

NORTHWEST & ALASKA FISHERIES CENTER PROCESSED REPORT

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FUR SEAL INVESTIGATIONS, 1977

by

Marine Mammal Division

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**U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
Northwest and Alaska Fisheries Center
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FUR SEAL INVESTIGATIONS, 1977

Prepared

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FUR SEAL INVESTIGATIONS, 1977

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INTRODUCTION

The National Marine Fisheries Service is responsible for managing northern fur seals on the Pribilof Islands in Alaska and is the federal agency which cooperates with Canada, Japan, and the USSR in carrying out terms of the Interim Convention on Conservation of North Pacific Fur Seals.

In 1977, the National Marine Fisheries Service conducted studies on feeding habits, distribution and migration, growth, reproduction, population dynamics, causes of death, and behavior and biology.

In this report, "Pribilof Islands" includes St. Paul (Figure 1) and St. George (Figure 2) Islands, and, at times, Sea Lion Rock. Two of the five Pribilof Islands, Walrus and Otter, do not have fur seal rookeries or hauling grounds. Two fur seal populations are associated with San Miguel Island, (Figure 3), one in Adams Cove and another on nearby Castle Rock.

Terms having special meanings in fur seal research are described in the glossary.

Part I. POPULATION ASSESSMENT, PRIBILOF ISLANDS

The objective of this project is to build a population structure data base on fur seals of the Pribilof Islands essential for managing the resource for maximum sustainable productivity. Several parameters are measured to monitor changes within the population as they relate to the objective. In addition, marks applied to fur seals during their summer of birth are recovered at the ages of harvest (2-6 years) for use in studies of intermixture on land and at sea.

Population Parameters

Population values currently monitored include: (1) age and sex composition of seals killed, (2) number of adult males, (3) number of seals that die on land, and (4) number of seal pups born.

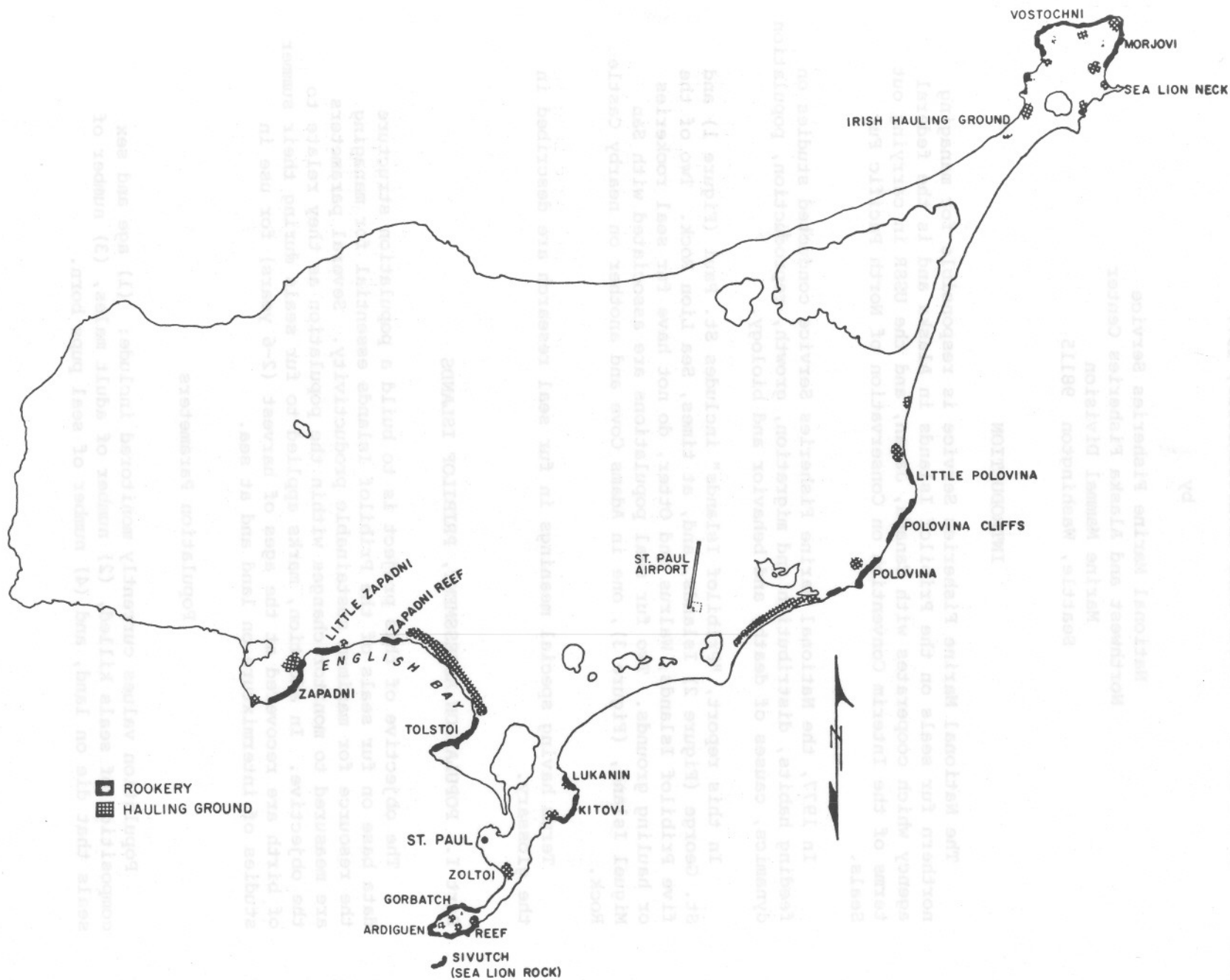


Figure 1. --Location of rookeries and hauling grounds, St. Paul Island.

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

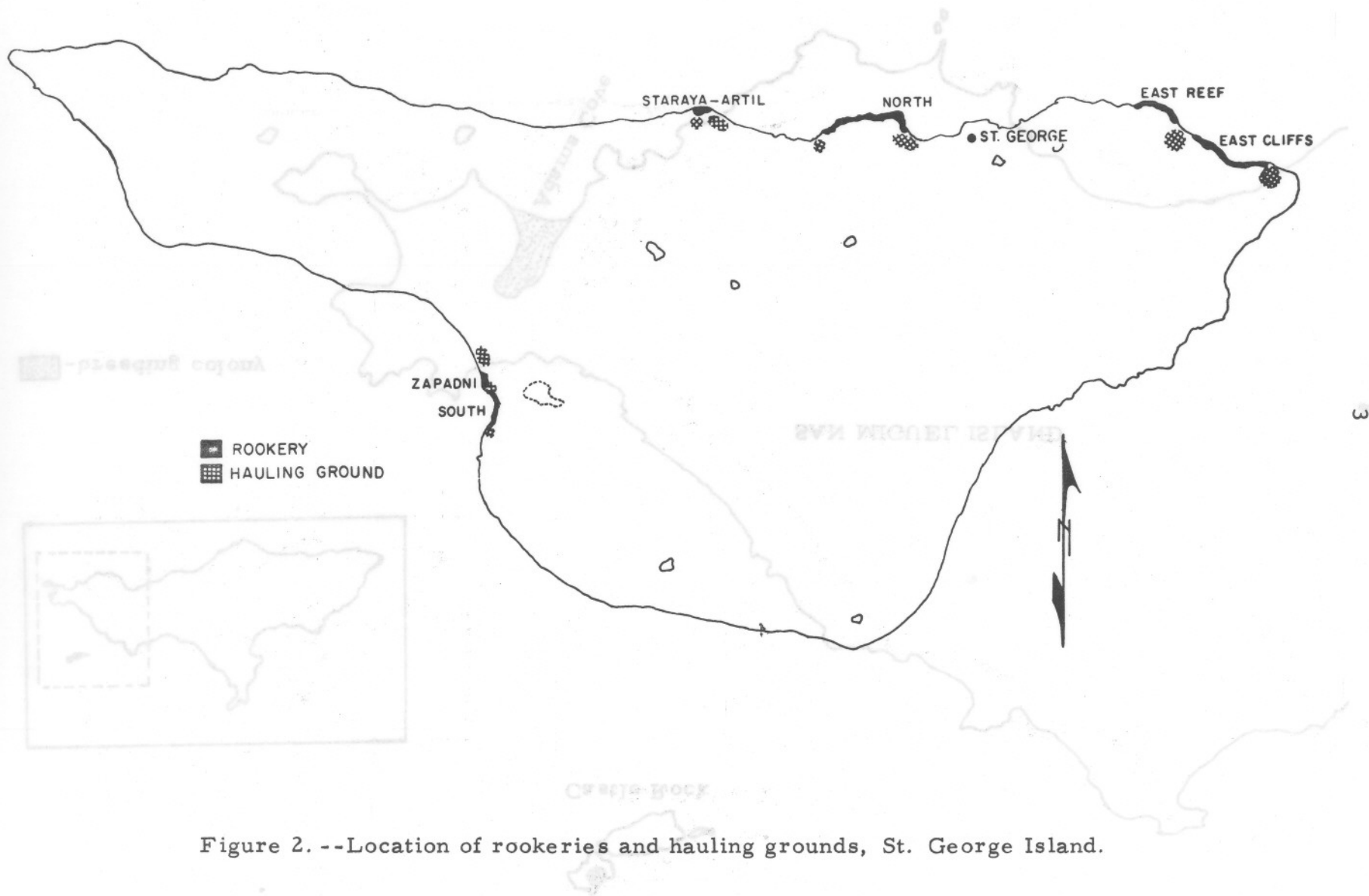


Figure 2. --Location of rookeries and hauling grounds, St. George Island.

Age and Sex Composition of Seals Killed

A maximum body length limit of 47 inches (119.4 cm) from tip of tail to tip of nose was prescribed for harvesting male seals on St. Paul Island in 1977. From 27 June to 29 July, 28,396 males were taken during a harvesting season carried out Monday through Friday each week for 5 weeks beginning at 5 a.m. each morning. The age composition of each daily harvest by rookery/hauling ground complex was determined from a 20% sample of maxillary canine teeth (Table A-1). The harvest of 3- and 4-year-old males, which comprised 91% of the total kill of males on St. Paul Island (2's, 5's, and 6's made up the remainder), is presented by round,^{1/} in Figure 4. Figure 5 and Table 1 give the number of males killed, by year class, since 1962 and 1963, respectively. Table 2 gives the age composition of males killed each year on the Pribilof Islands since 1968. In addition, 48 females were killed unintentionally during the male harvest on St. Paul Island and not classified by age.

On St. George Island, where there has been no commercial harvest of fur seals since 1972, 350 males were taken for local subsistence purposes from 28 June to 28 July with no restrictions on size or age. Maxillary canine teeth were collected from most of these seals as a basis for determining age (Table A-2).

Living Adult Male Seals Counted

Counts of adult males^{2/} on St. Paul Island totaled 8,273 in June and 10,302 in July (Tables A-3 to A-8). On St. George Island, 2,153 and 2,509 were counted in June and July, respectively (Tables A-4, A-6, and A-8). As expected, the number of territorial males on St. George Island increased in 1977 as a continuing result of the harvest ban introduced there in 1973 (see page 19 of this report for further discussion). On St. Paul Island, expected increases in the number of adult males also occurred in 1977 (Table A-8), primarily as a result of the reimposition of an upper body length limit on harvestable males beginning in 1972. During the previous 9 years, all males without a mane were taken, which resulted in a much higher utilization of each year class. Figure 6 shows the relative locations of the classes of adult males on a rookery/hauling ground complex.

^{1/} See glossary for definition of round.

^{2/} See Table A-3 or glossary for a description of the classes of adult male seals.

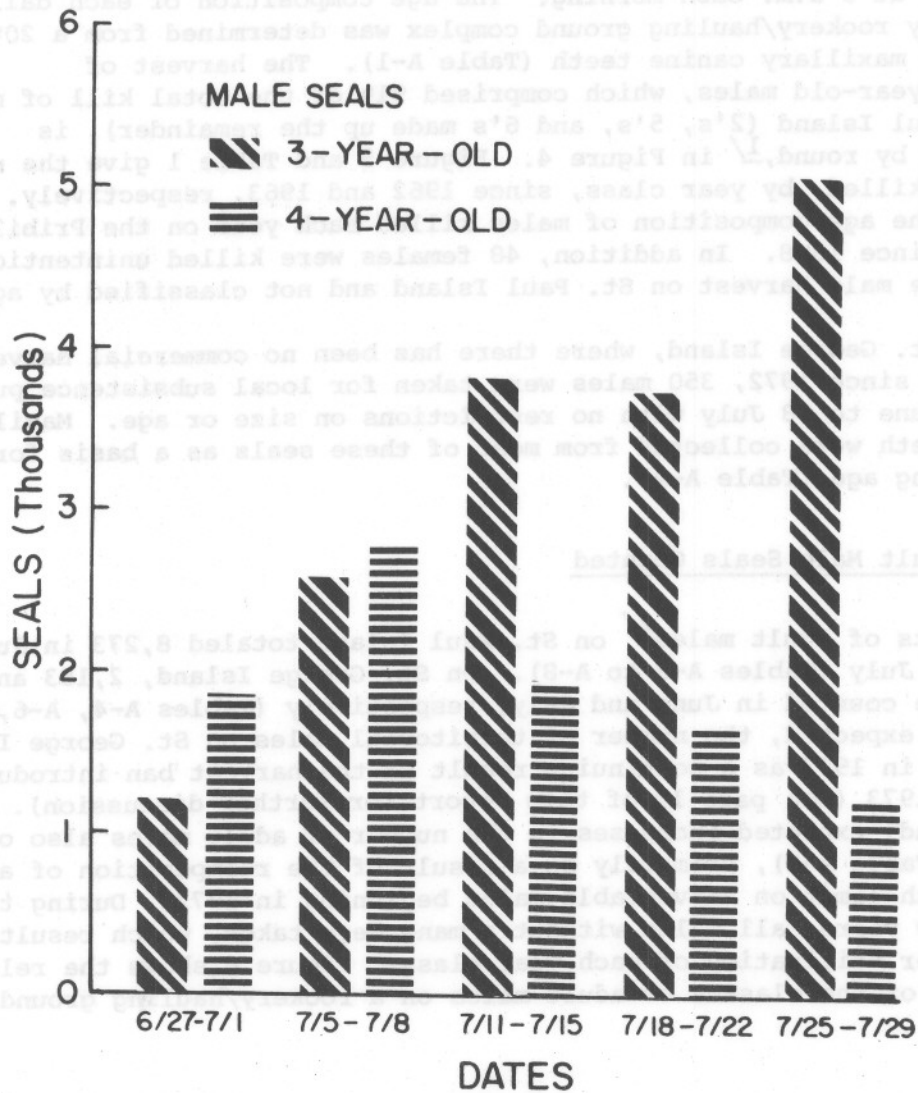


Figure 4.--Three-and four-year-old male seals killed, St. Paul Island, 27 June to 29 July, 1977.

