were double-tagged with yellow Roto-tags from 4 to 26 July (Appendix A, Table A-17).

Mortality on Land

In 1981, 289 (31%) of the fur seal pups born in Adams Cove died. Of these deaths, 93% (269) occurred during three periods of abnormally hot weather conditions (14-23 June, and 2-10 and 14-15 July).^{10/} Of the remaining 20 known deaths, 2 were attributed to emaciation (no fat layer on the carcasses), 1 was observed stillborn, 3 appeared to have drowned, and 14 were undetermined.

The sex and approximate ages of 106 dead fur seal pups were determined: 44 of 45 males (98%) and 43 of 61 females (71%) died during periods of abnormally hot weather conditions; 75% of all the pups examined had died within 1 to 4 days postpartum; and no adult nor subadult fur seals died on land during the 1981 field season.

Fur Seal Pup Study

The pup growth and development study conducted during the 1980 field season was repeated in 1981 for comparative purposes. The methods of capturing and marking the pups were identical to those described on pages 40-41 of the 1980 Report of Fur Seal Investigations^{11/}, with the exception that length measurements were not obtained during the 1981 study. Table 11 summarizes information on male and female pup weights collected from the Adams Cove population in 1980 and 1981. Pup weights at birth and at ages 42-52 days were compared using the Mann-Whitney U Test (Siegal 1956), and the results are as follows: weights at birth for both male and female pups were significantly greater in 1981 than in 1980 ($p < 0.05$), and at 42-52 days of age, the female pups born in 1981 remained significantly heavier than those

^{10/} High air and sand temperature, solar radiation, and calm air combine to raise body temperature and cause heat prostration.

^{11/} See footnote 2 in this report.

TABLE 11.--Mean weights of northern fur seal pups from Adams Cove, San Miguel Island, California, 1980 and 1981.

Year and sex	Mean weight at birth (kg)	Mean weight at age 42- 52 days (kg)
1980 male	5.46 (SD=0.86; N=63)	9.66 (SD=1.33; N=41)
female	4.81 (SD=0.79; N=75)	8.29 (SD=1.14; N=53)
1981 male	5.90 (SD=1.03; N=47)	10.04 (SD=1.45; N=22)
female	5.17 (SD=0.71; N=42)	9.08 (SD=1.06; N=13)

born in 1980 ($p < 0.05$), although there was no significant difference between the 42-52 day-old males for the 2 years ($p \geq 0.05$).

Additional comparisons of the pup growth data from San Miguel Island during 1980-81 and from the Pribilof Islands in 1980 are currently in progress.

Female Feeding Behavior Study

In late July, feeding behavior studies of northern fur seal females were conducted at Adams Cove in cooperation with G. L. Kooyman of Scripps Institution of Oceanography, La Jolla, California 92093. Six parturient female fur seals were captured and fitted with harnesses mounted with time-depth recorders and radio tags. A programmable scanning receiver and a strip-chart recording system were used to document timing of departure and arrival of radio-tagged females from Adams Cove. The expected time of at-sea feeding cycles for females of San Miguel Island in late July and early August was 4 days, yet the mean duration at sea for the six instrumented females was 17 days (range 10-25 days). One female had lost her harness and five females were recaptured shortly after their arrival and the instruments removed. Two recorders failed and the remaining three contained records of dives for portions of the time the animals were at sea feeding.

The prolonged period of time at sea for instrumented females at San Miguel Island was much greater than for those equipped with identical apparatus at St. George Island. Studies will be conducted in 1982 to assess if the harness or the mass of the depth recorder constitute the encumbrance responsible for extending the feeding cycles of female fur seals.

Castle Rock

A summary of census information for Castle Rock is presented in Table 12 for 1972-81. In 1981, a count of 597 pups (568 live and 29 dead) was obtained on 27 July, representing an increase in pup production of 34 animals (6%) from 1980. For the last 6 years, however, pup production on Castle Rock has fluctuated within a range of 521 (1976) to 653 (1979), suggesting a stabilization in the colony's growth in contrast to the continued growth of the Adams Cove colony.

Twenty eight breeding males were counted on Castle Rock from aerial photographs taken on 2 July 1981 (Table 12), representing an increase of one breeding male over the 1980 count. On 27 July, 51 fur seal pups were double-tagged with pink Roto-tags, and of these, 11 were given check marks by removing the cartilaginous extension on the first digit of the right hind flipper (Appendix A, Table A-18). On 23 September, 99 pups were single-tagged with modified (rounded post) monel cattle ear tags and given check marks in the same manner described above (Appendix A, Table A-19).

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TABLE 12.--Summary of censuses of northern fur seals, Castle Rock, California, 1972-81.^{1/}

Fur seals	Numbers observed, methods and date of observation				
	1972	1973	1974	1975	1976
Females	223 ^{a/} 1 Aug.	345 ^{a/} 11 July	301(+) ^{d/} 2 Aug.	396(+) ^{d/} 2 Aug.	526 ^{c/} 27 June
Pups (total observed) ^{2/}	95 ^{a/} 1 Aug.	193 ^{b/} 28 July	301(+) ^{b/} 2 Aug.	396 ^{b/} 2 Aug.	521 ^{b/} 25 July
Pups (dead observed)	-	33 ^{b/} 28 July	21 ^{b/} 2 Aug.	28 ^{b/} 2 Aug.	27 ^{b/} 25 July
Reproductive large adult males ^{3/}	9 ^{a/} 1 Aug.	13 ^{a/} 11 July	11 ^{a/} 2 July	15 ^{a/} 1 July	16 ^{c/} 27 June
Total large adult males	10 ^{a/} 1 Aug.	14 ^{a/} 11 July	20 ^{a/} 2 July	20 ^{a/} 1 July	18 ^{c/} 27 June
Total small adult males	-	-	-	-	-

Fur seals	Numbers observed, methods and date of observation				
	1977	1978	1979	1980	1981
Females	617(+) ^{d/} 29 July	533(+) ^{d/} 2 Aug.	653(+) ^{d/} 1 Aug.	563(+) ^{d/} 1 Aug.	597(+) ^{d/} 27 July
Pups (total observed) ^{2/}	617 ^{b/} 29 July	533 ^{b/} 2 Aug.	653 ^{b/} 1 Aug.	563 ^{b/} 1 Aug.	597 ^{b/} 27 July
Pups (dead observed)	20 ^{b/} 29 July	26 ^{b/} 2 Aug.	27 ^{b/} 1 Aug.	38 ^{b/} 1 Aug.	29 ^{b/} 27 July
Reproductive large adult males ^{3/}	9(+) ^{a/} 26 July	20 ^{a/} 1 July	27 ^{a/} 3 July	27 ^{a/} 1 July	28 ^{a/} 2 July
Total large adult males	9(+) ^{a/} 26 July	25 ^{a/} 1 July	32 ^{a/} 3 July	32 ^{a/} 1 July	29 ^{a/} 2 July
Total small adult males	-	-	7 ^{a/} 3 July	2 ^{a/} 1 July	12 ^{a/} 2 July

^{1/} Methods by which counts were obtained
a - Aerial photographs.
b - Land based counts from afoot.
c - Offshore counts from skiff.
d - Minimum estimate from pup count.

^{2/} Includes dead pup count.

^{3/} Territorial adult males with females.

PART IV. PELAGIC STUDIES

Objectives

The NOAA ship Miller Freeman was used during the period from 12 October to 6 November 1981 with the objectives of 1) comparing the species composition and relative abundance of fish found in northern fur seal stomachs to the species composition and relative abundance of fish in the water column; 2) assessing the distribution of northern fur seals as they migrate from the Pribilof Islands, Alaska, through the southeastern Bering Sea, Unimak Pass, and into the North Pacific Ocean; 3) recording the distribution and abundance of fish captured during bottom and/or mid-water trawl operations; and 4) collecting whole fish specimens, length-frequency distribution data, weights, and otoliths for those fish species known to be consumed by northern fur seals.

Distribution of Fur Seals

Most northern fur seals leave the Pribilof Islands in early to late autumn and migrate south to warmer temperate waters. Fur seals were observed at sea moving south throughout most of the study area with higher concentrations observed along the shelf slope to shallower waters corresponding to the 40-60 fathom contour. Fur seals were not seen in deep waters off Bogoslof Island.

The known general trend of the fur seal migration is for the females to move through Unimak and Akutan Passes, moving along the shelf's edge, then dispersing into the Pacific Ocean. Our observations on this survey were consistent with this trend. It is not known where adult male fur seals spend the winter, and during this study, we were unable to confirm any sightings of these animals at sea. Their distribution and movements during October and November are still unknown. Figure 10 shows the area (within dotted line) surveyed.

Collection of Fur Seals

On 17 October, eight females were collected on the shelf area about midway between Amak Island and the Pribilof Islands. Six females and three immature males were collected on 28 October near shore at St. Paul Island (Table 13).

Collection of Fur Seal Specimens

All but one stomach collected appeared to be full or nearly so, even though collections occurred mostly during daylight hours. Since fur seals feed primarily at night or during crepuscular hours, it was expected that stomachs collected during the hours prior to noon would be full, and those collected during the afternoon would be progressively less full. Since most of the stomachs collected appeared full, the

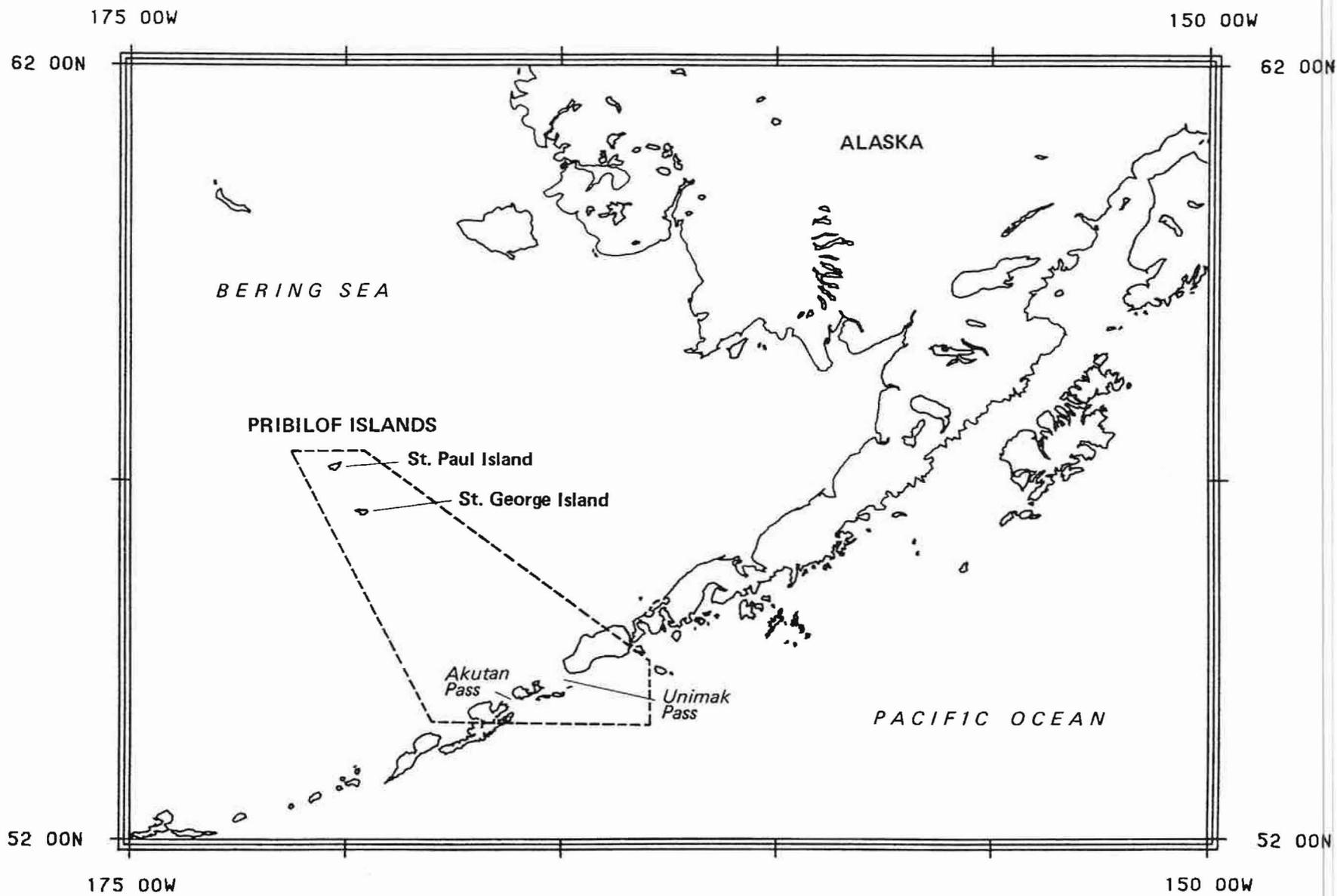


Figure 10.--Area of survey (within dotted line), NOAA ship Miller Freeman,
12 October to 6 November 1981.

TABLE 13.--Northern fur seals collected during NOAA ship Miller Freeman cruise MF-81-03, Leg II, 12 October to 6 November 1981.

Specimen number	Collection date (October)	Location (N Lat., W Long.)	Sex	Weight (kg)	Standard length (cm)
701	17	55°14', 165°08'	F	38.8	127.0
702	17	55°13', 165°09'	F	19.3	101.0
703	17	55°10', 165°09'	F	29.9	125.0
704	17	55°08', 165°02'	F	43.3	128.5
705	17	55°09', 165°03'	F	34.9	128.0
706	17	55°09', 165°03'	F	37.9	123.5
707	17	55°09', 165°02'	F	27.9	119.0
708	17	55°09', 165°02'	F	31.8	125.0
709	28	57°13', 170°15'	F	26.8	110.5
710	28	57°13', 170°15'	M	12.2	81.5
711	28	57°13', 170°15'	F	7.2	64.9
712	28	57°13', 170°15'	F	9.8	73.7
713	28	57°13', 170°15'	F	10.2	78.9
714	28	57°13', 170°15'	F	11.6	81.1
715	28	57°13', 170°15'	F	9.8	74.5
716	28	57°13', 170°15'	F	11.4	78.0
717	28	57°13', 170°15'	M	10.5	80.2

~~possible impact of inclement weather on the feeding activities of fur seals may need further study.~~

To insure maximum utilization of each seal collected, the following samples were taken for subsequent laboratory analysis:

<u>Organ</u>	<u>Purpose</u>	<u>Institution</u>
teeth	age classification	NWAFIC <u>12/</u>
reproductive tract	sex and reproductive history	NWAFIC
stomach - intestines	food studies	NWAFIC
throat - anus swabs	virology	Univ. Oregon
liver sample	toxicology	Univ. Oregon
blood serum	toxicology and virology	Univ. Oregon
samples of liver, blubber, muscle, spleen, pancreas, kidney and blood	protein analysis and toxicology	Portland State Univ.

Collection of Whole Fish Specimens

During the survey, 41 bottom trawl stations were sampled with a total biomass of 53,291.8 lb (24,179.6 kg) caught. Walleye pollock was the major fish species, comprising 17,775.7 lb (8,065.2 kg), or 46.1% of total fish weight. Walleye pollock was followed in percent of total fish weight by yellowfin sole (18.1%), Pacific cod (12.2%), and an assortment of flatfish and miscellaneous roundfish. The total fish weight was 38,533.3 lb (17,483.3 kg). Crabs and other invertebrates comprised the remaining 14,758.5 lb (6,696.2 kg) with snow (Tanner) crab being predominant.

A total of 929 otoliths were collected from 25 fish species for which the length, sex, and weight was determined. Thirty-three fish species were measured for length-frequency comparison, totaling 10,751 fish. Samples of 28 fish and invertebrate species were collected and frozen whole for archiving in the National Marine Mammal Laboratory fish collection in Seattle, Washington.

Thomas R. Loughlin

12/Northwest and Alaska Fisheries Center.

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Research on San Miguel Island, California, was completed with the cooperation of the staff of the Channel Islands National Monument, National Park Service, Ventura, California; and the Public Works Department, Pacific Missile Range Headquarters, U.S. Navy, Point Magu, California.

GLOSSARY

The following terms used in fur seal research and management on the Pribilof Islands, San Miguel Island, and Castle Rock have special meanings or are not readily found in standard dictionaries:

Bachelor Young male seals of ages 2-5 years.

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

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

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

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 other type of mark.

Male Seals, Adult Class 1 (Shoreline)--Full-grown males apparently with established territories spaced along the water's edge at intervals of 10-15 m. Most of these animals are wet or partly wet, and some acquire harems of one to four females between 10 and 20 July. They would then be called harem males (Class 3). Shoreline or Class 1 males should not be confused with Class 2 animals. The latter definitely have territories, whereas the shoreline males appear to be attached to such sites but may not be in all cases.

Class 2 (Territorial without females)--Full-grown males that have no females, but are actively defending territories. Most of these animals are located on the inland fringe of a rookery, some are between Class 1 (Shoreline) and Class 3 (Territorial with females) males, and an occasional Class 2 male may be completely surrounded by Class 3 males and their harems.

Class 3 (Territorial with females)--Full-grown males actively defending territories and females. Most Class 3 males and their harems combine to form a compact mass of animals. Isolated individuals, usually with small harems, may be observed at each end of a rookery, on sand beaches, and in corridors leading to inland hauling grounds. Some territorial males have as few as 1 or 2 females. Should these females be absent during the counts, their pups are used as a basis for putting the adult male into Class 3 rather than Class 2.

Class 4 (Back fringe)--Full- and partly-grown males on the inland fringe of a rookery. A few animals too young and too small to include in the count may be found here. Though some Class 4 males may appear to be holding territories, most will flee when approached or when prodded with a pole.

Class 5 (Hauling ground)--The hauling grounds contain males from May to late July and a mixture of males and females from then on. The counts include males that obviously are adults and all others that have a mane and the body conformation of an adult. Males included in this count will be approximately 7 years of age and older.

Prior to 1966, Class 3 males were formerly called harem bulls, and Classes 1, 2, 4, and 5 were collectively called idle bulls. From 1966 through 1974, the adult male seals were classified into five groups (Classes 1, 2, 3, 4, and 5). Beginning in 1975, Classes 1 and 2 were combined and designated as Class 2, Class 3 remained the same, and Classes 4 and 5 were combined and designated as Class 5.

Marked Describes a seal that has been marked by removing the cartilaginous tip of a digit from a hind flipper, by attaching an inscribed metal or plastic tag to one or more of its flippers, by freeze marking, by hair-clipping or by bleaching.

Mark Recoveries Includes the recoveries of seals marked by one of several methods. See Marked paragraph.

Rookery An area on which breeding seals congregate. See Hauling Ground.

Round The sequence in which hauling grounds are visited for the drive to harvest seals. A circuit or round of the hauling grounds is completed in 5 days, and the procedure is repeated throughout the harvest of males.

The following are English translations of names given to some of the rookeries or hauling grounds by the Russians in the 1700's:

RussianEnglishSt. Paul Island

Vostochni	From "Novoctoshni" meaning "place of recent growth"; applied to Northeast Point which was apparently at one time an island that has since been connected to St. Paul Island by drifting sand.
Morjovi	Walrus. Historically, walruscs hauled out here in summer.
Polovina	Halfway (to Northeast Point from the village).
Kitovi	Of "KIT" or whale. When whaling fleets were active in the Bering Sea between 1849 and 1856, a large right whale killed by some ship's crew drifted ashore here.
Gorbatch	Humpback. Apparently refers to the "hump like" nature of the scoria slope above the rookery.
Tolstoi	Thick. In this case, thick headland on which the rookery is located.
Zapadni	West. Western part of the island.
Lukanin	So named after a Russian pioneer sailor who was said to have taken over 5,000 sea otters from St. Paul Island in 1787.
Zoltoi (hauling ground)	Golden.

St. George Island

Staraya Artil	Old settlement or village. There was once a settlement or village adjacent to the rookery.
Zapadni	West. Western part of the island.

Sea Lion Rock

Sivutch	Sea lion. These animals haul out but do not breed here.
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REFERENCES

- Craig, A. M. 1964. Histology of reproduction and the estrus cycle in the female fur seal, Callorhinus ursinus. J. Fish. Res. Board Can. 21:773-811.
- Diamond, M. 1969. Intromission pattern and species vaginal code in relation to induction of pseudopregnancy. Science (Wash., D.C.) 169:995-997.
- Klevezal', G. A. 1980. Layers in the hard tissues of mammals as a record of growth rhythms of individuals. In W. F. Perrin and A. C. Myrick, Jr. (editors), Growth of odontocetes and sirenians: problems in age determination. Rep. Int. Whaling Comm., Spec. Issue 3:89-97.
- Kubota, K., K. Matsumoto, F. Nagasaki, and M. Tsuboi. 1961. Histological studies on the growth layers in the maxillary canines of fur seals as an indication of age. The teeth at the age of one to nine years. Bull. Tokyo Med. Dent. Univ. 8(3):261-85 + 8 pls.
- Lander, R. H. (editor). 1980. Summary of northern fur seal data and collection procedures, Volume 1: land data of the United States and Soviet Union (excluding tag and recovery records). U.S. Dep. Commer., NOAA Tech. Memo. NMFS F/NWC-3, 315 p.
- Murphy, H. D. 1970. Microscopic studies on the testis of the northern fur seal, Callorhinus ursinus. In T. C. Poulter (editor), Proceedings of the seventh annual conference on biological sonar and diving mammals. p. 97-103. Stanford Res. Inst., Menlo Park, Calif., October 1970.
- Pierce, K. V., and H. Kajimura. 1980. Acid etching and highlighting for defining growth layers in cetacean teeth. In W. F. Perrin and A. C. Myrick, Jr. (editors), Growth of odontocetes and sirenians: problems in age determination. Rep. Int. Whaling Comm., Spec. Issue 3:99-103.
- Scheffer, V. B. 1955. Body size with relation to population density in mammals. J. Mammal. 36(4):493-515.
- Siegel, S. 1956. Non-Parametric statistics for behavioral sciences. McGraw-Hill Book Co., Inc., New York, N. Y., 312 p.
- Whitten, W. K. 1956. Modifications of the oestrous cycle of the mouse by external stimuli associated with the male. J. Endocrinol. 13:399-404.

APPENDIX A

Tabulations of northern fur seal data collected on the Pribilof Islands, Alaska, and on San Miguel Island, California, and nearby Castle Rock in 1981.

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TABLE A-1.--Age classification of male northern fur seals harvested, St. Paul Island, Alaska, 23 June to 31 July 1981.