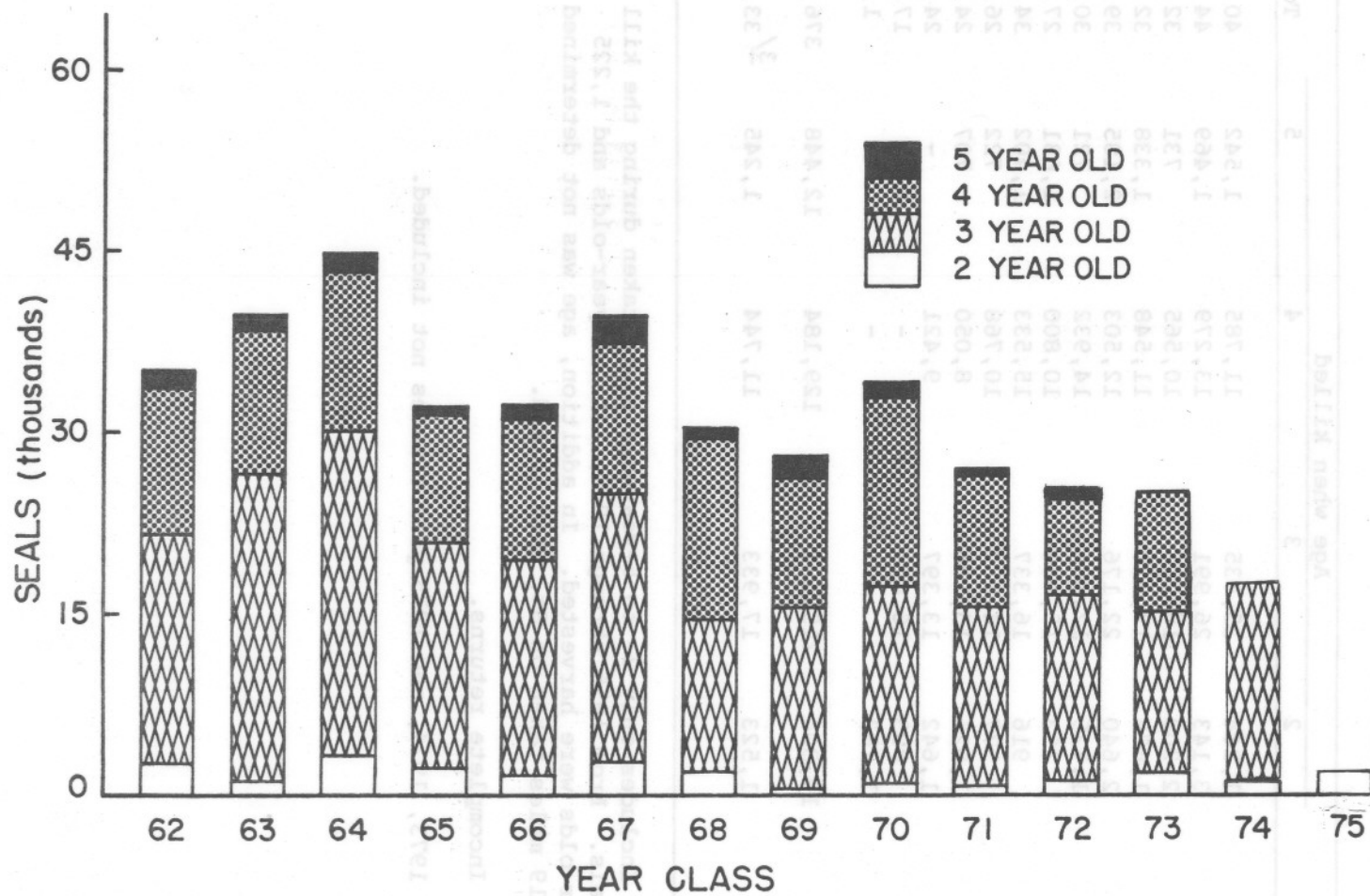


Figure 5.--Kill of male seals, by year class, St. Paul Island, 1962-75.

Table 1.--Kill of male seals, ^{1/} by year class, St. Paul Island, 1963-75.

Year class	Age when killed				Total
	2	3	4	5	
1963	1,264	25,535	11,785	1,542	40,126
1964	3,143	26,991	13,279	1,469	44,882
1965	2,200	18,706	10,565	731	32,202
1966	1,673	17,826	11,548	1,338	32,385
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 ^{2/}	1,642	13,397	9,421	-	24,460
1974 ^{2/}	893	16,476	-	-	17,369
1975 ^{2/}	1,783	-	-	-	1,783
Total	19,804	215,194	129,184	12,448	376,630
Mean	1,523	17,933	11,744	1,245	^{3/} 33,302

^{1/} Includes only 2- to 5-year-old seals taken during the kill of male seals. From 1956 through 1975, 131 one-year-olds and 1,225 six-year-olds were harvested. In addition, age was not determined for 4,919 males taken on St. Paul Island.

^{2/} Incomplete returns.




^{3/} 1973, 1974, and 1975 year classes not included.

Table 2.--Age classification of male seals killed, Pribilof Islands, Alaska, 1968-77

Year of harvest	St. Paul Island						St. George Island ^{1/}					
	Estimated seals killed from each age group						Estimated seals killed from each age group					
	2	3	4	5	6	Total	2	3	4	5	6	Total
	-----Number-----											
1968	1,673	18,706	13,279	1,542	92	35,292	433	4,443	3,680	406	38	9,000
1969	2,640	17,826	10,565	1,469	121	32,621	411	2,645	2,204	680	117	6,057
1970	1,725	22,176	11,548	731	17	36,197	98	2,916	2,274	547	89	5,924
1971	323	12,888	12,503	1,338	190	27,242	32	1,456	2,517	467	81	4,553
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	-	-	-	-	-	-

^{1/} No commercial fur seal harvest on St. George Island, 1973-77.

CLASSES OF BULLS

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

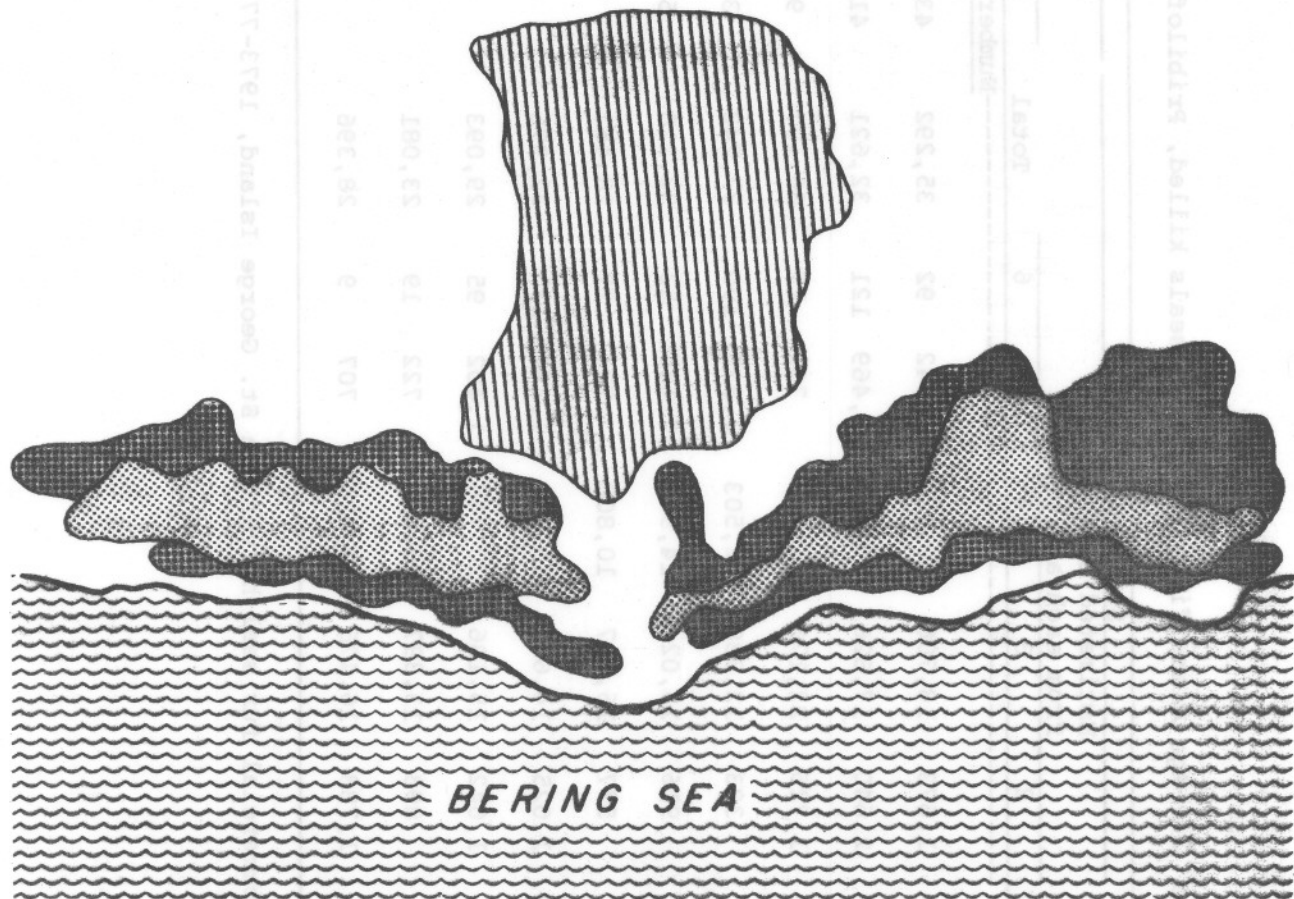


Figure 6. --General composition of a typical fur seal rookery.

Dead Seals Counted That Were Older Than Pups

In September, 129 dead adult males and females were found on the rookeries and hauling grounds of St. Paul Island (Table 3). Canine teeth collected from these seals will be used as a basis for determining mortality rates.

Dead Pups Counted

In 1976, dead fur seal pups totaled 1,208 on St. George Island 11 and 12 August and 14,083 on St. Paul Island from 22 to 26 August (Tables A-9 and A-10). The death rate of pups that died on St. George Island in 1977 was 0.0278 compared to 0.0441 in 1973.

Number of Pups Born

In 1977, 5,643 fur seal pups were marked on all rookeries of St. George Island by shearing a patch of guard hair from their heads to expose the light underfur and produce an easily identifiable mark. The total pup population was then sampled during two different periods for marked to unmarked ratios and to determine if estimates from the two periods were consistent. Estimates of the number of pups born in 1977 are given in Tables 4 and 5. A comparison of the number of pups born by rookery on St. George Island in 1973 and 1977 is presented in Table 5. The apparent but unexplainable decrease over all the rookeries since the estimate of 1973 was further substantiated by a decrease in the number of pups on the Zapadni behavior study site (Figure 10) as determined by actual counts.

Marking

Fur seals on the Pribilof Islands have been marked by several methods since 1941 and have been used for estimates of year-class sizes, studies of growth, survival, mortality, distribution at sea, homing tendencies, and intermixture on land and at sea.

Mark Recoveries

A total of 1,322 male seals that had been marked as pups on the Pribilof Islands was recovered during the commercial harvest on St. Paul Island in 1977. The seals ranged in ages from 2 through 5 years (Table A-11). Twelve male seals marked with metal tags on Bering and Medny Islands,

Table 3.--Dead seals counted that were older than pups, Pribilof Islands, Alaska, 1965-77. A dash indicates no data.