Date/Rookery ^{1/}	Males harvested	Tooth sample	Daily										Cumulative										
			Percent in each age group of sample					Estimated number harvested by age group					Total harvest to date	Estimated number harvested by age group					Percent harvested by age group				
			2	3	4	5	6	2	3	4	5	6		2	3	4	5	6	2	3	4	5	6
June 23 POL	2/ 100	33	0.0	27.3	66.7	6.0	0.0	0	27	67	6	0	100	0	27	67	6	0	0	27	67	6	0
29 NEP (east)	665	158	2.5	38.0	50.6	8.9	0.0	17	253	336	59	0	765	17	280	403	65	0	2	37	53	8	0
29 NEP (west)	218	52	1.9	40.4	48.1	9.6	0.0	4	88	105	21	0	983	21	368	508	86	0	2	37	52	9	0
30 TZR	284	72	5.5	27.8	51.4	15.3	0.0	16	79	146	43	0	1,267	37	447	654	129	0	3	35	52	10	0
30 ZAP	675	153	1.9	45.1	48.4	4.6	0.0	13	304	327	31	0	1,942	50	751	981	160	0	3	39	50	8	0
July 1 POL	420	103	2.0	49.5	45.6	2.9	0.0	8	208	192	12	0	2,362	58	959	1,173	172	0	2	41	50	7	0
1 L-K	299	72	4.2	45.8	47.2	2.8	0.0	13	137	141	8	0	2,661	71	1,096	1,314	180	0	3	41	49	7	0
2 REEF	789	159	3.8	44.0	47.8	4.4	0.0	30	347	377	35	0	3,450	101	1,443	1,691	215	0	3	42	49	6	0
6 ZAP	833	176	9.7	46.6	40.3	3.4	0.0	81	388	336	28	0	4,283	182	1,831	2,027	243	0	4	43	47	6	0
7 TZR	136	26	0.0	46.2	46.2	7.6	0.0	0	63	63	10	0	4,419	182	1,894	2,090	253	0	4	43	47	6	0
7 L-K	282	54	3.7	50.0	40.7	5.6	0.0	10	141	115	16	0	4,701	192	2,035	2,205	269	0	4	43	47	6	0
8 NEP (east)	697	138	8.0	50.7	36.2	5.1	0.0	56	353	252	36	0	5,398	248	2,388	2,457	305	0	5	44	45	6	0
8 NEP (west)	277	55	3.6	49.1	45.5	1.8	0.0	10	136	126	5	0	5,675	258	2,524	2,583	310	0	5	44	46	5	0
9 REEF	775	160	3.8	59.4	30.6	6.2	0.0	30	460	237	48	0	6,450	288	2,984	2,820	358	0	4	46	44	6	0
10 POL	2/ 363	65	1.5	47.7	49.3	1.5	0.0	5	174	179	5	0	6,813	293	3,158	2,999	363	0	4	47	44	5	0
13 ZAP	858	206	7.8	66.0	23.8	2.4	0.0	67	566	204	21	0	7,671	360	3,724	3,203	384	0	5	48	42	5	0
14 TZR	802	190	5.3	58.9	34.7	1.1	0.0	43	472	278	9	0	8,473	403	4,196	3,481	393	0	5	49	41	5	0
14 L-K	305	77	3.9	64.9	29.9	1.3	0.0	12	198	91	4	0	8,778	415	4,394	3,572	397	0	5	50	41	4	0
15 NEP (east)	381	79	10.1	67.1	21.5	1.3	0.0	38	256	82	5	0	9,159	453	4,650	3,654	402	0	5	51	40	4	0
15 NEP (west)	506	101	9.9	68.3	20.8	1.0	0.0	50	346	105	5	0	9,665	503	4,996	3,759	407	0	5	52	39	4	0
16 REEF	1,113	255	6.3	62.0	29.4	1.9	0.4	70	690	327	21	5	10,778	573	5,686	4,086	428	5	5	53	38	4	0
17 POL	2/ 499	113	6.2	69.9	23.9	0.0	0.0	31	349	119	0	0	11,277	604	6,035	4,205	428	5	5	54	37	4	0
20 ZAP	1,957	395	9.4	62.3	25.8	2.3	0.2	184	1,219	505	45	4	13,234	788	7,254	4,710	473	9	6	55	36	3	0
21 TZR	241	47	6.4	55.3	38.3	0.0	0.0	16	133	92	0	0	13,475	804	7,387	4,802	473	9	6	55	36	3	0
21 L-K	574	113	18.6	61.9	17.7	1.8	0.0	107	355	102	10	0	14,049	911	7,742	4,904	483	9	7	55	35	3	0
22 NEP (east)	837	174	9.8	67.2	21.8	1.2	0.0	82	562	183	10	0	14,886	993	8,304	5,087	493	9	7	56	34	3	0
22 NEP (west)	380	83	6.0	67.5	22.9	3.6	0.0	23	256	87	14	0	15,266	1,016	8,560	5,174	507	9	7	56	34	3	0
23 POL	473	101	10.9	62.4	25.7	1.0	0.0	52	295	121	5	0	15,739	1,068	8,855	5,295	512	9	7	56	34	3	0
24 REEF	1,592	323	9.6	67.2	19.8	3.1	0.3	153	1,070	315	49	5	17,331	1,221	9,925	5,610	561	14	7	57	33	3	0
27 ZAP	1,288	257	10.5	72.0	14.4	3.1	0.0	135	927	186	40	0	18,619	1,356	10,852	5,796	601	14	7	59	31	3	0
28 TZR	788	164	9.8	71.3	17.7	1.2	0.0	77	562	140	9	0	19,407	1,433	11,414	5,936	610	14	7	59	31	3	0
29 NEP (east)	854	167	13.8	64.1	20.9	1.2	0.0	118	547	179	10	0	20,261	1,551	11,961	6,115	620	14	8	59	30	3	0
29 NEP (west)	657	124	22.6	58.9	18.5	0.0	0.0	148	387	122	0	0	20,918	1,699	12,348	6,237	620	14	8	59	30	3	0
30 POL	596	117	7.7	60.7	30.0	0.8	0.8	46	361	179	5	5	21,514	1,745	12,709	6,416	625	19	8	59	30	3	0
30 L-K	494	99	22.2	68.7	8.1	1.0	0.0	110	339	40	5	0	22,008	1,855	13,048	6,456	630	19	9	59	29	3	0
31 REEF	1,884	372	22.8	62.4	13.7	1.1	0.0	429	1,176	258	21	0	23,892	2,284	14,224	6,714	651	19	10	59	28	3	0

^{1/} 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, Polovina Cliffs, and Little Polovina; ZAP = Zapadni; REEF = Reef, Gorbach, and Ardiquen; and L-K = Lukanin and Kitovi.

^{2/} Experimental afternoon harvest.

TABLE A-2.--Number of adult male northern fur seals counted, by class^{1/} and rookery section, St. Paul Island, Alaska, 10-17 July 1981. A dash indicates no numbered sections.

Rookery and class of male	Section														Total
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	
<u>Lukanin</u>															
2	15	14	-	-	-	-	-	-	-	-	-	-	-	-	29
3	24	63	-	-	-	-	-	-	-	-	-	-	-	-	87
5	23	0	-	-	-	-	-	-	-	-	-	-	-	-	23
<u>Kitovi</u> ^{2/}															
2	10(9)	2	11	19	15	-	-	-	-	-	-	-	-	-	66
3	45(16)	16	48	65	55	-	-	-	-	-	-	-	-	-	245
5	3(0)	17	4	4	80	-	-	-	-	-	-	-	-	-	108
<u>Reef</u>															
2	19	44	35	28	23	16	21	20	13	7	6	-	-	-	232
3	52	83	77	47	54	60	44	53	47	50	18	-	-	-	585
5	2	0	0	0	262	0	57	39	0	58	0	-	-	-	418
<u>Gorbatch</u>															
2	24	17	17	13	15	23	-	-	-	-	-	-	-	-	109
3	88	69	52	17	36	71	-	-	-	-	-	-	-	-	333
5	73	0	9	130	5	0	-	-	-	-	-	-	-	-	217
<u>Ardiquen</u>															
2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4
3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	62
5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
<u>Morjovi</u> ^{3/}															
2	24(11)	21	14	21	15	15	-	-	-	-	-	-	-	-	121
3	41(35)	61	52	74	80	64	-	-	-	-	-	-	-	-	407
5	79(5)	19	0	0	5	106	-	-	-	-	-	-	-	-	214
<u>Vostochni</u>															
2	24	5	10	2	3	26	23	27	16	2	8	15	18	8	187
3	60	36	55	48	44	101	76	76	63	37	50	66	142	68	922
5	2	6	0	33	86	3	0	5	30	0	0	67	54	81	367
<u>Little Polovina</u>															
2	15	15	-	-	-	-	-	-	-	-	-	-	-	-	30
3	39	31	-	-	-	-	-	-	-	-	-	-	-	-	70
5	214	1	-	-	-	-	-	-	-	-	-	-	-	-	215
<u>Polovina</u>															
2	20	17	-	-	-	-	-	-	-	-	-	-	-	-	37
3	50	33	-	-	-	-	-	-	-	-	-	-	-	-	83
5	126	0	-	-	-	-	-	-	-	-	-	-	-	-	126
<u>Polovina Cliffs</u>															
2	12	10	3	21	11	69	35	-	-	-	-	-	-	-	161
3	41	45	41	53	64	126	101	-	-	-	-	-	-	-	471
5	3	0	0	2	4	0	10	-	-	-	-	-	-	-	19
<u>Tolstoi</u>															
2	12	16	21	13	16	25	27	34	-	-	-	-	-	-	164
3	65	47	82	43	92	111	81	84	-	-	-	-	-	-	605
5	4	0	0	0	0	0	0	189	-	-	-	-	-	-	193
<u>Zapadni Reef</u>															
2	11	44	-	-	-	-	-	-	-	-	-	-	-	-	55
3	59	167	-	-	-	-	-	-	-	-	-	-	-	-	226
5	48	50	-	-	-	-	-	-	-	-	-	-	-	-	98
<u>Little Zapadni</u>															
2	13	10	16	27	9	24	-	-	-	-	-	-	-	-	99
3	22	67	94	120	26	80	-	-	-	-	-	-	-	-	409
5	6	0	0	0	0	108	-	-	-	-	-	-	-	-	114
<u>Zapadni</u> ^{4/}															
2	20(0)	36	19	47	21	20	16	2	-	-	-	-	-	-	181
3	63(1)	90	94	111	78	86	78	14	-	-	-	-	-	-	615
5	0(123)	45	0	0	98	13	3	134	-	-	-	-	-	-	416

^{1/} See glossary for a description of the classes of adult male seals.

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

^{3/} Numbers in parentheses are the adult males counted on the second point south of Sea Lion Neck.

^{4/} Numbers in parentheses are the adult males counted on Zapadni Point Reef.

TABLE A-3.--Number of adult male northern fur seals counted, by rookery, Pribilof Islands, Alaska, July 1981.

Island and rookery	Date	Class of adult male ^{1/}			Total
		2	3	5	
<u>St. Paul Island</u>					
	<u>July</u>				
Lukanin	10	29	87	23	139
Kitovi	16	66	245	108	419
Reef	10	232	585	418	1,235
Gorbatch	10	109	333	217	659
Ardiguen	10	4	62	0	66
Morjovi	17	121	407	214	742
Vostochni	17	187	922	367	1,476
Little Polovina	11	30	70	215	315
Polovina	11	37	83	126	246
Polovina Cliffs	11	161	471	19	651
Tolstoi	14	164	605	193	962
Zapadni Reef	16	55	226	98	379
Little Zapadni	14	99	409	114	622
Zapadni	13	<u>181</u>	<u>615</u>	<u>416</u>	<u>1,212</u>
Island total		1,475	5,120	2,528	9,123
<u>St. George Island</u>					
	<u>July</u>				
Zapadni	18	75	136	260	471
South	18	62	207	68	337
North	18	152	538	419	1,109
East Reef	19	22	118	51	191
East Cliffs	19	66	306	220	592
Staraya Artil	17	<u>74</u>	<u>167</u>	<u>177</u>	<u>418</u>
Island total		451	1,472	1,195	3,118
Total both islands		1,926	6,592	3,723	12,241

^{1/} See glossary for a description of the classes of adult male seals.

TABLE A-4.--Number of harem and idle male northern fur seals counted in mid-July, Pribilof Islands, Alaska, 1972-81.

Year	St. Paul Island		St. George Island		Both islands	
	Harem	Idle	Harem	Idle	Harem	Idle
1972 ^{1/}	3,738	2,384	1,153	328	4,891	2,712
1973	^{2/} 4,906	^{2/} 2,550	875	375	5,781	2,925
1974	^{3/} 4,563	^{3/} 1,782	822	481	5,385	2,263
1975	5,018	3,535	877	1,427	5,895	4,962
1976	5,324	4,041	1,093	996	6,417	5,037
1977	6,457	3,845	1,610	899	8,067	4,744
1978	6,496	3,908	1,590	1,220	8,086	5,128
1979	6,242	4,457	1,716	1,942	7,958	6,399
1980	5,490	4,248	1,563	1,795	7,053	6,043
1981	5,120	4,003	1,472	1,646	6,592	5,649

^{1/} Values for St. Paul Island were extrapolated from July counts on Northeast Point Rookeries in 1972 and counts on Northeast Point Rookeries and total counts on St. Paul Island in 1970. Values for St. George Island were extrapolated from July counts on Zapadni and South Rookeries and counts on Zapadni and South Rookeries and the total counts on St. George Island in 1971.

^{2/} Total numbers of harem and idle males in July were extrapolated from counts of harem and idle males on all rookeries in June and from counts of harem and idle males on sample rookeries (Zapadni, Little Zapadni, Zapadni Reef, and Tolstoi) in July using the following procedure:

$$(a) \text{ Assume } \frac{\text{June } (h+i)}{\text{July } (h+i)} = \frac{\text{June } (H+I)}{\text{July } (H+I)}, \text{ solve for July } (H+I)$$

$$(b) \text{ Assume } \frac{\text{July } (h)}{\text{July } (h+i)} = \frac{\text{July } (H)}{\text{July } (H+I)}, \text{ solve for July } (H)$$

$$(c) \text{ Solve } \text{July } (H+I) - \text{July } (H) = \text{July } (I);$$

where h, H = respective counts of harem males on sample rookeries and all rookeries;

i, I = respective counts of idle males on sample rookeries and all rookeries.

^{3/} Total numbers of harem and idle males in July were extrapolated from counts of harem and idle males on all rookeries in June and from counts of harem and idle males on sample rookeries (Reef, Gorbatch, and Ardiguen) in July using the same procedure applied in 1973 (see footnote 2 of this table).

TABLE A-5.--Number of dead northern fur seal pups counted, by rookery section, Pribilof Islands, Alaska, August 1981.

Island and rookery	Date	Section														Total
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	
<u>St. Paul Island</u>		<u>August</u>														
Morjovi	20	97 ^{1/}	56	34	61	40	58	-	-	-	-	-	-	-	-	346
Vostochni	27	27	4	36	34	64	244	45	73	48	14	32	51	164	53	889
Little Polovina	17	18	23	-	-	-	-	-	-	-	-	-	-	-	-	41
Polovina Cliffs	25	80	49	57	69	63	117	28	-	-	-	-	-	-	-	463
Polovina	19	35	54	-	-	-	-	-	-	-	-	-	-	-	-	89
Ardiguen ^{2/}	18	-	-	-	-	-	-	-	-	-	-	-	-	-	-	38
Gorbatch	18	101	92	66	18	43	59	-	-	-	-	-	-	-	-	379
Reef	18,25	41	111	114	63	56	59	90	39	39	10	1	-	-	-	623
Kitovi	17	54 ^{3/}	4	34	56	39	-	-	-	-	-	-	-	-	-	187
Lukanin	17	56	46	-	-	-	-	-	-	-	-	-	-	-	-	102
Tolstoi	21	88	80	103	85	225	243	242	481	-	-	-	-	-	-	1,547
Little Zapadni	20	9	60	62	122	64	60	-	-	-	-	-	-	-	-	377
Zapadni Reef	17	140	126	-	-	-	-	-	-	-	-	-	-	-	-	266
Zapadni	21	60	177	249	480	192	121	131	41	-	-	-	-	-	-	1,451
															Total	6,798
<u>St. George Island</u>		<u>August</u>														
North	16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	810
Zapadni	18	-	-	-	-	-	-	-	-	-	-	-	-	-	-	186
South	18	-	-	-	-	-	-	-	-	-	-	-	-	-	-	177
East Reef	14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	74
East Cliffs	14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	402 ^{5/}
Staraya Artil	15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	376
															Total	2,025
															Grand total	8,823

^{1/} Includes 24 dead pups counted on second point south of Sea Lion Neck.

^{2/} No numbered sections.

^{3/} Includes 22 dead pups counted in Kitovi Amphitheater.

^{4/} Dead pups were not counted by rookery section.

^{5/} Includes an estimate of 109 dead pups on an unsurveyed area of the rookery which was based on the ratio of the number dead pups per live adult male with a harem on the surveyed area and the number of live adult males on the area not surveyed for dead pups.

TABLE A-6.--Soviet tags recovered in the U. S. harvest of male northern fur seals, St. Paul Island, Alaska, 23 June to 31 July 1981. Each animal had been marked as a pup.

Date	Tag number	Age (years)	Sex	Island of tagging (Commander Isl.)	Rookery of recovery ^{1/}
20 July	YB-176	2	M	Bering	Zapadni
23 July	YM-198	2	M	Medny	Polovina
21 July	XB-754	3	M	Bering	Tolstoi-Zapadni Reef
15 July	XB-1027	3	M	Bering	Northeast Point
29 July	XB-3775	3	M	Bering	Northeast Point
20 July	XB-4939	3	M	Bering	Zapadni
24 July	XM-836	3	M	Medny	Reef
30 July	XM-1303	3	M	Medny	Polovina
29 July	XM-1328	3	M	Medny	Northeast Point
20 July	XM-2023	3	M	Medny	Zapadni
14 July	XM-2191	3	M	Medny	Tolstoi-Zapadni Reef
21 July	XM-2993	3	M	Medny	Tolstoi-Zapadni Reef
31 July	XM-3066	3	M	Medny	Reef
30 July	XM-3320	3	M	Medny	Polovina
28 July	XM-3607	3	M	Medny	Tolstoi-Zapadni Reef
28 July	XM-3838	3	M	Medny	Tolstoi-Zapadni Reef
27 July	XM-4602	3	M	Medny	Zapadni
22 July	XM-4688	3	M	Medny	Northeast Point
29 July	XM-4704	3	M	Medny	Northeast Point
29 July	XM-8354	3	M	Medny	Northeast Point
30 July	XM-9045	3	M	Medny	Polovina
31 July	TB-912	4	M	Bering	Reef
24 July	TB-2045	4	M	Bering	Reef
9 July	TB-3283	4	M	Bering	Reef
13 July	TB-4334	4	M	Bering	Zapadni
20 July	TB-5041	4	M	Bering	Zapadni
9 July	TM-671	4	M	Medny	Reef
27 July	TM-1583	4	M	Medny	Zapadni
21 July	TM-3341	4	M	Medny	Lukanin-Kitovi
29 July	TM-4759	4	M	Medny	Northeast Point
30 June	TM-5338	4	M	Medny	Zapadni
29 June	TM-6040	4	M	Medny	Northeast Point
21 July	TM-6997	4	M	Medny	Lukanin-Kitovi
29 July	TM-7214	4	M	Medny	Northeast Point

^{1/} One tag (XM-3161) was recovered from a 3-year-old male during the subsistence harvest on St. George Island, Alaska, on 4 August at the east hauling ground of North Rookery. The animal had been tagged as a pup on Medny Island.

TABLE A-7--Northern fur seals entangled in fishing debris and other materials,
U. S. commercial harvest of northern fur seals, St. Paul Island,
Alaska, 1967-81.

Year	Number of seals harvested ^{1/}	Number of entangled seals observed on the harvesting area ^{1/}	Percent of harvest
1967	50,229	75	0.15
1968	46,893	75	0.16
1969	32,817	67	0.20
1970	36,307	101	0.28
1971	27,338	113	0.41
1972	33,173	139	0.42
1973	28,482	135	0.47
1974	33,027	197	0.60
1975	29,148	211	0.72
1976	23,096	102	0.44
1977	28,444	99	0.35
1978	24,885	114	0.46
1979	25,762	110	0.43
1980	24,327	119	0.49
1981	23,928	102	0.43

^{1/} Includes both sexes.

TABLE A-8.--Northern fur seals tagged as pups on the Pribilof Islands (St. Paul and St. George), Commander Islands (Bering and Medny), and Robben Island, and dates first observed on San Miguel Island, California, 1968-81.

Tag number	Sex	Island of origin	Date tagged	Date observed				
				1968	1969	1970	1971	1972
E-2818	F	Bering	1960	21 July	-	11 Aug.	22 July	29 June
T-19022	F	Medny	1965	-	-	-	29 Oct.	23 July
N-41314	F	St. Paul	1961	21 July	-	-	-	24 Aug.
N-16387	F	St. Paul	1961	-	25 July	14 July	23 June	27 July
N-19851	F	St. Paul	1961	-	12 Sept.	12 Aug. ^{1/}	24 July	29 June
N-25437	F	St. Paul	1961	-	25 July	2 Aug.	9 July	26 July
M-53901	F	St. Paul	1960	-	31 July	23 July	14 June	-
O-26056	F	St. Paul	1962	-	25 July	18 July	29 July	3 Sept. ^{2/}
R-8179	F	St. Paul	1965	-	1 Oct.	-	-	-
J-4937	F	St. George	1957	-	18 Aug. ^{3/}	14 Aug.	14 June	24 Aug.
N-29437	F	St. Paul	1961	-	-	20 July	-	-
N-48079	F	St. Paul	1961	-	-	11 Aug.	-	-
N-2114	F	St. George	1961	-	-	-	14 June	31 July
N-31432	F	St. Paul	1961	-	-	-	7 July	12 July
Q-20975	F	St. Paul	1964	-	-	-	10 July	-
R-8844	F	St. Paul	1965	-	-	-	8 Aug.	27 Aug.
T-24	F	St. George	1967	-	-	-	7 Aug.	12 July
T-9697	F	St. Paul	1967	-	-	-	19 Aug.	2 Aug.
T-12129	F	St. Paul	1967	-	-	-	25 Aug.	26 July
U-6971	F	St. Paul	1968	-	-	-	21 Aug.	26 July
O-48131	F	St. Paul	1962	-	-	-	-	3 Sept.
T-6003	F	Robben	1965	-	-	-	-	5 Sept.
T-8572	F	St. Paul	1967	-	-	-	-	23 July
Y-7104	F	Robben	1966	-	-	-	-	30 Aug.
BB-1364	F	Bering	1969	-	-	-	-	7 Sept.
AM-8302	F	Medny	1968	-	-	-	-	-
U-697 ^{4/}	F	St. George	1968	-	-	-	-	-
U-5791	F	St. George	1968	-	-	-	-	-
CM-3667	F	Medny	1970	-	-	-	-	-
ET-593	F	Robben	1971	-	-	-	-	-
H-2314	F	Robben	1963	-	-	-	-	-
T-19022	F	Medny	1965	-	-	-	-	-
DT-TINRO ^{5/}	F	-	-	-	-	-	-	-
I-3698? ^{6/}	F	St. Paul	1956	-	-	-	-	-
ET-9564	F	Medny	1971	-	-	-	-	-
KT-1290	F	Robben	1973	-	-	-	-	-

TABLE A-8.--Northern fur seals tagged as pups on the Pribilof Islands (St. Paul and St. George), Commander Islands (Bering and Medny), and Robben Island, and dates first observed on San Miguel Island, California, 1968-81. (continued)

Tag number	Sex	Island of origin	Date tagged	Date observed				
				1973	1974	1975	1976	1977
E-2818	F	Bering	1960	6 July	-	4 Aug.	17 July	-
T-19022	F	Medny	1965	-	-	-	-	-
N-41314	F	St. Paul	1961	-	-	-	22 July	-
N-16387	F	St. Paul	1961	-	-	9 Aug.	-	-
N-19851	F	St. Paul	1961	21 July	-	-	-	-
N-25437	F	St. Paul	1961	4 Aug.	-	-	-	-
M-53901	F	St. Paul	1960	-	-	-	-	-
O-26056	F	St. Paul	1962	22 July	-	28 July	29 July	-
R-8179	F	St. Paul	1965	-	-	-	-	-
J-4937	F	St. George	1957	-	-	-	-	-
N-29437	F	St. Paul	1961	-	-	-	-	-
N-48079	F	St. Paul	1961	-	-	-	-	30 July
N-2114	F	St. George	1961	4 Aug.	-	27 July	24 July	-
N-31432	F	St. Paul	1961	3 July	-	26 Aug.	-	-
Q-20975	F	St. Paul	1964	-	-	-	-	-
R-8844	F	St. Paul	1965	19 July	-	27 July	18 July	-
T-24	F	St. George	1967	25 July	-	-	-	-
T-9697	F	St. Paul	1967	-	-	11 Aug.	7 Sept.	-
T-12129	F	St. Paul	1967	21 July	-	-	-	-
U-6971	F	St. Paul	1968	10 July	-	31 July	2 Aug.	-
O-48131	F	St. Paul	1962	-	-	-	-	-
T-6003	F	Robben	1965	10 July	12 Aug.	-	-	-
T-8572	F	St. Paul	1967	23 July	-	-	-	21 Aug.
Y-7104	F	Robben	1966	13 July	10 June	3 July	11 July	6 Aug.
BB-1364	F	Bering	1969	-	9 Aug.	-	-	8 Sept.
AM-8302	F	Medny	1968	-	14 Aug.	28 July	18 July	-
U-697 ⁴	F	St. George	1968	-	5 July	-	-	7 Sept.
U-5791	F	St. George	1968	-	1 Sept.	-	-	-
CM-3667	F	Medny	1970	-	-	3 July	-	-
ET-593	F	Robben	1971	-	-	17 July	-	-
H-2314	F	Robben	1963	-	-	20 Aug.	-	-
T-19022	F	Medny	1965	-	-	20 Aug.	-	-
DT-TINR0 ^{5/}	F	-	-	-	-	14 Aug.	21 July	-
I-3698? ^{6/}	F	St. Paul	1956	-	-	-	5 Sept.	-
ET-9564	F	Medny	1971	-	-	-	-	-
KT-1290	F	Robben	1973	-	-	-	-	-