Year	St. Paul Island		St. George Island		Total	
	Males	Females	Males	Females	Males	Females
	-----Number-----					
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

Marking

For seals on the Pribilof Islands have been marked by several methods since 1941 and have been used for estimates of year-class sizes, studies of growth, survival, mortality, distribution at sea, homing tendencies, and intermixure on land and at sea.

Mark Recoveries

A total of 1,312 male seals that had been marked as pups on the Pribilof Islands was recovered during the commercial harvest on St. Paul Island in 1977. The seals ranged in ages from 2 through 5 years (Table A-11). Twelve male seals marked with metal tags on Sealing and Moby Islands,

Table 4.--Estimated number of seal pups in 1977 at times of shearing and birth on St. George Island, Alaska. Pups were sheared, 4-9 August; sampling periods 1 and 2 were 11-12 and 15 August, respectively.

Item	Rookery						Total
	South	Zapadni	East Cliffs	East Reef	Staraya Artil	North	
No. pups sheared	1,087	460	913	427	638	2,118	5,643
No. 25-pup samples							
Period 1	50	54	46	22	57	134	--
Period 2	45	42	45	29	54	112	--
No. sheared pups counted							
Period 1	242	114	181	87	166	435	--
Period 2	195	117	175	113	159	358	--
Total no. pups counted ^{1/}							
Period 1	1,250	1,350	1,150	550	1,425	3,350	--
Period 2	1,125	1,050	1,125	725	1,350	2,800	--
Estimated no. live pups ^{2/}							
Period 1 Sampling	5,615	6,476 ^{3/}	5,801	2,699	5,477	16,311	42,379
Period 2 Sampling	6,271	5,157 ^{3/}	5,869	2,740	5,417	16,565	42,019
Mean, both periods	5,943	5,816	5,835	2,720	5,447	16,438	42,199
No. dead pups counted	98	92 ^{4/}	140	60	410	408	1,208
Estimated no. pups born ^{5/}	6,041	5,908	5,975	2,780	5,857	16,846	43,407

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

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

^{3/} Includes 1,029 live pups that were actually counted on rookery study area that was not disturbed during shearing or sampling survey.

^{4/} Partial count, does not include rookery study area.

^{5/} Sum of dead pups and pups alive at time of sampling.

Table 5.--Estimated numbers of seal pups born^{1/} in 1973 and 1977, based on shearing and sampling, and counts of dead pups, St. George Island, Alaska.

Rookery	1973				1977				Percentage change in pups born between 1973 and 1977
	Live	Dead	Born	Death Rate	Live	Dead	Born	Death Rate	
South	11,164	112	11,276	0.0099	5,943	98	6,041	0.0162	-46.4
Zapadni	6,821	338	7,159	0.0472	5,816	92	5,908	0.0156	-17.5
East Cliffs	10,290	431	10,721	0.0420	5,835	140	5,975	0.0234	-41.8
East Reef	2,922	75	2,997	0.0250	2,720	60	2,780	0.0216	- 7.2
Staraya Artil	6,540	552	7,092	0.0778	5,447	410	5,857	0.0700	-17.4
North	19,987	1,153	21,140	0.0545	16,438	408	16,846	0.0242	-20.3
All	57,724	2,661	60,385	0.0441	42,199	1,208	43,407	0.0278	-28.1

^{1/} Sum of dead pups and pups alive at time of sampling.

USSR, were also recovered during the harvest (Table A-12). Seals marked on the Pribilof Islands are listed in Tables A-13 and A-14, and illustrated examples of mark locations are presented in Figure 7.

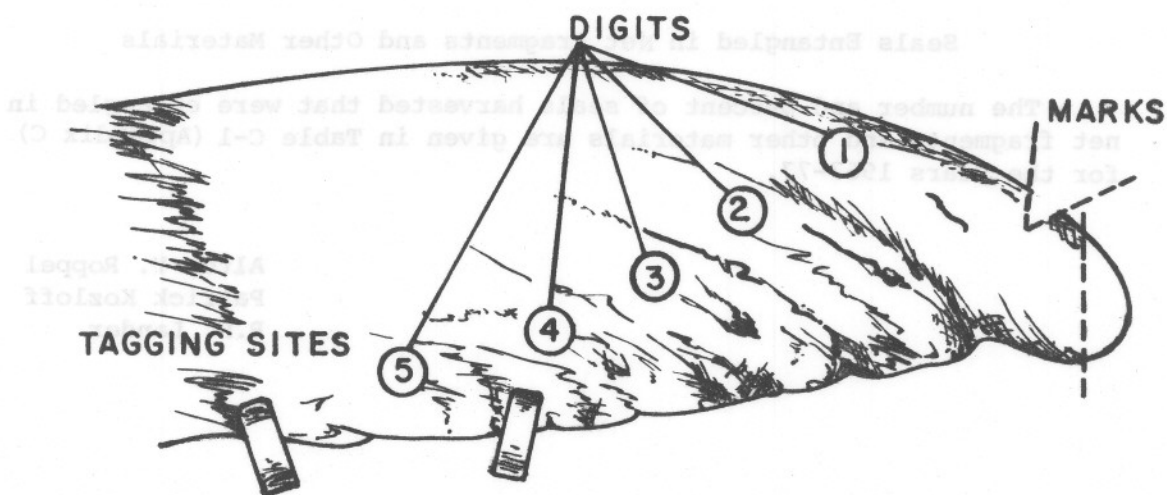
Seals Entangled in Net Fragments and Other Materials

The number and percent of seals harvested that were entangled in net fragments and other materials are given in Table C-1 (Appendix C) for the years 1967-77.

Alton Y. Roppel
Patrick Kozloff
R.H. Lander



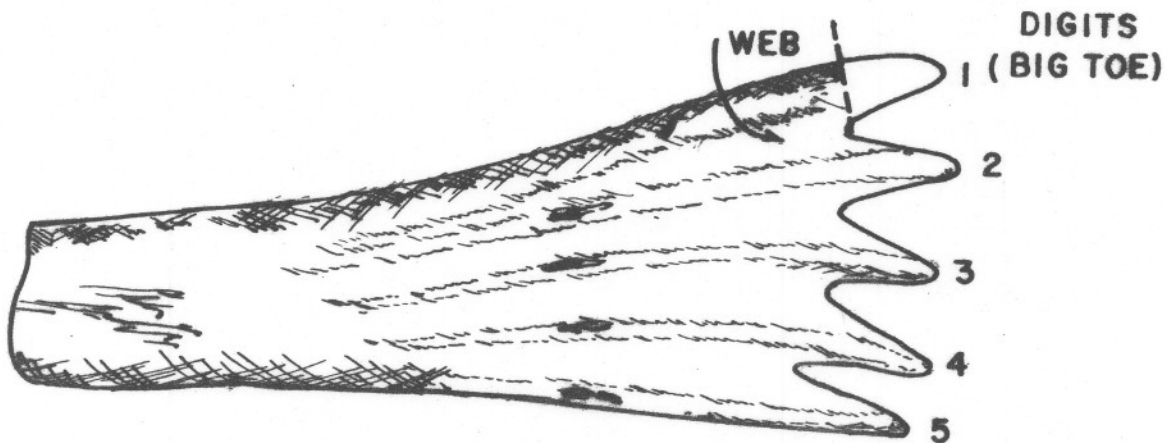
Figure 7. -- Examples of marks used on northern fur seals and their locations on the flippers, Pribilof Islands, Alaska.



FRONT FLIPPER

TAGS CLINCHED AT THE HAIRLINE AND BETWEEN THE FOURTH AND THE FIFTH DIGIT.

MARKS MADE BY CUTTING A V-NOTCH AND REMOVING THE TIP.



HIND FLIPPER

MARK MADE BY REMOVING THE TIP OF THE FIRST DIGIT.

Figure 7. -- Examples of marks used on northern fur seals and their locations on the flippers, Pribilof Islands, Alaska.

Part II. BEHAVIOR AND BIOLOGY, PRIBILOF ISLANDS

The format for behavioral studies in 1977 was similar to that reported for previous years; three observation sites were occupied continuously during the reproductive season, and routine data were collected on behavioral factors that may change as the sex ratio and density of the St. George Island herd changes. The 1977 field season was the last of four in which this format will be followed. Changes in the sex ratio at St. George Island indicate that the period for collecting baseline data at high female/male ratios has passed. The 5-year progress report of research on St. George Island summarizes all behavioral research during this baseline period. Research through 1979 will emphasize subadult male behavior and other specialized subjects and, in 1980, will repeat the data collected during the baseline period (1973-77).

Work Plan

Observational studies in 1977 were carried out on East Reef and Zapadni Rookeries, St. George Island, from 15 June to 17 August and on Kitovi Rookery, St. Paul Island, from 8 June until 16 November. Approximately 4,530 work-hours of observation constituted the field season. Data were collected on the number of seals ashore, their density, male aggression, copulations, births, female aggression, and female feeding cycles at all these sites, using identical data collection methods. A special study on mother-young behavior was conducted at Kitovi, and a new study of social behavior among subadult males was begun at Zapadni Rookery. An experimental study on the attachment of pups to suckling sites was conducted in the St. George Island holding facility.

In 1977, 660 animals were given permanent marks. The numbers in each age-sex group, the types of marks, and tag numbers appear in Table 6. In addition to tagging, the hair (not skin) of most of the adult females and subadult males was hot-iron branded on one shoulder. Each animal was given a unique letter-number combination, such as A1, B7, etc. The brands were applied to test the usefulness of this marking method and to increase the number of marked animals for behavioral study.

Data Analysis

Changes in Sex Ratio.

One of the predictions made at the cessation of commercial harvesting at St. George Island was that the ratio of females/males would change as males that escaped the harvest matured and entered the breeding aggregation. To monitor the sex ratio at St. George Island, daily counts of adult males and females residing on two study grids (a 100 by 30 meter grid at East Reef Rookery and a 100 by 40 meter grid at Zapadni Rookery) were made in each year of the study. These numbers show only the effective sex ratio,

TABLE 6.--Tags applied to fur seals for behavioral study,
Pribilof Islands, 1977.

Type of tag	Tag number	Age-sex class	Number	Rookery
Monel, silver	X 1661-1675,			
	X 1745-1780	Adult male	30	Zapadni
	IW 2373-2400	Adult female	26	Kitovi ^{1/}
Plastic, white	101-117	Adult female	17	Various rookeries
	118-166, 186-200	Adult female ^{2/}	64	Zapadni
	167-175, 208-261	Adult female ^{2/}	64	East Reef
	262-296	Female pup	45	East Reef
	297-400	Female pup	103	Zapadni
Plastic, blue	1-100	Male pup	99	East Reef
Plastic, yellow	101-282	Subadult male ^{2/}	180	Zapadni, North, East Reef
	283-285, 301-335	Male pup	58	East

^{1/} St. Paul Island. All others applied at St. George Island.

^{2/} Adult females and subadult males were also given a hot iron brand.

that is, the ratio on shore on a given day. They do not show the total sex ratio because the total female population is never on shore at the same time. However, these counts do give an index to the total sex ratio if we assume that the proportion of females at sea does not change as the female/male ratio changes.

Figure 8 shows the weekly means for daily female/male ratios on the two study sites, plotted for each year of study. These counts are terminated after 3 August because of the large influx of subadult males. The important trend shown here is that the effective female/male sex ratio has progressively decreased at East Reef from 20:1 to 12:1 in four years while at Zapadni it has decreased from 25:1 to 10:1. Other characteristics of the two sites, such as the date of first female arrivals, rate of female arrivals, date of peak sex ratio, and general seasonal changes in sex ratio have all remained the same for four years.

One reason for the progressive change in sex ratio is that the total number of adult males on the study sites has increased during these years as predicted. Figure 9 shows that the increase has been somewhat greater at Zapadni than at East Reef: in the week ending 13 July, when peak male numbers occur, the males on Zapadni increased by 92% between 1976 and 1977 while those on East Reef increased by only 7%. However, the change has been progressive at both sites. One result of this increase is that a greater number of males now have access to females as the decrease in mean number of copulations per male shows (at the right of Figure 8). It can be inferred that territory size has decreased. Daily maps of male distribution are available for all four years and will be analyzed for changes in territory size. An increase in male-male aggression might be expected to accompany a reduction in territory size. Quantitative data on male aggression collected for the first time at Zapadni in 1977 will be collected again in 1978 and 1979 when more male increases are expected.

The increase of males at the study sites reflects island-wide increases in the number of breeding males. Note in Table A-8 that the number of class 3 males^{3/} on St. George Island increased by approximately 47% between 1976 and 1977. This increase probably represents an influx of males that were four years old when the 1973 harvest ban occurred and that in 1977 entered the breeding aggregation as eight-year-old males. Additional increases are expected in subsequent years. The East Reef and Zapadni study sites reflect this island-wide increase differently, probably because of physical differences between the two rookeries.

Another (unexpected) reason for the change in sex ratio is that the number of adult females on the study sites has decreased over the past four years as shown in Figure 10. This decrease appears small at East Reef, and seems evident only in 1977. However the change at Zapadni is large, and, as Figure 10 shows, has been accompanied by a decrease in the number of pups born on the site. Pups cannot be counted at East Reef because of the broken nature of the terrain.

^{3/} See Table A-3 or glossary for description of the classes of adult male seals.

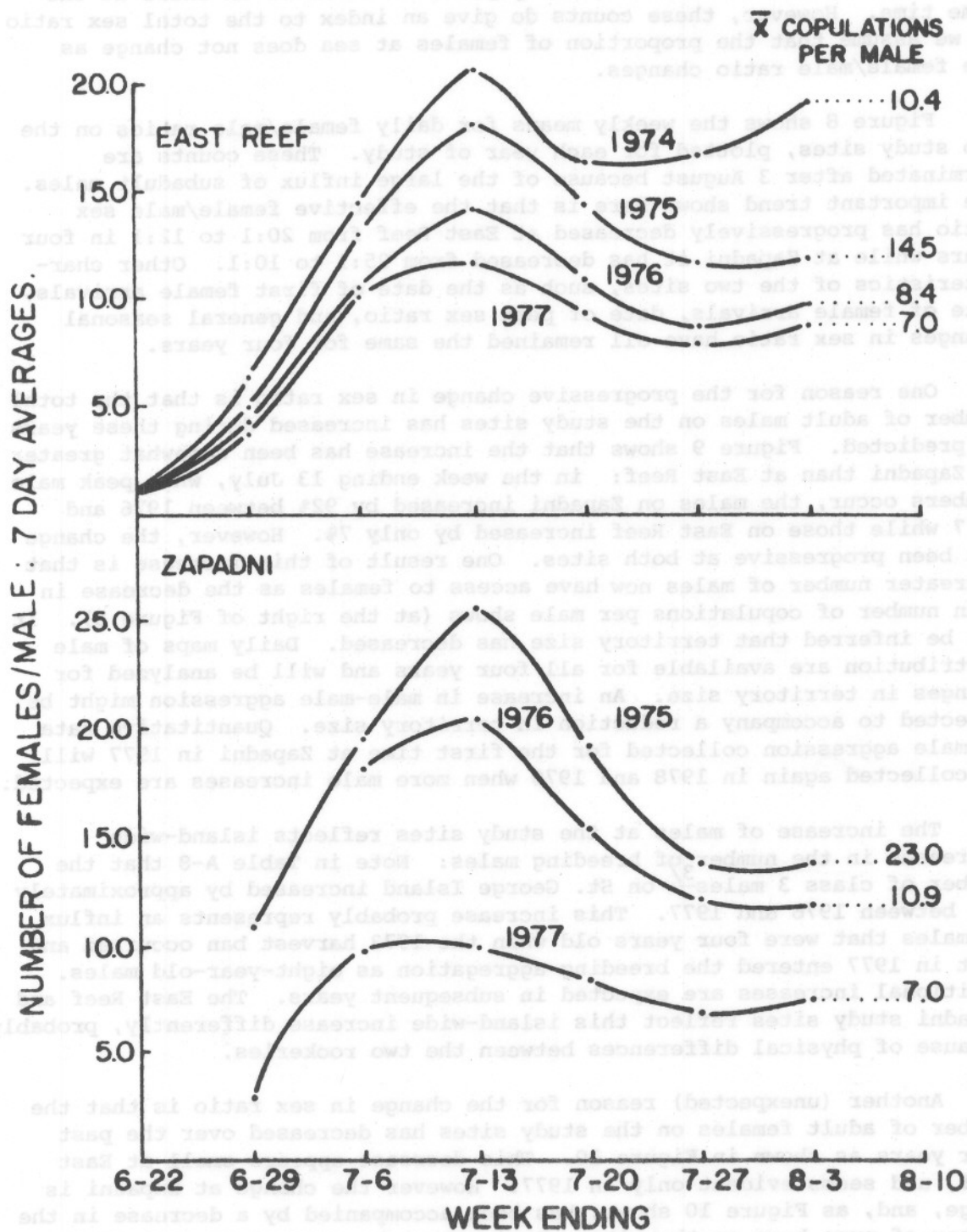


Figure 8.--Mean number of females per male by week, and copulations per male by year.

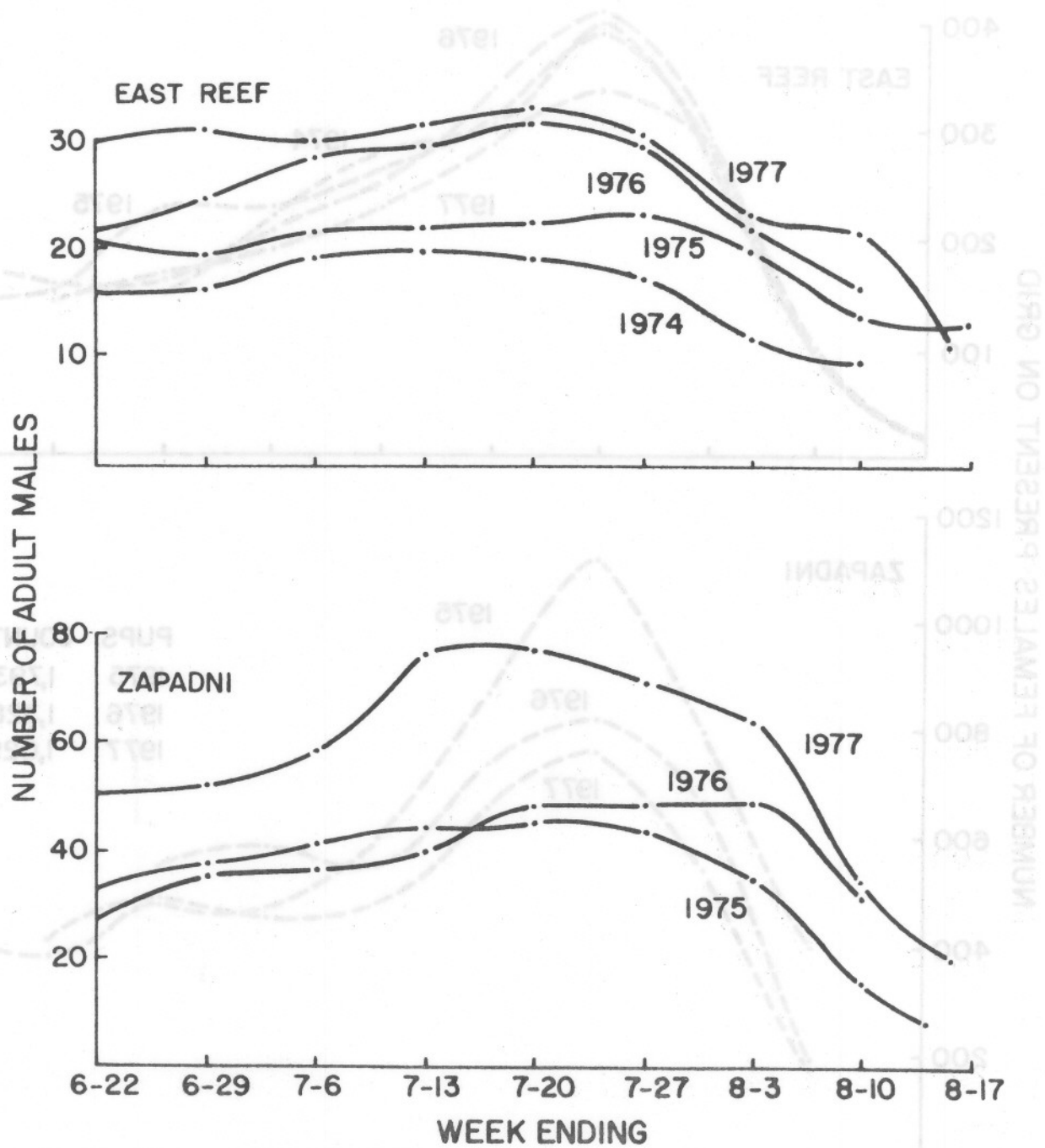


Figure 9.--Counts of adult males on study sites.

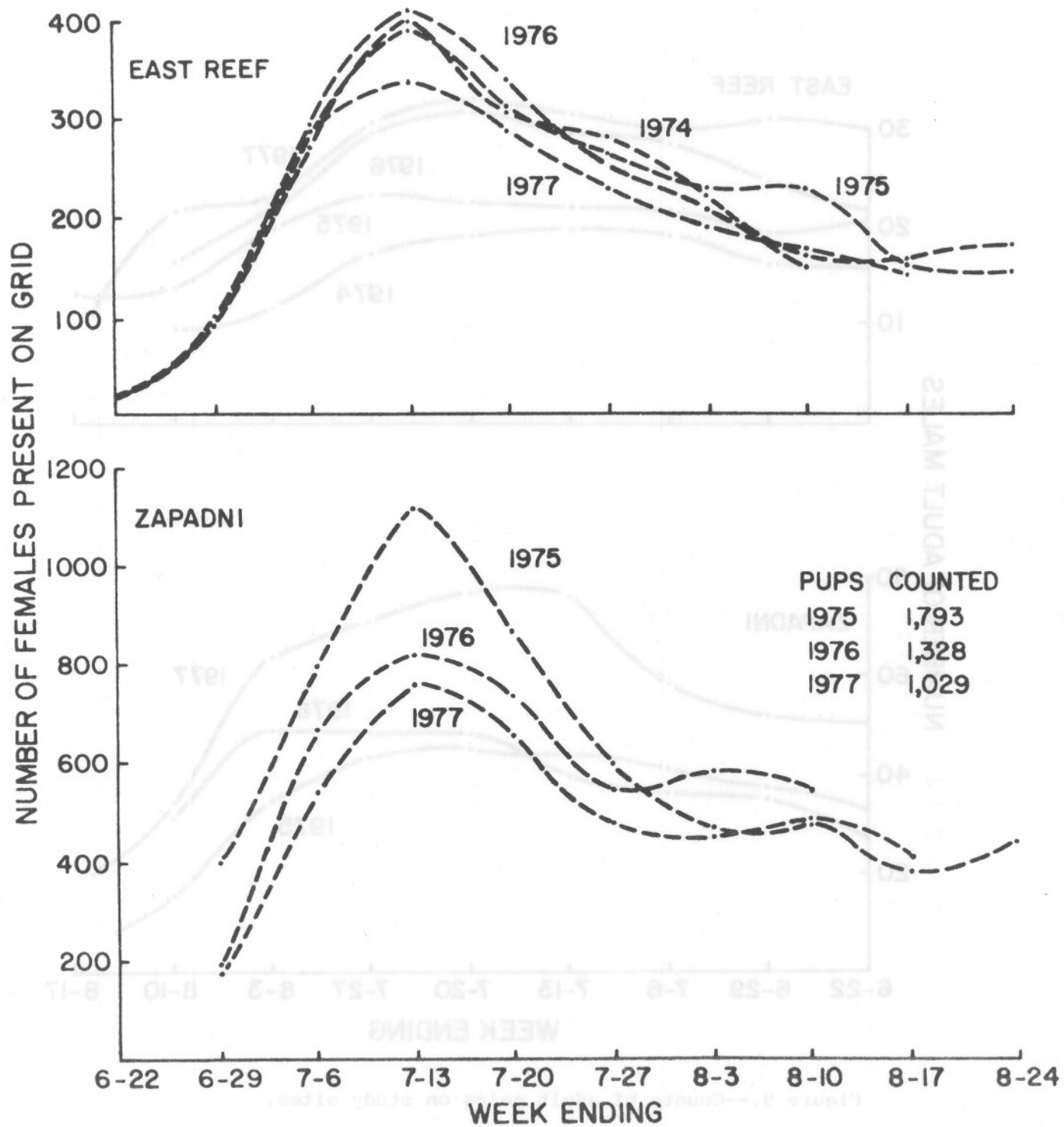


Figure 10.--Counts of adult females on study sites.

The reduction in the number of females appears to be island-wide as indicated by the shearing-sampling estimates of pup numbers. Table 5 (page 14) showed that the 1977 estimate was approximately 17,000, or 28% smaller than the 1973 estimate. In that Table, note that the rookery having the smallest reduction since 1973 was East Reef, a finding which agrees with the small change in female numbers observed there (Figure 10). Since the reduction in numbers appears to be island-wide, it is not likely that research activities have caused the decreases seen at the two study sites.

The Behavioral Basis of Site Fidelity.

Fur seals are known to be conservative in selection of breeding sites; 95% of seals above 5 years of age are found on the rookery of their birth. This species does not quickly colonize new islands or even extinct rookeries. The factors that motivate individuals to return to the same site on successive visits and in successive years have not yet been identified. If these factors can be identified and measured, perhaps they can be manipulated by management in starting new rookeries in areas where habitat is not limiting. Since 1975, experiments have been conducted to identify and measure the relative importance of the factors that may motivate animal movements.

Observations in 1975 suggested that pups form some type of attachment to a site within the first 30 days of life. Twenty-seven pups were held captive for varying intervals (10 to 30 days) while their mothers were used in estrus experiments (Marine Mammal Division, 1976). In early August, pups and mothers were released as close to their parturition sites as possible. Unexpectedly, 4 of the 27 pups returned to the holding facility a few days after their release. No pups were swimming at this time of year, and it is suspected that the pups walked the 2 kilometers from their parturition site to the holding facility. Three of the pups had been held captive 30 days and one for 25 days; none of the animals held captive for shorter periods returned. The four pups were taken back to their parturition sites and released; within three days, three of the pups had again returned to the holding facility. One pup made nine returns, often requiring less than 8 hours each time. These observations demonstrate that by 30 days of age pups can discriminate between sites, that they are extremely motivated to return to the site where suckling occurs if they are displaced, and that parturition on a site has little if anything to do with the pup's later attachment to the site.