TABLE A-8.--Northern fur seals tagged as pups on the Pribilof Islands (St. Paul and St. George), Commander Islands (Bering and Medny), and Robben Island, and dates first observed on San Miguel Island, California, 1968-81. (continued)

Tag number	Sex	Island of origin	Date tagged	Date observed			
				1978	1979	1980	1981
E-2818	F	Bering	1960	-	-	-	-
T-19022	F	Medny	1965	-	1 Sept.	-	-
N-41314	F	St. Paul	1961	19 Aug.	2 Sept.	-	-
N-16387	F	St. Paul	1961	-	-	-	-
N-19851	F	St. Paul	1961	-	-	-	-
N-25437	F	St. Paul	1961	-	-	29 June	-
M-53901	F	St. Paul	1960	-	-	-	-
O-26056	F	St. Paul	1962	17 July	24 May	-	-
R-8179	F	St. Paul	1965	-	-	-	-
J-4937	F	St. George	1957	-	-	-	-
N-29437	F	St. Paul	1961	-	-	-	-
N-48079	F	St. Paul	1961	-	8 Aug.	-	-
N-2114	F	St. George	1961	-	-	-	-
N-31432	F	St. Paul	1961	-	-	-	-
Q-20975	F	St. Paul	1964	-	-	-	-
R-8844	F	St. Paul	1965	-	10 Aug.	-	9 Aug.
T-24	F	St. George	1967	-	-	-	-
T-9697	F	St. Paul	1967	-	-	-	-
T-12129	F	St. Paul	1967	-	-	-	-
U-6971	F	St. Paul	1968	17 July	8 Aug.	5 July	23 July
O-48131	F	St. Paul	1962	-	-	-	-
T-6003	F	Robben	1965	-	24 Aug.	-	-
T-8572	F	St. Paul	1967	-	-	-	-
Y-7104	F	Robben	1966	-	-	4 July	-
BB-1364	F	Bering	1969	8 July	11 Aug.	20 July	-
AM-8302	F	Medny	1968	-	11 Aug.	-	-
U-697 ⁴	F	St. George	1968	-	-	-	-
U-5791	F	St. George	1968	-	-	-	-
CM-3667	F	Medny	1970	-	-	8 Sept.	-
ET-593	F	Robben	1971	-	-	-	-
H-2314	F	Robben	1963	-	-	-	-
T-19022	F	Medny	1965	-	-	-	-
DT-TINRO ^{5/}	F	-	-	-	-	-	-
I-3698? ^{6/}	F	St. Paul	1956	-	-	-	-
ET-9564	F	Medny	1971	-	6 Aug.	18 July	-
KT-1290	F	Robben	1973	-	-	14 Sept.	-

^{1/} Tag number N-19851 recorded as N-15851 in 1970.

^{2/} Tag number O-26056 also recorded on Castle Rock, 8 September 1972.

^{3/} Tag number J-4937 recorded as J-4939 in 1969.

^{4/} Female identified by tag number U6971 may be the same individual.

^{5/} A double-tagged female. TINRO was read but the numbers could not be seen with the scope.

^{6/} Last number on tag unreadable.

TABLE A-9.--Northern fur seals tagged on San Miguel Island, California, in 1968 and the dates first resighted, 1969-81.^{1/}

Tag number Right / Left flipper / flipper	Date observed						
	1969	1970	1971	1972	1973	1974	1975
UC-3789/ -	-	-	24 July	23 July	31 July	-	-
3793/ -	-	21 July	13 July	11 July	-	-	-
3927/3926	31 July	23 July	9 July	26 July	21 July	-	-
<u>2/</u> 3931/ -	-	-	-	-	-	-	-
3932/3933	16 Aug.	29 July	2 July	13 July	-	27 July	8 Aug.
- /3934 <u>2/</u>	-	-	-	-	-	-	-
3937/3936	-	-	24 July	31 July	22 July	28 July	-
3939/3938	31 July	10 Aug.	8 June	29 June	-	-	-
3941/3940	31 July	29 July	-	-	-	-	-
3942/3943	31 July	17 July	22 July	14 July	-	-	20 Aug.
3944/3945	14 Aug.	17 July	14 June	27 June	18 July	15 July	9 July
<u>3/</u> 3953/3951	-	21 July	22 July	12 July	-	-	-
3955/3956	25 July	31 July	2 July	15 July	-	-	-
<u>4/</u> 3957/-	7 Aug.	-	-	-	-	-	-
3959/-	25 July	-	-	-	-	-	-
<u>2/</u> 3961/-	12 Sept.	-	-	-	-	-	-
3965/3964	12 Aug.	2 Aug.	21 July	12 July	1 Aug.	-	-
3968/3971	-	18 July	6 July	-	-	-	-
3973/3972	31 July	16 Aug.	22 July	5 Aug.	-	-	-
3975/3974	-	-	-	-	5 Aug.	15 July	8 Aug.
3976/3977	31 July	-	-	-	-	-	11 Aug.
- /3978 <u>2/</u>	-	22 July	-	-	-	-	-
3980/3984	-	31 July	9 July	30 Aug.	-	15 July	-
3981/3982	31 July	9 July	5 July	11 July	4 Aug.	-	-
3986/3985	31 July	-	17 July	-	-	-	-
3988/3987	-	10 Aug.	6 July	14 July	2 Aug.	-	-
3990/3989	10 Aug.	8 July	5 July	27 June	11 June	10 Aug.	7 Aug.
3991/3992	7 Aug.	20 July	27 July	12 July	4 Aug.	-	28 July
3993/3994	16 Aug.	17 Aug.	4 July	-	-	27 July	17 July
3995/3996	-	21 July	-	11 Aug.	-	28 July	17 July
3998/3997	-	-	21 July	-	4 July	-	10 July
3999/4000	-	-	3 Aug.	-	-	13 Aug.	-

TABLE A-9.--Northern fur seals tagged on San Miguel Island, California, in 1968 and the dates first resighted, 1969-81.^{1/} (continued)

Tag number Right flipper / Left flipper	Date observed					
	1976	1977	1978	1979	1980	1981
UC-3789/-	-	-	-	-	-	-
3793/-	-	12 Aug.	1 Sept.	-	-	-
3927/3926	-	-	-	-	-	-
^{2/} 3931/-	-	-	19 Aug.	-	-	-
3932/3933	10 July	18 Aug.	18 Aug.	1 Sept.	-	-
- /3934 ^{2/}	29 Aug.	-	-	-	-	-
3937/3936	10 July	18 Aug.	21 July	-	-	-
3939/3938	-	-	-	-	-	-
3941/3940	-	-	-	-	-	-
3942/3943	29 July	18 Aug.	15 Aug.	11 Aug.	3 Aug.	15 July
3944/3945	14 July	12 Aug.	15 Aug.	9 Aug.	18 July	-
^{3/} 3953/3951	-	-	-	-	-	-
3955/3956	-	-	-	-	-	-
^{4/} 3957/-	-	-	-	-	-	-
3959/-	-	-	-	-	-	-
^{2/} 3961/-	-	-	-	-	-	-
3965/3964	2 Aug.	-	30 Aug.	-	-	-
3968/3971	-	-	-	-	-	-
3973/3972	-	-	-	-	30 June	-
3975/3974	4 Aug.	22 Aug.	8 July	15 Aug.	17 June	-
3976/3977	-	-	-	-	-	-
- /3978 ^{2/}	-	-	-	-	-	-
3980/3984	18 July	-	-	-	-	-
3981/3982	-	-	-	-	-	-
3986/3985	-	-	-	-	-	-
3988/3987	-	-	-	-	-	-
3990/3989	-	-	-	-	-	-
3991/3992	-	21 Aug.	25 July	-	19 July	-
3993/3994	10 July	-	25 July	16 Aug.	-	-
3995/3996	-	-	-	-	-	-
3998/3997	6 Sept.	-	-	16 Aug.	-	-
3999/4000	-	-	-	-	-	-

^{1/} A total of 36 pups (3751-3800 and 3958-3963 series and 3983) and 33 adult females (all other 3900-4000 series) were tagged on 20 July 1968.

^{2/} Female was double-tagged, but the other tag number has never been resighted.

^{3/} Tag loss confirmed by observation of tag scar.

^{4/} Left flipper injured, not tagged.

TABLE A-10.--Adult female northern fur seals double-tagged (the two tag numbers within the lines represent one seal) in Adams Cove, San Miguel Island, California, on 9 October 1975 and the dates first resighted, 1976-81.^{1/}

Tag number	Date of first resighting					
	1976	1977	1978	1979	1980	1981
SMI-201	23 Aug.	-	13 July	12 July	22 June	17 July
202						
203	-	21 Sept.	2 Sept.	-	-	-
204						
205	-	-	-	-	26 July	-
206						
207	-	-	-	-	-	-
208						
209	-	-	-	-	-	-
210						
211	12 Aug.	-	-	16 Aug.	29 June	-
212						
213	-	-	-	7 Aug.	19 July	-
214						
215	17 July	8 Sept.	-	-	-	-
216						
217	12 July	4 Sept.	19 Aug.	3 Aug.	9 June	-
218						
219	11 July	-	30 Aug.	9 Aug.	16 July	-
220						
221	-	-	22 Aug.	-	13 July	-
222						
223	-	4 Sept.	22 July	-	-	-
224						
225	Tag lost in sand of Arroyo west of Mallo Roses, Adams Cove					
226	11 July	18 Aug.	-	14 July	8 Sept.	17 July
227						
228	25 Aug.	-	27 Aug.	16 Aug.	14 July	13 Aug.
229						
230	-	-	-	-	-	-
231						
232	-	18 Aug.	18 Aug.	-	4 Aug.	-
233						
234	-	-	-	-	-	-
235						
236	22 Aug.	-	18 Aug.	-	25 July	-
237						
238	2 Aug.	6 Aug.	25 July	6 Aug.	8 Sept.	-
239						
240	-	-	-	6 July	-	-
241						
242	-	12 Aug.	-	-	-	-
243						
244	12 July	18 Aug.	12 July	8 July	-	-
245						

TABLE A-10.--Adult female northern fur seals double-tagged (the two tag numbers within the lines represent one seal) in Adams Cove, San Miguel Island, California, on 9 October 1975 and the dates first resighted, 1976-81.¹⁷ (continued)

Tag number	Date of first resighting					
	1976	1977	1978	1979	1980	1981
SMI-246	-	20 Aug.	9 Aug.	-	-	-
247						
248	11 July	-	-	6 Aug.	-	-
249						
250	-	20 Aug.	-	5 Aug.	-	-
251						
252	-	19 Aug.	-	-	-	-
253						
254	-	-	16 Aug.	1 Sept.	-	1 July
255						
256	-	-	-	-	-	-
257						
258	-	-	20 Aug.	-	-	-
259						
260	-	-	-	23 Aug.	13 July	13 July
261						
262	-	10 July	10 July	-	-	-
263						
264	10 July	18 Aug.	22 July	11 June	5 Aug.	-
265						
266	26 July	12 Aug.	9 Aug.	-	10 Aug.	-
267						
268	29 July	-	-	-	10 Aug.	-
269						
270	29 July	12 Aug.	-	-	18 July	-
271						
272	23 July	20 Aug.	18 Aug.	-	17 July	-
273						
274	5 Sept.	-	10 July	1 Sept.	-	-
275						
276	21 Aug.	3 Sept.	16 Aug.	-	-	-
277		Tag destroyed				
278						
279	5 Aug.	-	17 July	30 July	-	-
280						
281	23 July	4 Sept.	22 July	-	-	-
282						
283	24 July	12 Aug.	20 July	-	7 Aug.	-
284						
285	25 Aug.	-	20 July	16 Aug.	-	-
286						
287	-	-	-	-	-	-
288						
289	-	30 July	-	15 Aug.	-	-
290						

TABLE A-10.--Adult female northern fur seals double-tagged (the two tag numbers within the lines represent one seal) in Adams Cove, San Miguel Island, California, on 9 October 1975 and the dates first resighted, 1976-81.^{1/} (continued)

Tag number	Date of first resighting					
	1976	1977	1978	1979	1980	1981
SMI-291	-	-	-	23 Aug.	10 Aug.	-
292	-	-	-	-	-	-
293	10 Aug.	-	-	-	-	-
294	-	-	-	-	-	-
295	22 July	-	30 Aug.	-	17 July	-
296	-	-	-	-	-	-
297	29 Aug.	-	1 Sept.	18 Aug.	10 July	24 July
298	-	-	-	-	-	-
299	8 Aug.	30 July	28 Aug.	9 Aug.	4 Aug.	-
300	-	-	-	-	-	-
301	21 Aug.	-	20 Aug.	24 Aug.	23 June	-
302	-	-	-	-	-	-

^{1/} Fifty adult females were tagged.