If pups are attracted to the site at which suckling occurs, is this attraction a result of suckling itself or of some other activity at that site, such as play and social contact with peers? To address this question, and to repeat the basic observations made in 1975, five pups were held captive for 30 days in 1977. They were housed for two days with their

mothers but without any peer contact and were then moved to a separate holding facility 1 kilometer away where they were kept for two days with peers but without contact with mothers. Pups were moved between the two holding sites every two days for 30 days. In other words, the suckling and peer contact normally experienced on a rookery were replicated in captivity except that a greater than normal time was spent with the mother (Marine Mammal Division, 1977), and suckling and peer contact occurred on geographically separate sites. At the end of the 30 day captivity, pups were released at a site intermediate between the two holding facilities, and their movements were followed on a daily basis. None of the pups returned to the compound at which they experienced peer contact only. All pups returned to the facility where suckling occurred; two of these pups were released again and once again returned to the suckling facility. At the end of the experiment all pups and their mothers were released on the rookery of birth. The tentative conclusions from these pup studies is that the suckling experience is more important than parturition or peer contact in establishing the pup's initial attachment to the site and that this attachment is formed by 30 days of age. Whether this attachment forms in some "critical period" (as in imprinting) and whether the initial attachment is continuous into adulthood, thereby forming the basis of adult site fidelity, must be determined by future research.

The factors that motivate females to return to a rookery or other land site within a season are being studied in a series of translocation tests. Two basic questions are being asked... First, which alternative prevails if females are forced to choose between residence on the favored site (the site on which she gave birth) or residence on a nonfavored site where her pup has been moved? In other words, is the female's attachment to a land site stronger than her attachment to a pup? To answer this question, 18 females and their young were captured on the day of parturition and were moved to a foreign rookery on the same island (distances between rookeries varied from 100 m to 20 km) or on a different island (distance of 65 km) where their residence could be monitored daily. Of the 18 females, 12 (67%) underwent normal feeding excursions, returning to suckle their young at regular intervals; 6 females abandoned their pups and returned to their preferred sites (pups were returned to their mothers at these sites). A similar proportion was faithful to the pup whether the translocation was on the same or to a different island. These translocations will be repeated in 1978. Tentative conclusions now are that (a) the attachment of females to given sites with a season is not fixed and inflexible, and (b) most females in the population are influenced more strongly by the location of the pup than by the location of the preferred rookery in making repeated visits to land in the same season.

The second question being asked is whether generalization (b) above pertains to land areas that are not traditional breeding sites. Eight females and their young were moved to Little East Rookery on St. George Island (extinct since approximately 1915-20), held overnight in a mutual cage, and then allowed to leave the cage. All females remained with the

pup for six days postpartum (a normal interval) but failed to return from feeding to suckle their young. All of these females were soon found on their preferred rookeries and their pups were returned to them there. The total failure of females to suckle their pups on nontraditional sites suggests that the presence of a pup is a necessary but not sufficient condition for females to come ashore at a given site. Some other condition, such as presence of other females or males, must also be met. These other conditions will be addressed in future translocations.

It is assumed that after females attain breeding age, they bear young on the same rookery year after year and that pupping usually occurs on the rookery of each female's birth. However, one of the females translocated from Zapadni to East Reef in 1976 returned to East Reef and bore a pup in 1977, suckling it normally throughout the season. This finding suggests that the selection of a rookery on which to give birth may be more complex than previously assumed and may be subject to experimental manipulation. Future research will investigate the influence of pupping experience of the previous year on the selection of pupping site.

Roger L. Gentry

John Holt

Part III. PHYSIOLOGY AND MEDICINE

Pathology--St. Paul Island

From 30 June through 15 August, M.C. Keyes, D.M. Barton, and K.C. Keyes collected or counted 139 dead fur seal pups from under catwalks on study areas at Reef and Northeast Point Rookeries as described in "Fur Seal Investigations, 1967," SSR-Fish. No. 597, (Marine Mammal Biological Laboratory, 1970).

Ten pups were necropsied by Dr. R.K. Stroud, Veterinary Pathologist on leave from Oregon State University and temporarily employed by MMD, from 1-5 July. Three of these cases were diagnosed as leptospirosis, three as emaciation syndrome, one as peritonitis, one as trauma, and two as undetermined causes.

Twenty-six pups were necropsied by Dr. R.J. Brown, Veterinary Pathologist on loan to the Naval Bioscience Laboratory from the Aerospace Institute of Medicine, Pensacola, FL., from 28 July to 5 August. Of the 26 pups, 13 died of hookworm disease, 5 of emaciation syndrome, and 5 of undetermined causes. One pup each died of leptospirosis and peritonitis, and one was unsuitable for examination. The tissues of these pups were used also for histopathology and isolation of infectious agents.

Infectious Disease Research in Cooperation with
the Naval Bioscience Laboratory (NBL)

A research team of four scientists, made up of one veterinary virologist, one veterinary pathologist, and two research assistants, conducted investigations from 23 July to 6 August. One research assistant remained until 18 August. In addition, a veterinary virologist and assistant from the University of Wisconsin and a cooperator from National Institutes of Health worked in cooperation for the second summer season on avian-mammalian disease relationships.

The Naval Bioscience Laboratory prepared a 6-season summary report of activities and findings. The highlights of this summary are as follows:

Pathology

Necropsies were performed on 185 dead newborn fur seals, and tissues from 69 pups were examined microscopically. Kidney tissues from 89 adult females taken at sea have also been examined microscopically. These studies are still in progress but three articles on new lesions in the fur seal have been published (Brown, et al., 1974a, 1974b, 1975).

Virology

Cooperative studies with Dr. Bernard Easterday, University of Wisconsin, show that fur seals have been exposed to influenza viruses of human and avian types, including swine flu-- the strain that prompted a massive U.S. immunization effort in 1976.

Numerous strains of a vesicular virus, indistinguishable from vesicular exanthema of swine virus, have been isolated from fur seals, and these can be divided into three distinct subgroups. Serologic evidence (antibodies) indicates that fur seals have been infected with strains not yet isolated. We have not yet been able to assess the effects of these viruses on the fur seal population but in swine they cause abortion, stillbirths, retarded growth, and reduced lactation by nursing sows.

Bacteriology

The most significant known pathogen isolated from fur seals so far is Leptospira interrogans var. pomona. (Smith, et al., 1977). It has been associated with perinatal death in pups and interstitial nephritis (chronic kidney disease) in older animals. Serologic evidence indicates that the primary exposure of this agent occurs after the juveniles leave the islands; hence exposure must be in the food chain. This conclusion is logical and understandable; it encourages us to consider vaccination of the juveniles before they leave the islands as a way of preventing the harmful effects of the disease and, just as importantly, as a way of evaluating the detrimental effects of this disease on the fur seal population.

Bacteria that have been isolated and identified from the nose, throat, tonsil crypt, and ear are Corynebacterium sp., Moraxella sp., Achromobacter sp., Neisseria sp., Listeria sp., Staphylococcus sp., Proteus mirabilis, and Streptococcus durans.

Aerobic bacteria isolated from the rectum and seven areas of the intestinal tract are Neisseria caviae, Actinobocillus sp., Alcaligenes faecalis, E. coli, Staphylococcus epidermis, Corynebacterium sp., and Achromobacter sp. Aerobic bacteria isolated from the blood, liver, and kidney are Micrococcus sp., Neisseria caviae, Staphylococcus sp., Micrococcus luteus, Bacillus sp., Proteus vulgaris, Escherichia coli, and Moraxella sp. These isolates came from 61 kidney and 61 liver samples.

Specialized media were used to attempt isolations from 46 gallbladders and 130 gut specimens. No growth was obtained on XLD, SS, or McConkey media.

Neisseria caviae was isolated from the kidney, rectum, and gut; N. cuniculi, from the throat.

Anaerobic bacteria isolated were Eubacterium sp., Fusobacterium sp., Bacteroides sp., Propionibacterium acnes, Clostridium sordellii, Cl. paraputrificum, Cl. felisineum, Cl. perfringens, Cl. septicum, Cl. chauvoei, Cl. difficile, Cl. saccharolyticum, Cl. fallox, and Cl. sporogenes.

Also isolated were 30 species of Clostridia and 25 other anaerobes not yet identified.

Immunology

The immune systems of 55 fur seal pups, ranging in age from full-term, unborn pups to 4-month old pups, and 25 3- and 4-year-old males from the harvest have been examined. The main findings were:

1. There is no placental transfer of immunoglobulins.
2. Uptake of immunoglobulins from colostrum by newborn fur seals is moderate, and the circulating immunoglobulins either drop rapidly to low levels or disappear after 1-2 weeks.
3. At 35 days of age, fur seal pups appear to have mature and competent immune systems free of circulating parental immunoglobulins.
4. At age 3-5 months, the level of circulating immunoglobulins in fur seal pups is only about one fourth of that in 3- and 4-year-old males.
5. By November, fur seal pups show a depleted thymus gland, a sign of stress on the immune system,

Parasitology

Hookworm research

This work was carried out in cooperation with the principal investigator, Eugene T. Lyons, Ph.D., University of Kentucky from 7 to 23 July.

An experiment with 13 newborn pups which had never nursed was conducted to determine if parasitic third stage larvae of the hookworm Uncinaria lucasi, taken from the subcutaneous fat (blubber) of adolescent and adult male fur seals, would develop into adult hookworms in susceptible pups.

Larvae from the tissues of pregnant females did develop into adult worms 13 days after feeding to susceptible pups, but larvae from the tissues of adolescent and adult males did not.

The results suggest that third stage infective larvae need to be conditioned by the hormones of pregnancy or parturition to be infective.

The efficacy of oral and injectable organic phosphate (dichlorvos and disophenol) was tried on 20 pups with 10 pups as untreated controls. Removal of adult hookworms was 99.8% for five pups treated with dichlorvos capsules at a dosage of about 30 mg/kg, 99.4% for five pups treated with dichlorvos tablets at a dosage of about 11 mg/kg, and 77.2% for ten pups treated with disophenol injection at 9.9 mg/kg body weight.

It was also noted that all treatments were effective against lice and probably nasal mites as well.

Nasal mite research

The heads, tracheas, bronchii, and lungs of nine post partem female fur seals were sent frozen to Ke Chung Kim, Ph.D., Pennsylvania State University, for nasal mite research. One preliminary finding of special interest is that one species of adult mite, Orthohalarachne attenuata, resides only in the naso-pharynx, whereas the other species, Orthohalarachne diminuata, resides in the lungs. The larvae of both species inhabit the nasal turbinates. Lesions of the nasal passage have been described (Dunlap, et al., 1976).

Tunic worm research

The tunic worm, Dipetalonema odendhali, is a filariid worm that resides in the subcutaneous tissues of fur seals. What effect such resident adult worms have on the host is not known but circulating larvae (microfilariae) have been found in 80% of the young males examined in some years. The life cycle has not been worked out; the single most important part of which, identity of the intermediate host, is unknown but believed to be a biting insect or arachnid.

Gerald Conlogue, B.S., M.S. from Washington State University began working on the problem from 5-27 July. His primary accomplishment was in working out methods, techniques, and approaches under existing conditions, enabling him to plan more precisely his research approach for the coming season.

Physiology

Thermoregulation

From 12-23 July the Physiology and Medicine Section gave assistance to Dr's Arnoldus S. Blix and Hans Grave, thermoregulatory physiologists from University of Oslo, Norway (Dr. Blix was affiliated with University of Alaska).

One approach was to measure the oxygen consumption of freshly isolated mitochondria from the tissue cells of fur seal pups at birth and at about 10 days of age. Direct resistance to cold, with and without inhibition of shivering during artificial generation of cold, was measured. One conclusion drawn was that thermogenesis in pups was primarily owing to fatty acid metabolism and anaerobic glycolysis. A paper for publication is in progress.

Artificial seal milk-pup husbandry

Thirteen newborn pups were maintained on artificial seal milk for 15 days to support studies of experimental transmission of hookworm larvae.

The formula ingredients for artificial seal milk and husbandry methods were the same as reported in Fur Seal Investigations, 1966 (Marine Mammal Biological Laboratory, 1969), except that seal oil was substituted for whale oil as the fat component. The seal oil was recovered from seal fat removed from fresh skins in the blubbering shed during the 1974 sealing season by a process developed by Mr. John Dyer. The seal oil was stored in 5 gallon tins in an unheated warehouse.

The results using seal oil in the formula were more than satisfactory. In other years, newborn pups reared on formula all lost weight or remained the same between the end of their first and second week on formula, but in the 1977 group of 13, 5 pups showed slight gains, 4 remained the same, and 4 lost slightly.

Pathology - St. George Island

After a 3-year delay, a pup mortality study, concentrating on causes of death, was successfully launched on St. George Island this July.

Staraya Artil Rookery on St. George offered one of the better available concentrations of newborn pups but was bypassed in 1975 because of bachelor hauling grounds near by. Catwalks from which dead pups could be collected were then constructed in the spring of 1975 on North Rookery,

but the number of dead pups available there was inadequate. Only 15 could be retrieved in a 2-week period.

We were thwarted from constructing new catwalks in a new location the following spring because of heavy residual and drifting snow, so the catwalks could not be laid out and constructed until the fall of 1976.

The catwalk on Staraya Artil Rookery consists of a long approach section which crosses a portion of the hauling ground and a small portion of the rookery, a connecting catwalk from the back of the rookery seaward and perpendicular to the approach which is generally parallel to the shore, and three spurs projecting into the more densely populated areas of the rookery. The spurs are also generally parallel to the shoreline.

The height of the catwalk varies from 7 to 10 feet. The total rookery area accessible by means of an 18 ft. bamboo gaff pole measures approximately 2,000 sq. yards. The area is moderately sloped, rocky, and well drained.

In 1977, even though pup mortality was the lowest in many years, an adequate sample was obtained. From 6 July to 15 August, Dr. Richard K. Stroud and Mrs. Melody E. Roelke collected 204 dead pups from the study area. In recent years, study areas on St. Paul Island have yielded only about 250 dead pups even though collectively they were 2 1/2 times larger than the St. George study area.

The reason for the better sample on St. George Island is that the catwalks are located in such a way that harem concentrations are unable to shift away from the catwalks as they have done on St. Paul Island.

Dr. Stroud is a veterinary pathologist from Oregon State University and has had considerable experience with marine mammals. He has been investigating causes of death of marine mammals stranded along the Oregon coast for the past several years and, prior to his graduation from the Washington State University, College of Veterinary Medicine, he directed one of our pelagic research vessels, the M/V Tonquin. Before that he worked several summers on St. Paul Island as a fisheries aide.

Mrs. Roelke is a junior veterinary medical student at Washington State University and is particularly interested in wildlife disease research. She is an accomplished bacteriologist and worked on the isolation and identification of pathogenic bacteria of seal pups on St. George Island.

Of the 204 dead pups collected, 175 were necropsied and 29 discarded as unsuitable for examination because of advanced post-mortem degeneration.

Tabulation of the primary diagnoses for the 175 pups (Table 7) shows that emaciation syndrome and hookworm disease accounted for 70% of the pup deaths on the Staraya Artil study area. Infectious disease was next

Table 7. Primary diagnoses of causes of death among seal pups on Staraya Artil Rookery, mortality study area 4, St. George Island, Alaska, by weekly intervals from 5 July to 15 August, 1977.

Primary diagnosis	5-11 July		12-18 July		19-25 July		26 July - 1 Aug		2-8 Aug		9-15 Aug		Total	Percent
	No	%	No	%	No	%	No	%	No	%	No	%		
Emaciation syndrome	7	21.9	17	42.5	12	27.3	15	41.7	17	53.1	10	50	78	38.2
Hookworm disease	1	3.1	9	22.5	22	50.0	15	41.7	11	34.4	6	30	64	31.4
Microbial infection	6	18.8	5	12.5	4	9.1	2	5.6	1	3.1	2	10	20	9.8
Peritonitis	--	--	--	--	--	--	(1)	(2.8)	--	--	(1)	(5)	(2)	(1.0)
Pleuritis	--	--	--	--	--	--	--	--	(1)	(3.1)	(1)	(5)	(2)	(1.0)
Enteritis	(2)	(6.3)	(1)	(2.5)	--	--	--	--	--	--	--	--	(3)	(1.5)
Abscess/cellulitis	--	--	(1)	(2.5)	--	--	(1)	(2.8)	--	--	--	--	(2)	(1.0)
Meningitis	--	--	--	--	(1)	(2.3)	--	--	--	--	--	--	(1)	(0.5)
Leptospirosis (perinatal complex)	(4)	(12.5)	(3)	(7.5)	(3)	(6.8)	--	--	--	--	--	--	(10)	(4.8)
Trauma	3	9.4	--	--	2	4.5	--	--	--	--	--	--	5	2.4
Bite wound	(1)	(3.1)	--	--	--	--	--	--	--	--	--	--	(1)	(0.5)
Organ rupture	(1)	(3.1)	--	--	(1)	(2.3)	--	--	--	--	--	--	(2)	(1.0)
Skull fracture	(1)	(3.1)	--	--	(1)	(2.3)	--	--	--	--	--	--	(2)	(1.0)
Miscellaneous	--	--	--	--	1	2.3	1	2.8	--	--	--	--	2	1.0
Hydrocephalis	--	--	--	--	--	--	(1)	(2.8)	--	--	--	--	(1)	(0.5)
Drowning	--	--	--	--	(1)	(2.3)	--	--	--	--	--	--	(1)	(0.5)
Undetermined	--	--	4	10	1	2.3	--	--	--	--	1	5	6	3.0
Unsuitable for examination	15	46.8	5	12.5	2	4.5	3	8.2	3	9.4	1	5	29	14.2
Total	32	100.0	40	100.0	44	100.0	36	100.0	32	100.0	20	100.0	204	100.0

at 10%, including the perinatal hemorrhagic complex caused by leptospiral infection of the prepartum mother seals involved. Trauma (2%) and miscellaneous causes (1%) were of lesser importance. A primary diagnosis could not be made in 3% of the cases, and 14.2% were discarded as unsuitable for examination.

Total head counts of live pups at weekly intervals were as follows: 12 July, 1490 pups; 18 July, 1801 pups; 25 July, 1389 pups; 1 August, 1932 pups; and 8 August, 1685 pups. If we assume an average population count of 1659 pups, then 12.3% (204) of the pups died before August 15.

In addition to gross pathologic observations, the histopathology and bacteriology of selected tissues and exudates was done. These findings will be reported separately.

Acute hookworm disease is characterized by severe anemia. Sudden increases in death from hookworm induced anemia occurred immediately following a rain and chilling winds. Because the weather was unusually mild throughout the 1977 pupping season, there was probably a lowered incidence of acute hookworm caused deaths. Peritonitis as a sequel to hookworm perforation of the intestine was seen in 29.5% of the hookworm caused deaths, or 9.3% of the total sample.

Of special significance was a case of meningoencephalitis (infection of the brain and its membranes) from which the bacterium Salmonella enteritidis was cultured. This case is the first of its kind to be observed in fur seals; a separate case report will be published.

Small protozoan organisms similar to Cryptosporidia sp. were observed in the intestinal crypts of a pup with severe fibrinonecrotic enteritis. This is the first time this type of organism has been observed in northern fur seal pups.

A single case of congenital hydrocephalus was observed--the second case in 10 years (Marine Mammal Biological Laboratory, 1970) (Fish. No. 597) for the Pribilof Islands.

These data on causes of death in St. George Island pups show little if any difference with corresponding data for fur seal pups on St. Paul Island. It has been our intention to regard these new data as baseline data representing conditions prior to a peak buildup of adult male fur seals. We think we can collect two more years of baseline data on St. George. Then, 5 years later, another three years of data on causes of death in pups will be gathered. This will permit detection of changes, if any, in mortality caused by an increase in the number of adult males.

Mark C. Keyes, Alvin W. Smith, Richard J. Brown, Eugene T. Lyons, and Richard K. Stroud^{4/}

^{4/} Dr. Smith, Veterinary Virologist and Dr. Brown, Certified Veterinary Pathologist, are with the Naval Bioscience Laboratory, Oakland, California. Dr. Lyons is with the University of Ky Ag. Expt. Sta. Dr. Stroud, a temporary NMFS employee, is with the Oregon State University School of Veterinary Medicine.

Part IV. POPULATION GROWTH - SAN MIGUEL ISLAND
(Adams Cove and Castle Rock)

Adams Cove

The population of fur seals breeding in Adams Cove on the west end of San Miguel Island has been monitored daily during each breeding season from 1969 through 1977. A summary of population information is presented in Table 8 and described below.

The adult males and females haul out in late May, and the mean pupping date occurs in late June. The numbers of pups born in Adams Cove increased only slightly in 1977 (421 compared to 417 in 1976). The reason for the relatively small increase in pup production is not understood at this time. The largest number of females ashore (681) since the beginning of the studies was counted on 26 August. The female count does not reflect the total number of females in the breeding population because (1) a large portion of parturient females were at sea and (2) new females continued to arrive on land as evidenced by the presence of algae on their pelage.

Growth of the Adams Cove colony is being continuously supplemented by an influx of females from elsewhere, presumably the Pribilof, Commander, and Robben Islands because some of these animals had been tagged and checkmarked as pups at these locations. Marked males from these northern populations have not been observed here.

Tagging Records

Records have been kept of each tagged or checkmarked seal observed ashore in Adams Cove starting in 1968 with the discovery of this colony on San Miguel Island. As stated earlier, some of these females had been tagged as pups on the Pribilof, Commander, and Robben Islands (Tables A-15, A-16) and some had been tagged as adult females or pups at Adams Cove on 20 July 1968 (Table A-17). Records have also been kept of observed adult females and pups which were tagged on San Miguel Island more recently (Table A-18 and A-19). In 1977, one hundred fur seal pups were tagged and checkmarked (Table A-20) in the manner described in Part V of Fur Seal Investigations, 1975 (Marine Mammal Division, 1976).

Pup Mortality

In 1977, 64 fur seal pups died on land. During abnormally hot weather conditions from 22-25 June and from 12-13 July, 89% (54 pups) of the pup mortality occurred. During these periods, solar radiation reached 1.36 cal/cm^2 , winds were less than 5 km/hour, and sand and air

Table 8. --Summary of some observations of the northern fur seal colony in Adams Cove on San Miguel Island, California, 1969-77

Observation	1969	1970	1971	1972	1973	1974	1975	1976	1977
Season span									
Beginning date ^{1/}	16 May	23 May	15 May	16 May	9 May	20 May	19 May	29 May	18 May
Ending date	1 Oct.	20 Sept.	6 Sept.	7 Sept.	15 Aug.	9 Sept.	6 Sept.	14 Sept.	22 Sept.
First male	16 May	29 May	24 May	16 May	26 May	20 May	12 May	29 May ^{2/}	18 May ^{9/}
First female	27 May	28 May	25 May	22 May	17 May	20 May ^{3/}	19 May	29 May ^{2/}	18 May ^{9/}
First birth	6 June	28 May	31 May	22 May	7 June ^{4/}	27 May	27 May	29 May ^{5/}	29 May
Mean birth date	24 June	21 June	26 June	22 June	24 June	23 June	27 June	29 June	25 May ^{10/}
Total births	28	33	45	70	68	220	329	417	421
Total pup deaths	2	14	15	21	17	52	46	91	64
Total females (maximum counted and date) ^{6/}	175 23 Aug.	179 23 Aug.	274 2 Sept.	310 16 Aug.	394 4 Aug.	551 8 Sept.	563 24 Aug.	495 14 July	681 26 Aug.
Total large adult males	4	2	4	6	6	6	12 ^{7/}	7	6
Total small adult males	4	4	6	7	5	6	6	5	3
Total bachelors ^{8/}	4	5	6	10+	6	8	7	11	7+

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

^{2/} Four males, nine females present 29 May--arrived prior to 29 May.

^{3/} May have arrived earlier.

^{4/} One still birth occurred on 19 May.

^{5/} One pup present 29 May--born prior to 29 May.

^{6/} A few 2-, 3-, and 4-year-old males may have been included because they are about the same size as adult females.

^{7/} Includes two males who arrived in late August and were not territorial (probably from Castle Rock).

^{8/} Animals about 104-127 cm in body length, tip of nose to tip of tail.

^{9/} Three males and 2 females present 18 May--arrived prior to 18 May.

^{10/} Estimated from previous census information.

temperatures reached 35° C (95° F) and 19° C (66° F), respectively. This same correlation between hot weather and pup mortality has been observed in past years. Presumably, pups become heat prostrated and die because they are unable to locate water or wet sand to cool themselves. Another cause of pup mortality is falling earth embankments. In 1976, 11 pups died from this phenomenon but in 1977 only 2 deaths were observed. The major reason for this decrease is probably due to the eroding away of the large hazardous ridges and cliffs which were frequently used by fur seal pups seeking shade from the sun or shelter from the strong northwest winds.

Castle Rock

A summary of the Castle Rock census information from 1972 to 1977 is shown in Table 9. The census information for fur seals on Castle Rock has been obtained in a variety of ways, since inclement weather and or logistical problems affect the manner by which census information is collected. The three methods for censusing the animals on this area are to make counts (1) from afoot, (2) from aerial photographs, and (3) from off shore from a small skiff. In 1977, a count of 617 pups (597 living) was obtained during a land based census, 29 July. Counts of breeding males for 1977 were lower than in previous years (Table 9) because they were censused late in the breeding season after they had already begun to abandon their territories.

On 16 September, 100 fur seal pups were tagged on Castle Rock (Table A-21) and checkmarked in the same manner described for the Adams Cove population.

Table 9. Summary of northern fur seal censuses on Castle Rock (adjacent to San Miguel Island, California, 1972-77^{1/}).

Fur seals	Numbers observed, methods and date of observation					
	1972	1973	1974	1975	1976	1977
Females	223 ^a 1 Aug.	345 ^a 11 Jul.	301(+) ^d	396(+) ^d	526 ^c 27 Jun.	617(+) ^d
Pups Total observed ^{2/}	95 ^a 1 Aug.	193 ^b 28 Jul.	301(+) ^b 2 Aug.	396 ^b 2 Aug.	521 ^b 25 Jul.	617 ^b 29 Jul.
Pups Dead observed	- -	33 ^b 28 Jul.	21 ^b 2 Aug.	28 ^b 2 Aug.	27 ^b 25 Jul.	20 ^b 29 Jul.
Reproductive males ^{3/}	9 ^a 1 Aug.	13 ^a 11 Jul.	11 ^a 2 Jul.	15 ^a 1 Jul.	16 ^c 27 Jun.	9(+) ^a 26 Jul.
Total males	10 ^a 1 Aug.	14 ^a 11 Jul.	20 ^a 2 Jul.	20 ^a 1 Jul.	18 ^c 27 Jun.	9(+) ^a 26 Jul.