TABLE A-11.--Northern fur seal females double-tagged with white plastic Roto tags in Adams Cove, San Miguel Island, California, on 18 November 1979, and dates first resighted, 1980-81.

Tag number <u>1/</u>		Vibrissae color ^{3/}	Date resighted <u>2/</u>	
Right flipper	Left flipper		1980	1981
401	402	white	23 July*	6 July*
404	403	mixed	10 Aug.*	5 July*
405	406	white	5 July*	15 July
407	408	white (tag lost, right side)	-	-
410	409	white	1 July*	18 June
411	412	white	6 July**	-
413	414	mixed	5 July	15 July
416	415	white	21 June**	11 July
417	419	white	5 July*	23 July*
420	421	white	4 July	9 July
422	423	white	18 July*	15 July
424	425	white	15 Aug.	19 July
426	427	white	27 June*	6 July*
428	430	white	21 June*	6 July*
431	432	white	29 July	12 Aug.
433	434	white	29 July	13 Aug.*
435	437	white	2 June	18 June
438	439	white	5 July	20 June
440	441	white	5 July*	15 July
442	443	mixed	18 June*	23 July
445	444	mixed	23 July	-
447	446	white	6 Sept.	29 June**
448	449	white	Died Aug. 16, due to cliff collapse, right side tag lost.	
450	451	white	28 June*	24 June
452	453	white	-	-
454	455	white	-	-
456	457	white	-	-
458	459	white	21 June	23 Sept. ^{4/}
460	461	white	13 Aug.*	-

1/ Tags destroyed: 418, 429 and 436.

2/ "*" indicates the female was known parturient that year and "**" indicates the pup was stillborn or died shortly after birth.

3/ Mixed = combination of black and white.

4/ Resighted on Castle Rock.

TABLE A-12.--Northern fur seals tagged as pups in Adams Cove, San Miguel Island, California, and the date first observed in subsequent years at Adams Cove, 1977-81.

Tag number	Year tagged	Sex	Date of first resighting				
			1977	1978	1979	1980	1981
SMI- 4	1975	F	-	31 Aug.	6 Aug.	21 Aug.	-
5	1975	F	-	-	11 Aug. ^{2/}	-	-
11	1975	M	-	-	7 July	24 May	-
15	1975	M	-	18 Aug.	28 May	-	-
16	1975	F	-	-	1 Aug. ^{2/}	17 July ^{2/}	-
17	1975	M	-	-	16 June	-	-
20	1975	F ^{1/}	-	22 Aug.	12 June	22 June ^{2/,3/,4/}	-
21	1975	M	-	9 Aug.	-	-	-
22	1975	M	-	9 Aug.	23 June	8 Aug.	-
24	1975	M	-	9 Aug.	24 May	13 July	-
32	1975	M	-	-	9 June	11 June	12 Aug.
40	1975	M	-	-	9 July	-	-
41	1975	F	18 Aug.	-	-	-	-
42	1975	M	-	-	5 May	28 June	18 June
44	1975	F	-	21 Aug.	-	-	16 Aug.
46	1975	M	-	29 Aug.	-	15 July	13 July
52	1975	F	-	21 Aug.	-	-	-
54	1975	F	-	-	-	1 Aug.	-
55	1975	F	-	13 Aug.	16 Aug.	-	-
58	1975	F	-	-	24 Aug.	-	-
61	1975	F	-	22 Aug.	15 Aug.	19 July	-
63	1975	M	-	-	2 June	-	-
65	1975	M	-	-	-	25 July	-
70	1975	F	-	19 Aug.	-	26 June	4 Aug.
72	1975	F	-	1 Sept.	-	-	-
73	1975	M	-	29 July	2 Aug.	30 June	-
75	1975	F	2 Sept.	17 Aug.	27 May	10 July	-
83	1975	F	-	-	5 Aug.	14 Aug.	-
85	1975	F	-	6 Sept.	-	-	-
86	1975	M	-	17 July	18 June	-	-
89	1975	M	-	-	9 Aug.	18 July	9 July
90	1975	F	-	9 Sept.	4 Sept.	-	-
99	1975	F	-	-	8 Aug.	-	-
304	1975	M	-	1 Sept.	-	26 June	-
312	1976	F	-	-	8 Aug.	3 Aug.	-
313	1976	F ^{1/}	-	16 Sept.	5 June	24 May	-
315	1976	F	-	-	-	14 June	-
322	1976	F	-	-	-	10 Aug.	4 Sept.
325	1976	M	-	-	-	24 May	-
328	1976	F	-	-	-	3 Aug.	-
330	1976	M	-	-	23 July	22 June	-
334	1976	F	-	-	3 Sept.	11 July ^{2/,4/}	-
344	1976	F	-	-	-	7 Aug.	-
351	1976	M	-	-	-	21 July	-

TABLE A-12.--Northern fur seals tagged as pups in Adams Cove, San Miguel Island, California, and the date first observed in subsequent years at Adams Cove, 1977-81. (continued)

Tag number	Year tagged	Sex	Date of first resighting				
			1977	1978	1979	1980	1981
SMI- 368	1976	F	-	-	-	17 Aug.	-
377	1976	M	-	-	-	11 June	-
615	1976	F	-	-	28 Aug.	-	-
678	1977	F	-	-	-	23 Aug.	-
904	1977	F	-	-	-	3 Sept.	-
908	1977	F	-	-	-	31 July	-
912	1977	F	-	-	-	19 July	-
921	1977	F	-	-	-	21 July	-
926	1977	F	-	-	-	10 Aug.	-
927	1977	M	-	-	-	31 July	-
928	1977	F	-	-	-	3 Sept.	-
931	1977	M	-	-	-	7 Aug.	18 June
946	1977	M	-	-	-	10 July	18 June
956	1977	M	-	-	5 July	9 June	-
961	1977	F	-	-	15 Aug.	7 Aug.	-
962	1977	F	-	-	-	23 Aug.	-
973	1977	F ^{1/}	-	-	-	26 July	9 June
977	1977	M	-	-	-	15 July	-
997	1977	F	-	-	3 Aug.	30 July	-
999	1977	M	-	-	-	3 Aug.	-
1187	1978	M	-	-	-	-	9 July
1188	1978	F	-	-	-	-	26 Sept.
1189	1978	F	-	-	-	4 Oct.	-
1200	1978	M	-	-	-	10 Aug.	18 June
1205	1978	F	-	-	-	-	6 July
1206	1978	M	-	-	-	26 July	23 July
1216	1978	F	-	-	-	-	31 Aug.
1217	1978	M	-	-	-	3 Aug.	18 June
1228	1978	F	-	-	-	8 Sept.	-
1261	1978	M	-	-	-	26 July	-
1263	1978	M	-	-	-	16 Aug.	20 July
1264	1978	M	-	-	-	10 Aug.	-
1368	1979	F	-	-	-	9 Sept.	-
2021	1980	F	-	-	-	-	17 July
2031	1980	F	-	-	-	-	26 July

^{1/} Mistakenly identified as a male and tagged on the right flipper.

^{2/} Observed nursing a pup of the year.

^{3/} Tag recorded as being floppy and/or reversed in flipper at least once.

^{4/} Pup was used in growth study.

TABLE A-13.--Northern fur seal pups tagged during 1981 with pink plastic Roto-tags in Adams Cove, San Miguel Island, California. Each animal was double-tagged with the same number applied to both front flippers.

Tag number	Date tagged	Sex	Weight (kg)	Check mark ^{1/}
A- 1	28 July	F	7.50	RHD-1
2	"	M	7.25	None
3	"	F	6.75	None
4	"	M	6.00	RHD-1
5	"	M	8.00	RHD-1
6	"	M	8.25	None
7	"	M	8.00	None
8	"	F	5.25	None
9	"	M	5.75	None
10	"	M	8.50	RHD-1
11	"	M	10.00	RHD-1
12	"	M	6.25	RHD-1
13	"	F	6.75	None
14	"	M	9.00	None
15	"	M	6.50	RHD-1
16	"	F	6.50	RHD-1
17	"	M	7.00	None
18	"	F	5.75	RHD-1
19	"	F	7.25	RHD-1
20	"	F	5.75	None
21	"	F	8.00	RHD-1
22	"	M	7.00	None
23	"	F	5.50	None
24	"	F	5.25	None
25	"	M	6.75	None
26	"	M	6.00	RHD-1
27	"	M	6.75	RHD-1
28	"	M	6.75	None
29	"	F	7.00	RHD-1
30	"	F	5.75	RHD-1
31	30 July	F	6.75	None
32	"	M	8.75	RHD-1
33	"	M	8.50	None
34	"	M	6.00	RHD-1
35	"	F	6.75	RHD-1
36	"	M	10.00	None
37	"	F	5.25	None
38	"	M	6.75	RHD-1
39	"	M	6.50	None
40	"	F	7.25	None
41	"	F	8.50	None
42	"	F	6.25	None
43	"	F	6.50	None

TABLE A-13.--Northern fur seal pups tagged during 1981 with pink plastic Roto-tags in Adams Cove, San Miguel Island, California. Each animal was double-tagged with the same number applied to both front flippers. (continued)

Tag number	Date tagged	Sex	Weight (kg)	Check mark ^{1/}
A-44	30 July	F	8.50	RHD-1
45	"	M	6.50	RHD-1
46	"	M	9.00	None
47	"	M	9.00	RHD-1
48	"	M	6.25	RHD-1
49	"	M	5.25	None
50	"	F	6.50	None
51	"	M	7.50	None
52	"	F	8.00	None
53	7 August	M	9.75	RHD-1
54	"	M	7.50	None
55	"	F	9.50	RHD-1
56	"	M	10.00	None
57	"	M	11.75	RHD-1
58	"	M	7.25	None
59	"	M	7.50	RHD-1
60	"	F	9.25	None
61	"	F	9.00	None
62	"	M	11.50	RHD-1
63	10 August	M	12.75	None
64	"	M	9.75	None
65	"	Unknown	7.50	None
66	"	M	8.00	RHD-1
67	"	M	11.50	RHD-1
68	"	M	6.50	None
69	"	F	10.50	None
70	"	F	9.00	RHD-1
71	"	M	8.25	None
72	11 August	M	8.00	RHD-1
73	"	M	9.50	RHD-1
74	"	M	10.75	None
75	"	M	10.50	None
76	10 August	M	13.50	None
77	15 August	M	11.75	RHD-1
78	30 July	F	6.75	None
79	15 August	F	7.00	None
80	"	Unknown	Unknown	None
81	"	M	8.25	RHD-1
82	"	M	9.00	RHD-1
83	"	F	7.25	RHD-1
84	"	F	9.00	None

TABLE A-13.--Northern fur seal pups tagged during 1981 with pink plastic Roto-tags in Adams Cove, San Miguel Island, California. Each animal was double-tagged with the same number applied to both front flippers. (continued)

Tag number	Date tagged	Sex	Weight (kg)	Check mark ^{1/}
A-85	15 August	M	14.00	RHD-1
86	30 August	F	12.25	None
87	31 August	F	11.25	RHD-1
88	1 September	M	13.50	RHD-1
89	9 September	F	9.75	None
90	"	M	13.75	None
91	"	F	10.50	None
92	10 September	F	11.25	None
93	"	M	12.25	None
94	26 September	M	14.00	RHD-1
95	"	M	15.75	RHD-1
96	"	F	15.25	RHD-1
97	"	F	12.00	RHD-1
98	"	F	13.75	RHD-1
99	"	M	16.50	RHD-1
100	"	M	11.50	RHD-1

^{1/} RHD-1 = cartilaginous extension of the first digit on the right hind flipper removed.