- ^{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 in territories.

Part V. PELAGIC ECOSYSTEM

To facilitate the analysis of fur seal pelagic data collected by the United States and Canada during 1958-74, data summaries have been calculated for various topics related to migration, distribution, age/sex ratios, growth, reproduction and feeding habits.

As a first step in determining distribution and migration of fur seals, all sighting and collection data were summarized by a monthly series of graphical charts in grid format by 1° latitude and 2° longitude. These monthly data summaries include: sighting effort (boat hours = hours of research effort), number of seals seen, number seen per boat hour, number seen per boat hour per square kilometer of the 1° x 2° areal grid, number of seals collected by age and sex. Examples of some of these graphical summary charts are shown in Figures A-1 to A-5. In addition, Tables A-22, A-23, and A-24 list the age and sex breakdown of all fur seals collected by the U.S. and Canada during 1958-74 by month and research area.

Growth-age studies have been initiated to better estimate ages of animals older than 6 years of age. A technique of cutting thin sections from upper canine teeth and staining them to reveal canine growth layers is being investigated for both age determinations and growth studies. A measure of fur seal growth is permanently recorded on the canine teeth of fur seals as annual growth increments. A study to measure these increments as they relate to food consumption or availability (energy transfer and efficiency of utilization) is underway using teeth collected from 1958-74. Perfection of this technique may in time permit a study of body growth through measurement of annual growth increments within the canine teeth. Body length and weight data collected from 1958 to 1974 have been summarized by year class to facilitate an analysis of growth. In addition, mean lengths and weights of each age class of males, females, pregnant females, and fetuses have been calculated.

As a first step in the analysis of fur seal feeding habits, summaries of prey consumption by percent of frequency of occurrence and percent total volume of stomach contents have been calculated for each age class by sex and month. These summaries have been calculated by 10' latitude by 10' longitude, 1° latitude by 1° longitude, and for combined major research areas.

In order to improve our understanding of the relationships of fur seals with other components of the marine ecosystem of the eastern Bering Sea, Aleutians area, and western Gulf of Alaska^{5/}, an analysis was made

^{5/} Area west of Kodiak Island beginning at 158°00'W and from 49°00' N to the Aleutian Islands.

on feeding habits data collected by the United States during 1958-74 from contents from the stomachs of 2,914 seals taken in the eastern Bering Sea and from 438 seals taken in the western Gulf of Alaska area. Percentages of total volume and frequency of occurrence of prey species in fur seal stomachs, and size of prey species were determined. These data have been combined with fur seal population estimates (including abundance and mean weights of component age classes) in the eastern Bering Sea and Aleutians area to describe a conceptual model of the trophodynamic relationships of fur seals with other marine mammals, standing stocks of fish and squid, and commercial fisheries within the ecosystem.

Forms have been prepared for use by vessel captains or by U.S. observers aboard foreign fishing vessels to determine incidental take of fur seals and other marine mammals by foreign fisheries. Information obtained will include incidental take, injury and mortality in relation to the fishery catch.

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GLOSSARY

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

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

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

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 meters. Most of these animals are wet or partly wet and some acquire harems of 1-4 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 the 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 one or more 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.

Class 4 (Back fringe)--Full- and partly grown males on the inland fringe of the 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 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 age 7 and older.

Class 3 males were formerly called harem bulls, and Class 1, 2, 4, and 5 were collectively called idle bulls. From 1966 through 1974, the adult male seals were classified into 5 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.

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

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

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

Round The sequence in which hauling grounds on St. Paul Island are visited to harvest seals. A circuit or round of the hauling grounds is completed in 5 days and the procedure is repeated throughout the kill of males.

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Table A-1. ---Age classification of male seals killed on St. Paul Island, 27 June to 29 July 1977.

Date	Rookery ^{1/}	Males killed	Tooth sample	Daily						Cumulative																	
				Percent in each age class of sample						Estimated number killed from each age class						Estimated number killed from each age class						Percent killed from each age class					
				2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20					
June 27	NEP(west)	518	118	1.7	28.8	58.5	10.2	0.8	9	149	303	53	4	518	9	149	303	53	4	2	29	58	10	1			
27	NEP(east)	290	68	0	23.5	69.1	7.4	0	0	68	200	22	0	808	9	217	503	75	4	1	27	62	9	1			
28	POL	281	132	0.8	26.5	59.1	13.6	0	2	75	166	38	0	1,089	11	292	669	113	4	1	27	62	10	0			
29	TZR	932	167	0.6	43.1	50.3	6.0	0	6	401	469	56	0	2,021	17	693	1,138	169	4	1	34	56	9	0			
30	ZAP	177	37	0	45.9	43.3	10.8	0	0	81	77	19	0	2,198	17	774	1,215	188	4	1	35	55	9	0			
July 1	Reef	929	162	0	39.5	53.7	6.2	0.6	0	367	499	58	5	3,127	17	1,141	1,714	246	9	1	36	55	8	0			
1	L-K	216	39	0	33.3	59.0	7.7	0	0	72	127	17	0	3,343	17	1,213	1,841	263	9	1	36	55	8	0			
5	NEP(west)	645	172	3.5	43.0	49.4	4.1	0	23	277	319	26	0	3,988	40	1,490	2,160	289	9	1	38	54	7	0			
5	NEP(east)	653	130	2.3	26.2	63.1	8.4	0	15	171	412	55	0	4,641	55	1,661	2,572	344	9	1	36	56	7	0			
5	POL	452	48	0	29.2	64.6	6.2	0	0	132	292	28	0	5,093	55	1,793	2,864	372	9	1	35	56	8	0			
6	TZR	1,366	252	2.4	49.6	44.8	3.2	0	33	677	612	44	0	6,459	88	2,470	3,476	416	9	1	38	54	7	0			
7	ZAP	639	128	3.1	52.3	43.8	0.8	0	20	334	280	5	0	7,098	108	2,804	3,756	421	9	2	39	53	6	0			
8	Reef	1,434	257	1.9	53.7	42.5	1.9	0	27	770	610	27	0	8,532	135	3,574	4,366	448	9	2	42	51	5	0			
8	L-K	490	105	1.9	43.8	52.4	1.9	0	9	215	257	9	0	9,022	144	3,789	4,623	457	9	2	42	51	5	0			
11	NEP(west)	439	74	5.4	62.2	31.1	1.3	0	24	273	136	6	0	9,461	168	4,062	4,759	463	9	2	43	50	5	0			
11	NEP(east)	708	140	0.7	59.3	39.3	0.7	0	5	420	278	5	0	10,169	173	4,482	5,037	468	9	2	44	49	5	0			
12	POL	596	121	2.5	52.1	41.3	4.1	0	15	311	246	24	0	10,765	188	4,793	5,283	492	9	2	44	49	5	0			
13	TZR	1,026	196	6.6	62.8	29.6	1.0	0	68	644	304	10	0	11,791	256	5,437	5,587	502	9	2	46	48	4	0			
14	ZAP	1,457	173	5.2	60.1	33.5	1.2	0	76	876	488	17	0	13,248	332	6,313	6,075	519	9	2	48	46	4	0			
15	Reef	1,384	278	5.4	67.6	25.9	1.1	0	75	936	358	15	0	14,632	407	7,249	6,433	534	9	3	49	44	4	0			
15	L-K	551	113	8.0	69.0	22.1	0.9	0	44	380	122	5	0	15,183	451	7,629	6,555	539	9	3	50	43	4	0			
18	NEP(west)	775	139	7.9	62.6	25.9	3.6	0	61	485	201	28	0	15,958	512	8,114	6,756	567	9	3	51	42	4	0			
18	NEP(east)	528	92	1.1	48.9	46.7	3.3	0	6	258	247	17	0	16,486	518	8,372	7,003	584	9	3	51	42	4	0			
19	POL	722	139	5.8	68.3	23.0	2.9	0	42	493	166	21	0	17,208	560	8,865	7,169	605	9	3	52	42	3	0			
20	TZR	816	149	5.4	56.4	36.2	2.0	0	44	460	296	16	0	18,024	604	9,325	7,465	621	9	3	52	41	4	0			
21	ZAP	1,147	203	7.4	69.9	22.2	0.5	0	85	802	254	6	0	19,171	689	10,127	7,719	627	9	4	53	40	3	0			
22	Reef	1,518	332	9.4	62.0	27.1	1.5	0	143	941	411	23	0	20,689	832	11,068	8,130	650	9	4	54	39	3	0			
22	L-K	455	97	11.3	69.1	19.6	0	0	52	314	89	0	0	21,144	884	11,382	8,219	650	9	4	54	39	3	0			
25	NEP(west)	1,009	162	7.4	71.6	19.8	1.2	0	75	722	200	12	0	22,153	959	12,104	8,419	662	9	4	55	38	3	0			
25	NEP(east)	460	78	2.5	65.4	30.8	1.3	0	11	301	142	6	0	22,613	970	12,405	8,561	668	9	4	55	38	3	0			
26	POL	294	61	11.5	59.0	27.9	1.6	0	34	173	82	5	0	22,907	1,004	12,578	8,643	673	9	4	55	38	3	0			
27	TZR	2,381	486	14.2	70.2	15.0	0.6	0	338	1672	357	14	0	25,288	1,342	14,250	9,000	687	9	5	56	36	3	0			
28	ZAP	1,039	188	10.6	72.4	17.0	0	0	110	752	177	0	0	26,327	1,452	15,002	9,177	687	9	5	57	35	3	0			
29	Reef	1,319	317	18.6	67.8	12.6	1.0	0	246	894	166	13	0	27,646	1,698	15,896	9,343	700	9	6	57	34	3	0			
29	L-K	750	106	11.3	77.4	10.4	0.9	0	85	580	78	7	0	28,396	1,783	16,476	9,421	707	9	6	58	33	3	0			

^{1/} NEP(east) = east or Morjovi side of Northeast Point; NEP(west) = West or Vostochni side of Northeast Point; TZR = Tolstoy, Zapadni Reef, and Little Zapadni; POL = Polovina, Polovina Cliffs, and Little Polovina; ZAP = Zapadni; REEF = Reef, Gorbach, and Ardiquen; L-K = Lukanin and Kitovi.

Table A-2. --Age classification of male seals killed, subsistence harvest, Staraya Artil and North Rookeries, St. George Island, 28 June to 28 July 1977.

Date	Males killed	Tooth sample	Percent in each age class of sample					Estimated number killed from each age class				
			2	3	4	5	6	2	3	4	5	6
<u>June</u>												
28	55	51	0	17.6	54.9	25.5	2.0	0	10	30	14	1
<u>July</u>												
6	60	55	1.8	27.3	69.1	1.8	0	1	16	42	1	0
12	78	70	0	24.3	65.7	10.0	0	0	19	51	8	0
21	91	81	0	35.8	58.0	6.2	0	0	32	53	6	0
28 ^{1/}	13	-	-	-	-	-	-	-	-	-	-	-
28 ^{1/}	53	-	-	-	-	-	-	-	-	-	-	-
Season total	350											

^{1/} Tooth samples were not collected from 13 and 53 males killed on North and Staraya Artil Rookeries, respectively.