TABLE A-14. ~~Northern fur seal pups tagged with monel cattle ear tags in~~
 Adams Cove, San Miguel Island, California, on 24 September 1981. Each
 animal was double-tagged with even numbers applied on the left front
 flipper, odd numbers on the right front flipper. All pups were given check
 marks by removing the cartilaginous extension of the first digit on
 the right hind flipper.

Tag number ^{1/}	Sex	Weight (kg)	Remarks
SMI-2256	F	13.50	
2257			
2258	F	13.25	
2259			
2260	F	13.76	
2261			
2262	M	11.50	
2263			
2264	F	15.00	
2265			
2266	M	11.00	
2267			
2268	M	12.25	
2269			
2270	M	14.25	
2271			
2272	F	15.25	
2273			
2274	F	13.50	
2275			
2276	M	10.50	
2277			
2278	M	10.75	
2279			
2280	F	8.50	
2281			
2282	F	12.25	
2283			
2284	F	12.75	
2285			
2286	F	14.25	
2287			
2288	M	13.75	Microbiological samples collected
2289			
2290	M	11.50	
2291			
2292	F	12.00	Microbiological samples collected
2293			
2294	M	12.00	
2295			
2296	F	10.75	
2297			

TABLE A-14.--Northern fur seal pups tagged with monel cattle ear tags in Adams Cove, San Miguel Island, California, on 24 September 1981. Each animal was double-tagged with even numbers applied on the left front flipper, odd numbers on the right front flipper. All pups were given check marks by removing the cartilaginous extension of the first digit on the right hind flipper. (continued)

Tag number ^{1/}	Sex	Weight (kg)	Remarks
SMI-2298	M	14.50	
2299			
2300	M	11.75	
2301			
2302	F	12.75	
2303			
2304	M	11.50	
2305			
2306	M	7.50	
2307			
2308	M	16.50	
2309			
2310	F	10.00	
2311			
2312	F	11.50	
2313			
2314	M	10.75	
2315			
2316	M	10.25	
2317			
2318	M	8.75	
2319			
2320	F	12.50	
2321			
2322	M	14.50	Microbiological samples collected
2323			
2324	F	12.50	
2325			
2326	F	10.75	
2327			
2328	F	14.50	Microbiological samples collected
2329			
2330	F	9.75	
2331			
2332	M	10.50	Microbiological samples collected
2333			
2334	F	12.25	
2335			
2336	F	10.75	
2337			
2340	M	12.50	
2341			

TABLE A-14.--Northern fur seal pups tagged with monel cattle ear tags in Adams Cove, San Miguel Island, California, on 24 September 1981. Each animal was double-tagged with even numbers applied on the left front flipper, odd numbers on the right front flipper. All pups were given check marks by removing the cartilaginous extension of the first digit on the right hind flipper. (continued)

Tag number ^{1/}	Sex	Weight (kg)	Remarks
SMI-2342	M	15.75	
2343			
2344	M	11.00	
2349			
2350	M	17.00	
2351			
2352	F	13.00	
2353			
2354	F	13.75	
2355			
2356	M	12.25	
2357			
2358	F	11.00	
2359			
2360	M	14.00	
2361			
2362	M	12.25	
2363			
2364	M	12.00	
2365			
2366	M	12.25	
2367			
2368	F	11.75	
2369			
2370	F	14.75	
2371			
2372	M	11.50	
2373			
2374	F	5.75	
2375			
2376	F	14.25	
2377			
2378	F	10.50	
2379			
2380	F	11.75	
2381			
2382	F	13.25	
2383			
2384	M	13.25	
2385			
2386	M	9.50	
2387			

TABLE A-14.--Northern fur seal pups tagged with monel cattle ear tags in Adams Cove, San Miguel Island, California, on 24 September 1981. Each animal was double-tagged with even numbers applied on the left front flipper, odd numbers on the right front flipper. All pups were given check marks by removing the cartilaginous extension of the first digit on the right hind flipper. (continued)

Tag number ^{1/}	Sex	Weight (kg)	Remarks
SMI-2388	M	10.50	
2389			
2390	M	15.50	
2391			
2392	M	14.75	
2393			
2394	M	16.50	
2395			
2396	M	16.50	
2397			
2398	F	13.25	
2399			
2400	M	14.75	
2401			
2402	M	12.00	
2403			
2404	M	10.50	
2405			
2406	F	9.75	
2407			
2408	F	8.25	
2409			
2410	F	8.50	
2411			
2412	M	14.00	
2413			
2414	M	14.50	
2415			
2416	F	7.50	
2417			
2418	M	15.00	
2419			
2420	F	14.75	
2421			
2422	F	10.75	
2423			
2424	M	13.25	
2425			
2426	F	13.50	
2429			
2428	M	14.00	
2431			

TABLE A-14.--Northern fur seal pups tagged with monel cattle ear tags in Adams Cove, San Miguel Island, California, on 24 September 1981. Each animal was double-tagged with even numbers applied on the left front flipper, odd numbers on the right front flipper. All pups were given check marks by removing the cartilaginous extension of the first digit on the right hind flipper. (continued)

Tag number ^{1/}	Sex	Weight (kg)	Remarks
SMI-2432	F	10.00	
2433			
2434	M	15.00	
2437			
2438	M	16.25	
2441			
2442	M	15.50	
2443			
2444	M	12.50	
2445			
2446	M	10.75	
2447			
2448	M	15.75	
2449			
2450	F	15.50	
2451			
2452	F	12.25	
2453			
2454	F	9.75	
2455			
2456	F	11.25	
2457			
2458	F	10.50	
2459			
2460	F	13.00	
2461			
2462	M	15.50	
2463			
2464	M	12.75	
2465			
2466	F	10.00	
2467			

^{1/} Tags destroyed: SMI #'s 2238, 2239, 2345, 2346, 2347, 2348, 2427, 2430, 2435 and 2436.

TABLE A-15.--Northern fur seal pups tagged with green Riese-tags in Adams Cove, San Miguel Island, California, on 24 and 26 September 1981. Each animal was double-tagged, with the same number applied to each front flipper. All pups were given check marks by removing the cartilaginous extension of the first digit on the right hind flipper.

Tag number ^{1/}	Sex	Weight (kg)	Remarks
A- 1	M	10.50	
2	F	5.75	
3	M	13.00	
4	M	12.75	
5	F	13.50	
6	F	8.25	
7	F	13.75	
8	F	11.25	
9	F	10.50	
10	F	10.75	
11	F	11.25	
12	F	11.25	
13	M	12.00	
14	M	11.50	
15	M	16.00	
16	M	16.50	
17	M	17.00	
18	F	12.25	
19	F	10.75	
20	M	13.00	
21	M	13.00	
22	M	15.00	
23	M	12.50	
24	F	11.50	
26	M	13.50	
27	M	15.25	
28	F	10.25	
29	F	11.50	
30	M	15.75	
31	M	9.25	
32	F	11.00	
33	F	14.75	
34	F	13.75	
35	M	15.50	
36	F	13.25	
37	F	17.25	
38	F	13.00	
39	F	13.50	
40	F	9.50	
41	M	12.25	
42	M	13.25	
43	M	12.00	

TABLE A-15.--Northern fur seal pups tagged with green Riese-tags in Adams Cove, San Miguel Island, California, on 24 and 26 September 1981. Each animal was double-tagged, with the same number applied to each front flipper. All pups were given check marks by removing the cartilaginous extension of the first digit on the right hind flipper. (continued)

Tag number ^{1/}	Sex	Weight (kg)	Remarks
A-44	M	14.75	
45	M	13.00	
46	M	12.25	
47	M	13.00	
48	F	14.00	
49	F	10.50	
50	M	9.25	
51	F	12.00	
52	M	16.00	
53	M	11.75	
54	M	12.50	
55	F	12.50	
56	M	14.25	
57	F	12.75	
58	F	12.50	Microbiological samples collected
59	F	11.75	Blood collected, no vesicles present
60	M	10.75	
61	F	11.50	Blood collected, no vesicles present
62	M	15.50	Blood collected, no vesicles present
63	M	11.50	Blood collected, no vesicles present
64	F	11.75	Blood collected, no vesicles present
65	F	11.25	Blood collected, no vesicles present
66	F	10.75	Blood collected, no vesicles present
67	M	18.25	Blood collected, no vesicles present
68	M	13.75	Blood collected, no vesicles present
69	F	11.50	Blood collected, no vesicles present
70	M	13.50	Blood collected, no vesicles present
71	F	11.75	Blood collected, no vesicles present
72	M	13.25	Blood collected, no vesicles present
73	M	16.00	
74	F	12.00	
75	M	13.50	
76	F	12.00	
77	M	11.50	Vesicles present
78	M	8.25	
79	F	11.00	
80	M	12.25	
81	F	11.75	
82	F	14.00	
83	F	12.75	
84	M	12.75	
85	F	10.75	

TABLE A-15.--Northern fur seal pups tagged with green Riese-tags in Adams Cove, San Miguel Island, California, on 24 and 26 September 1981. Each animal was double-tagged, with the same number applied to each front flipper. All pups were given check marks by removing the cartilaginous extension of the first digit on the right hind flipper. (continued)

Tag number ^{1/}	Sex	Weight (kg)	Remarks
A- 86	F	15.25	
87	F	9.75	
88	F	13.75	
89	F	17.25	
90	F	13.25	
91	M	14.50	
92	M	16.50	
93	M	17.25	
94	F	13.75	
95	F	10.50	
96	M	12.50	
97	F	11.75	
98	F	12.50	
99	M	13.25	
100	M	11.25	

^{1/} Tag destroyed: A-25.

TABLE A-16.--Northern fur seal males double-tagged with white
Roto-tags in Adams Cove, San Miguel Island, California, 1 May 1981.^{1/}

Tag number		Age ^{2/} (years)
Right flipper	Left flipper	
465	464	3-4 (e)
466	SMI 1211 (mone1)	3 (a)
468	467	3-4 (e)
470	469	3-4 (e)

^{1/} Some fur seals had been tagged previously as pups with different tag types and number series.

^{2/} (e) = estimated age
(a) = actual age

TABLE A-17.--Parturient female northern fur seals double-tagged with yellow Roto-tags during 1981 in Adams Cove, San Miguel Island, California.

Tag number ^{1/}	Date tagged	Date of parturition
A- 2	4 July	3 July
A- 3	7 July	6 July
A- 4 (Right flipper) A- 5 (Left flipper)	13 July	12 July
A- 6	24 July	Unknown
A- 7	24 July	Unknown
A- 8	25 July	Unknown
A- 9	26 July	Unknown
A-10	26 July	Unknown

^{1/} Tag number A-1 destroyed.

TABLE A-18.--Northern fur seal pups tagged on 27 July 1981 with pink plastic Roto-tags on Castle Rock, near San Miguel Island, California. Each animal was double-tagged with the same number applied to both front flippers.

Tag number	Sex	Weight (kg)	Check mark ^{1/}	Remarks
C- 1	F	7.00	None	Oil on pelage
2	M	7.00	None	
3	M	7.00	RHD-1	
4	F	6.50	None	
5	M	6.75	None	Oil on pelage
6	F	6.25	None	
7	M	8.25	None	
8	F	6.25	RHD-1	
9	F	6.75	RHD-1	
10	M	8.00	RHD-1	
11	M	8.50	None	
12	M	8.75	None	
13	F	8.25	None	
14	F	7.25	None	
15	F	7.50	RHD-1	
16	M	6.00	None	
17	M	8.00	None	
18	F	7.75	RHD-1	
19	M	9.00	None	
20	M	6.75	None	
21	M	6.25	None	
22	F	5.25	None	
23	M	6.25	None	
24	M	9.25	None	
25	M	7.00	None	
26	F	7.00	None	

(Presence of vesicles on flippers was noted after the above animal.)

27	M	8.25	None	Vesicles present
28	M	8.00	None	
29	F	8.00	None	
30	M	8.50	None	
31	M	8.50	RHD-1	
32	M	8.00	None	
33	F	8.25	None	Vesicles present
34	M	8.25	None	
35	F	5.75	None	Vesicles present
36	F	10.00	RHD-1	
37	M	9.00	None	
38	M	8.00	None	Vesicles present
39	F	4.75	None	
40	M	8.25	None	Vesicles present

TABLE A-18.--Northern fur seal pups tagged on 27 July 1981 with pink plastic Roto-tags on Castle Rock, near San Miguel Island, California. Each animal was double-tagged with the same number applied to both front flippers. (continued)

Tag number	Sex	Weight (kg)	Check mark ^{1/}	Remarks
C-41	M	8.25	None	
42	F	6.50	None	
43	M	6.00	RHD-1	
44	F	6.00	None	Vesicles present
45	M	7.75	RHD-1	
46	F	7.00	RHD-1	
47	M	6.00	None	
48	M	9.75	None	Vesicles present
49	F	7.25	None	
50	F	5.00	None	
51	M	7.00	None	

^{1/} RHD-1 = cartilaginous extension of the first digit on the right hind flipper removed.

TABLE A-19.--Northern fur seal pups single-tagged with monel cattle ear tags on Castle Rock, near San Miguel Island, California, on 23 September 1981. Each animal was given a check mark by removing the cartilaginous extension of the first digit on the right hind flipper.

Tag number ^{1/}	Sex	Weight (kg)	Remarks
SMI-2151	M	12.50	
2152	F	11.75	
2153	M	9.75	
2154	M	9.75	
2155	M	12.00	
2156	M	12.00	
2158	M	12.00	
2159	M	13.00	
2160	M	14.00	
2161	M	15.00	
2162	M	11.25	Microbiological samples collected
2163	F	11.75	Microbiological samples collected
2164	M	14.00	
2165	F	11.00	
2166	F	9.00	
2167	F	10.50	
2168	F	9.25	
2169	M	11.25	
2170	F	10.25	Microbiological samples collected
2171	M	16.25	
2172	F	7.75	
2173	M	10.50	
2174	M	11.50	
2175	F	10.25	
2176	M	9.75	
2177	F	6.50	
2178	F	10.00	
2179	F	11.00	
2180	F	8.00	
2181	M	9.00	
2182	F	8.75	
2183	M	12.75	
2185	M	11.00	
2186	M	12.00	
2187	F	5.75	
2188	M	11.75	Microbiological samples collected
2189	M	11.50	Microbiological samples collected
2190	M	10.75	
2191	F	10.25	
2192	M	13.50	
2193	F	10.25	
2194	F	10.25	
2195	F	10.75	
2196	F	8.50	
2197	M	10.25	

TABLE A-19.--Northern fur seal pups single-tagged with monel cattle ear tags on Castle Rock, near San Miguel Island, California, on 23 September 1981. Each animal was given a check mark by removing the cartilaginous extension of the first digit on the right hind flipper. (continued)

Tag number ^{1/}	Sex	Weight (kg)	Remarks
SMI-2198	F	9.50	
2200	F	8.75	
2201	M	11.75	
2202	F	11.25	
2203	F	13.25	
2204	M	13.50	
2205	F	11.50	Oil on pelage
2206	M	13.25	
2207	F	8.75	Oil on pelage
2208	F	9.00	Oil on pelage
2209	M	12.50	
2210	F	9.75	Oil on pelage
2211	F	8.75	
2212	M	10.00	Microbiological samples collected, oil on pelage
2213	F	11.00	
2214	F	7.50	Oil on pelage
2215	F	12.75	Oil on pelage
2216	M	16.50	
2217	F	11.00	
2218	M	12.25	Oil on pelage
2219	F	10.25	
2220	F	10.50	
2221	M	14.00	
2222	M	12.25	
2223	F	9.50	
2224	M	11.50	
2225	F	11.75	
2226	M	17.00	Oil on pelage
2227	M	12.50	Oil on pelage
2228	M	13.50	Microbiological samples collected
2229	M	11.50	
2230	F	9.00	
2231	M	12.00	
2232	F	5.50	
2233	M	7.75	Oil on pelage
2234	M	12.25	
2235	F	11.25	
2236	F	11.25	
2237	F	11.50	
2239	M	13.00	
2240	M	15.75	
2241	F	10.25	
2242	M	10.50	

TABLE A-19.--Northern fur seal pups single-tagged with monel cattle ear tags on Castle Rock, near San Miguel Island, California, on 23 September 1981. Each animal was given a check mark by removing the cartilaginous extension of the first digit on the right hind flipper. (continued)

Tag number ^{1/}	Sex	Weight (kg)	Remarks
SMI-2243	M	13.25	Oil on pelage
2244	F	10.25	
2245	F	8.50	Microbiological samples collected
2246	F	5.25	
2247	F	7.50	
2248	M	12.75	
2249	F	11.25	Oil on pelage
2250	M	11.75	Microbiological samples collected
2251	F	12.50	
2252	M	12.50	Microbiological samples collected
2253	F	10.50	

^{1/} Tags destroyed: SMI #'s 2157, 2184, 2199 and 2238.

TABLE A-20.--Number of dead northern fur seal pups counted^{1/}, by rookery, Pribilof Islands, Alaska, 1972-81.

Island and rookery	1972	1973 ^{2/}	1974 ^{2/}	1975	1976	1977	1978	1979	1980	1981
<u>St. Paul Island</u>										
Morjovi	2,187	-	-	1,765	1,829	870	606	269	508	346
Vostochni	4,701	-	-	3,259	3,826	2,021	1,041	573	932	889
Little Polovina	372	-	-	252	316	103	90	28	77	41
Polovina Cliffs	1,566	-	-	1,529	1,862	733	761	433	627	463
Polovina	345	-	-	419	378	160	151	85	127	89
Ardiguen	161	-	111	142	212	112	15	31	76	38
Gorbatch Reef	1,332	-	1,188	1,025	1,341	860	475	260	699	379
Reef	1,686	-	1,580	1,837	2,055	1,233	593	651	790	623
Kitovi	559	-	-	787	846	331	203	171	256	187
Lukanin	494	-	-	505	385	250	197	132	206	102
Tolstoi	3,540	3,613	-	4,141	4,241	3,291	1,488	1,645	1,488	1,547
Little Zapadni	1,686	1,783	-	1,204	1,977	1,133	674	637	645	377
Zapadni Reef	505	661	-	508	638	427	129	161	243	266
Zapadni	3,515	3,851	-	3,252	3,770	2,559	1,650	1,368	1,185	1,451
Counted total	22,649	9,908	2,879	20,625	23,676	14,083	8,073	6,444	7,859	6,798
Estimated oversight 5% ^{3/}	1,132	495	144	1,031	1,184	704	404	322	393	340
Total	23,781	10,403	3,023	21,656	24,860	14,787	8,477	6,766	8,252	7,138
<u>St. George Island</u>										
North	1,032	1,153	545	1,230	791	408	1,068	774	949	810
Zapadni	331	338	278	470	373	92	179	277	350	186
South	133	112	196	344	280	98	225	186	197	177
East Reef	-	75	59	102	37	60	164	104	121	74
East Cliffs	372 ^{4/}	431	275	434	354	140	292	285	284	402
Staraya Artil	616	552	- 5/	709	454	410	590	565	484	376
Counted total	2,484	2,661	1,353	3,289	2,289	1,208	2,518	2,191	2,385	2,025
Estimated oversight 5% ^{3/}	124	133	68	165	114	60	126	110	119	101
Total	2,608	2,794	1,421	3,454	2,403	1,268	2,644	2,301	2,504	2,126

TABLE A-20.--Number of dead northern fur seal pups counted^{1/}, by rookery, Pribilof Islands, Alaska, 1972-81.
(continued)

Island and rookery	1972	1973 ^{2/}	1974 ^{2/}	1975	1976	1977	1978	1979	1980	1981
Pribilof Islands counted total	25,133	12,569	4,232	23,914	25,965	15,291	10,591	8,635	10,244	8,823
Estimated oversight 5% ^{3/}	1,256	628	212	1,196	1,298	764	530	432	512	441
Total	26,389	13,197	4,444	25,110	27,263	16,055	11,121	9,067	10,756	9,264

^{1/} The dead pups are counted after 15 August each year; most mortality has occurred by that date.

^{2/} The dead pups were counted only on selected rookeries on St. Paul Island.

^{3/} As established by survey conducted in 1960: C. E. Abegglen, A. Y. Roppel, and F. Wilke. 1960. Alaska fur seal investigations, Pribilof Islands, Alaska. Unpubl. manuscr., 165 p. Natl. Mar. Mammal Lab., Northwest and Alaska Fish. Cent., Natl. Mar. Fish. Serv., NOAA, 7600 Sand Point Way N. E., Seattle, WA 98115.

^{4/} Includes dead pups counted on East Reef Rookery.

^{5/} Dead pups were not counted.

APPENDIX B

Persons engaged in northern fur seal research in 1981
 National Marine Mammal Laboratory (NMML)
 Michael F. Tillman, Director
 Robert V. Miller, Deputy Director
 Charles W. Fowler, Manager, Fur Seal Program

Name	Affiliation	Assignment
Scientific Staff, Fur Seal Program		
<u>Permanent</u>		
Alton Y. Roppel	NMML	Population Assessment
Patrick Kozloff	NMML	Population Assessment
Roger L. Gentry	NMML	Behavior and Biology
Robert L. DeLong	NMML	Behavior and Biology
George A. Antonelis, Jr.	NMML	Behavior and Biology
Mark C. Keyes	NMML	Veterinary Medical Services
Hiroshi Kajimura	NMML	Pelagic Ecosystem
Anne E. York	NMML	Population Dynamics
<u>Temporary</u>		
Michael E. Goebel	NMML	Behavior and Biology
Kathlene Newell	NMML	Behavior and Biology
Ronald J. Ryel	NMML	Behavior and Biology
M. Robert Kochergin	NMML	Population Assessment
Aifey L. Hanson	NMML	Population Assessment
James R. Hartley	NMML	Population Assessment
Charles A. Melovidov	NMML	Population Assessment
Myron A. Melovidov	NMML	Population Assessment
Teresa L. Clocksin	NMML	Population Assessment
K. Freya Skarin	NMML	Population Assessment
Andrew R. Lestenkof	NMML	Population Assessment
Lavrenty Stepetin	Pribilof Isl. Prog.	Population Assessment
<u>Cooperators^{1/}</u>		
Linda L. Jones	NMML	Fur Seal Fisheries Interaction
Thomas R. Loughlin	NMML	Pelagic Studies
David J. Rugh	NMML	Pup Tagging Project
Jack LaLanne	REFM ^{2/}	Tooth Growth Study
Greg Small	REFM	Tooth Growth Study
Douglas DeMaster	SWFC ^{3/}	Pup Tagging Project
Larry Hansen	SWFC	Behavior and Biology
Nick Whelen	Natl. Park Serv. ^{4/}	Pup Tagging Project
Edward C. Jameyson	MARIS ^{5/} , Seattle, Wash.	Behavior and Biology
Brent Stewart	Hubbs Res. Inst., San Diego, Calif.	Pup Tagging Project
Harriet Huber	Pt. Reyes Bird Obs., Stinson Beach, Calif.	Pup Tagging Project
Gerald L. Kooyman	Scripps Res. Inst. Oceanogr., La Jolla, Calif.	Feeding Study

APPENDIX B (continued)

Name	Affiliation	Assignment
Cooperators (continued)		
Daniel Costa	Scripps Inst. of Oceanogr., La Jolla Calif.	Energetics of Milk Production
Steven Feldkamp	Scripps Inst. of Oceanogr., La Jolla, Calif.	Energetics of Milk Production
Visiting Scientist		
Mike Hunter	North Pac. Fur Seal Comm.	Canadian Commissioner

1/ Financed wholly or in part by the National Marine Mammal Laboratory or other Federal Agency.

2/ Resource Ecology and Fisheries Management Division, Northwest and Alaska Fisheries Center, 2725 Montlake Blvd. E., Seattle, WA 98112.

3/ Southwest Fisheries Center, National Marine Fisheries Service, NOAA, P.O. Box 271, 8604 La Jolla Shores Drive, La Jolla, CA 92038.

4/ The National Park Service manages San Miguel Island, California, for the Department of Navy and frequently assists in wildlife management activities when needed.

5/ Marine Aquatic Research Institute.