Table A- 3.--Adult male seals counted, by class^{1/} and rookery section, St. Paul Island, 22-24 June 1977.
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	
-----Number-----															
<u>Lukanin</u>															
2	25	29	-	-	-	-	-	-	-	-	-	-	-	-	54
3	28	30	-	-	-	-	-	-	-	-	-	-	-	-	58
5	48	0	-	-	-	-	-	-	-	-	-	-	-	-	48
<u>Kitovi^{2/}</u>															
2	31(14)	4	40	54	30	-	-	-	-	-	-	-	-	-	173
3	31(13)	5	19	31	22	-	-	-	-	-	-	-	-	-	121
5	0(1)	10	0	0	21	-	-	-	-	-	-	-	-	-	32
<u>Reef</u>															
2	50	59	62	44	55	34	70	54	43	41	22	-	-	-	534
3	18	27	28	12	18	24	8	26	18	16	15	-	-	-	210
5	5	6	0	0	287	5	12	72	0	8	0	-	-	-	395
<u>Gorbach</u>															
2	69	52	35	7	27	51	-	-	-	-	-	-	-	-	241
3	35	28	25	8	16	23	-	-	-	-	-	-	-	-	135
5	99	1	9	167	6	2	-	-	-	-	-	-	-	-	284
<u>Ardiguen</u>															
2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	37
3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	40
5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	32
<u>Morjovi^{3/}</u>															
2	41(30)	51	48	59	49	60	-	-	-	-	-	-	-	-	338
3	20(9)	23	15	22	26	20	-	-	-	-	-	-	-	-	135
5	130(29)	6	4	63	4	130	-	-	-	-	-	-	-	-	366
<u>Vostochni</u>															
2	43	25	33	27	9	87	57	62	51	25	32	46	68	42	607
3	13	17	14	14	14	25	24	30	22	15	24	21	44	14	291
5	0	10	0	48	85	0	0	0	0	0	0	60	30	30	263

See footnotes at end of table

Table A- 3.--Adult male seals counted, by class^{1/} and rookery section, St. Paul Island, 22-24 June 1977--Continued.
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	
-----Number-----															
<u>Little Polovina</u>															
2	42	36	-	-	-	-	-	-	-	-	-	-	-	-	78
3	14	20	-	-	-	-	-	-	-	-	-	-	-	-	34
5	0	101	-	-	-	-	-	-	-	-	-	-	-	-	101
<u>Polovina</u>															
2	47	20	-	-	-	-	-	-	-	-	-	-	-	-	67
3	15	11	-	-	-	-	-	-	-	-	-	-	-	-	26
5	165	19	-	-	-	-	-	-	-	-	-	-	-	-	184
<u>Polovina Cliffs</u>															
2	31	39	33	54	49	56	179	-	-	-	-	-	-	-	441
3	18	8	15	21	26	12	40	-	-	-	-	-	-	-	140
5	6	5	0	5	0	69	29	-	-	-	-	-	-	-	114
<u>Tolstoi</u>															
2	52	30	45	14	86	69	66	72	-	-	-	-	-	-	434
3	24	21	31	25	72	44	37	37	-	-	-	-	-	-	291
5	1	0	1	0	7	3	0	250	-	-	-	-	-	-	262
<u>Zapadni Reef</u>															
2	76	31	-	-	-	-	-	-	-	-	-	-	-	-	107
3	37	18	-	-	-	-	-	-	-	-	-	-	-	-	55
5	19	44	-	-	-	-	-	-	-	-	-	-	-	-	63
<u>Little Zapadni</u>															
2	12	32	30	49	45	30	-	-	-	-	-	-	-	-	198
3	15	28	36	26	29	17	-	-	-	-	-	-	-	-	151
5	12	2	0	4	0	104	-	-	-	-	-	-	-	-	122
<u>Zapadni^{4/}</u>															
2	39(0)	63	56	89	63	58	54	11	-	-	-	-	-	-	443
3	21(0)	46	41	36	27	31	26	10	-	-	-	-	-	-	238
5	0(168)	7	7	10	19	1	1	117	-	-	-	-	-	-	330

See footnotes at end of table

Table A- 3.--Adult male seals counted, by class^{1/} and rookery section, St, Paul Island, 22-24 June 1977--Continued
 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	

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

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

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

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

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

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

From 1966 through 1974, the adult male seals were classified into 5 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.

^{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.

2	0	2	0	2	0	88	39	-	-	-	-	-	-	-	139
3	18	9	72	37	36	73	80	-	-	-	-	-	-	-	445
3	37	39	33	24	48	28	739	-	-	-	-	-	-	-	1018
Kitovi Amphitheater															
2	188	19	-	-	-	-	-	-	-	-	-	-	-	-	207
3	72	17	-	-	-	-	-	-	-	-	-	-	-	-	89
3	41	30	-	-	-	-	-	-	-	-	-	-	-	-	71
Sea Lion Neck															
2	0	107	-	-	-	-	-	-	-	-	-	-	-	-	107
3	74	30	-	-	-	-	-	-	-	-	-	-	-	-	104
3	43	26	-	-	-	-	-	-	-	-	-	-	-	-	69
Zapadni Point Reef															
2	1	5	2	4	2	8	1	8	6	10	11	13	73	74	149

Table A-4. --Adult male seals counted, by rookery, Pribilof Islands Alaska, June 1977

Island and rookery	Date	Class of adult male ^{1/}			Total
		2	3	5	
		-----Number-----			
<u>St. Paul Island</u>		<u>June</u>			
Lukanin	24	54	58	48	160
Kitovi	24	173	121	32	326
Reef	23	534	210	395	1,139
Gorbatch	23	241	135	284	660
Ardiguen	23	37	40	32	109
Morjovi	23	338	135	366	839
Vostochni	23	607	291	263	1,161
Little Polovina	22	78	34	101	213
Polovina	22	67	26	184	277
Polovina Cliffs	22	441	140	114	695
Tolstoi	24	434	291	262	987
Zapadni Reef	24	107	55	63	225
Little Zapadni	24	198	151	122	471
Zapadni	24	443	238	330	1,011
Total		3,752	1,925	2,596	8,273
<u>St. George Island</u>		<u>June</u>			
Zapadni ^{2/}	22	82	27	134	243
South	22	120	79	145	344
North	23	295	216	181	692
East Reef	23	61	19	40	120
East Cliffs	23	113	107	220	440
Staraya Artil	23	160	33	121	314
Total		831	481	841	2,153
Total both islands		4,583	2,406	3,437	10,426

^{1/} See Table A-3 or glossary for a description of the classes of adult male seals.

^{2/} Partial count, does not include rookery area below cliffs.

Table A- 5.--Adult male seals counted, by class^{1/} and rookery section, St. Paul Island, 11-18 July 1977.
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	
	----- Number -----														
<u>Lukanin</u>															
2	2	5	-	-	-	-	-	-	-	-	-	-	-	-	7
3	55	72	-	-	-	-	-	-	-	-	-	-	-	-	127
5	68	0	-	-	-	-	-	-	-	-	-	-	-	-	68
<u>Kitovi^{2/}</u>															
2	4(4)	3	5	6	4	-	-	-	-	-	-	-	-	-	26
3	57(34)	13	58	92	65	-	-	-	-	-	-	-	-	-	319
5	0(2)	2	0	0	35	-	-	-	-	-	-	-	-	-	39
<u>Reef</u>															
2	16	12	11	17	6	19	7	9	6	1	6	-	-	-	110
3	71	97	105	56	77	57	72	83	65	57	38	-	-	-	778
5	0	6	0	30	295	0	6	60	2	30	20	-	-	-	449
<u>Gorbatch</u>															
2	12	13	8	2	3	11	-	-	-	-	-	-	-	-	49
3	126	93	73	15	44	89	-	-	-	-	-	-	-	-	440
5	95	0	0	260	10	7	-	-	-	-	-	-	-	-	372
<u>Ardiguen</u>															
2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	13
3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	99
5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	36
<u>Morjovi^{3/}</u>															
2	7(8)	11	10	12	16	10	-	-	-	-	-	-	-	-	74
3	69(42)	76	61	131	72	78	-	-	-	-	-	-	-	-	529
5	74(0)	2	30	0	0	38	-	-	-	-	-	-	-	-	144
<u>Vostochni</u>															
2	5	8	7	6	4	22	23	21	10	4	12	7	15	8	152
3	63	40	55	48	29	129	74	100	75	43	64	80	148	64	1,012
5	6	2	3	40	97	0	0	0	5	12	2	70	44	30	311

See footnotes at end of table.

Table A- 5.--Adult male seals counted, by class^{1/} and rookery section, St. Paul Island, 11-18 July 1977 --Continued.
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	
-----Number-----															
<u>Little Polovina</u>															
2	15	11	-	-	-	-	-	-	-	-	-	-	-	-	26
3	46	58	-	-	-	-	-	-	-	-	-	-	-	-	104
5	10	145	-	-	-	-	-	-	-	-	-	-	-	-	155
<u>Polovina</u>															
2	15	13	-	-	-	-	-	-	-	-	-	-	-	-	28
3	71	39	-	-	-	-	-	-	-	-	-	-	-	-	110
5	159	17	-	-	-	-	-	-	-	-	-	-	-	-	176
<u>Polovina Cliffs</u>															
2	16	10	6	9	11	20	24	-	-	-	-	-	-	-	96
3	59	45	51	75	85	81	191	-	-	-	-	-	-	-	587
5	2	3	2	5	7	36	8	-	-	-	-	-	-	-	63
<u>Tolstoi</u>															
2	7	12	3	1	10	9	8	15	-	-	-	-	-	-	65
3	84	72	95	59	156	132	109	112	-	-	-	-	-	-	819
5	0	0	0	0	8	9	10	250	-	-	-	-	-	-	277
<u>Zapadni Reef</u>															
2	24	5	-	-	-	-	-	-	-	-	-	-	-	-	29
3	117	53	-	-	-	-	-	-	-	-	-	-	-	-	170
5	55	65	-	-	-	-	-	-	-	-	-	-	-	-	120
<u>Little Zapadni</u>															
2	4	7	13	10	4	3	-	-	-	-	-	-	-	-	41
3	40	78	96	85	104	86	-	-	-	-	-	-	-	-	489
5	4	5	3	3	10	175	-	-	-	-	-	-	-	-	200
<u>Zapadni^{4/}</u>															
2	10(0)	9	11	16	15	12	10	0	-	-	-	-	-	-	83
3	87(0)	123	147	158	116	114	100	29	-	-	-	-	-	-	874
5	20(158)	35	12	15	67	17	12	300	-	-	-	-	-	-	636

See footnotes at end of table.

Table A- 6.--Adult male seals counted, by rookery, Pribilof Islands, Alaska, July 1977.

Island and rookery	Date	Class of adult male ^{1/}			Total
		2	3	5	
-----Number-----					
<u>St. Paul Island</u> <u>July</u>					
Lukanin	11	7	127	68	202
Kitovi	11	26	319	39	384
Reef	12	110	778	449	1,337
Gorbach	12	49	440	372	861
Ardiguen	12	13	99	36	148
Morjovi	14	74	529	144	747
Vostochni	13	152	1,012	311	1,475
Little Polovina	12	26	104	155	285
Polovina	13	28	110	176	314
Polovina Cliffs	13	96	587	63	746
Tolstoi	12	65	819	277	1,161
Zapadni Reef	14	29	170	120	319
Little Zapadni	14	41	489	200	730
Zapadni	18	83	874	636	1,593
Total		799	6,457	3,046	10,302
<u>St. George Island</u> <u>July</u>					
Zapadni ^{2/}	12	47	93	108	248
South	12	33	230	64	327
North	13	88	664	173	925
East Reef	14	14	83	24	121
East Cliffs	14	18	275	172	465
Staraya Artil	13	53	265	105	423
Total		253	1,610	646	2,509
Total both islands		1,052	8,067	3,692	12,811

^{1/} See Table A-3 or glossary for a description of the classes of adult male seals.

^{2/} Partial count, does not include rookery area below cliffs.

Table A- 7.--Adult male seals counted, by class, ^{1/} rookery, and year, St. Paul Island,
June 1966-77

Rookery and class of male	Year											
	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977
<u>Lukanin</u>	-----Number-----											
1	13	12	8	4	10	6	2	0	1	-	-	-
2	83	93	62	51	24	22	36	36	66	65	69	54
3	67	53	45	34	59	58	39	26	29	52	45	58
4	0	4	1	2	0	0	1	0	0	-	-	-
5	84	51	15	28	45	54	44	21	40	80	50	48
Total	247	213	131	119	138	140	122	83	136	197	164	160
<u>Kitovi</u>												
1	22	17	31	10	5	8	7	6	3	-	-	-
2	229	211	179	156	69	96	95	86	143	151	174	173
3	193	144	122	76	137	136	96	63	45	120	87	121
4	4	4	0	2	0	0	0	1	5	-	-	-
5	102	91	49	52	45	51	66	69	44	45	68	32
Total	550	467	381	296	256	291	264	225	240	316	329	326
<u>Reef</u>												
1	119	72	57	77	26	33	16	22	7	-	-	-
2	852	752	616	508	401	522	431	375	376	410	454	534
3	333	272	255	222	206	110	142	103	137	230	251	210
4	0	18	42	11	29	4	4	3	11	-	-	-
5	425	241	400	175	313	229	239	236	163	336	488	395
Total	1,729	1,355	1,370	993	975	898	832	739	694	976	1,193	1,139
<u>Gorbach</u>												
1	78	43	32	31	16	8	14	11	11	-	-	-
2	441	407	341	250	205	193	205	183	199	228	228	241
3	180	159	128	146	128	136	88	76	83	147	144	135
4	62	25	25	23	13	5	1	2	12	-	-	-
5	362	236	242	202	155	213	109	120	106	254	272	284
Total	1,123	870	768	652	517	555	417	392	411	629	644	660
<u>Ardiguen</u>												
1	8	6	2	3	1	0	6	3	2	-	-	-
2	40	49	62	59	107	46	44	46	62	45	30	37
3	53	39	42	27	43	24	38	24	31	34	39	40
4	9	0	0	0	0	0	0	0	0	-	-	-
5	50	58	50	64	62	40	47	23	0	27	29	32
Total	160	152	156	153	213	110	135	96	95	106	97	109

^{1/} See footnote at end of table.

Table A- 7. --Adult male seals counted, by class,^{1/} rookery, and year, St. Paul Island,
June 1966-77 --Continued

Rookery and class of male	Year											
	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977
	-----Number-----											
<u>Morjovi</u>												
1	108	41	35	30	22	13	11	0	11	-	-	-
2	452	394	309	236	167	133	129	179	220	225	268	338
3	230	189	228	160	139	124	97	92	89	182	205	135
4	3	73	21	3	5	2	0	2	6	-	-	-
5	464	249	146	191	190	160	91	180	216	292	224	366
Total	1,257	946	739	620	523	432	328	453	542	699	697	839
<u>Vostochni</u>												
1	92	109	67	39	23	17	15	7	17	-	-	-
2	1,019	940	804	605	420	330	373	463	478	508	476	607
3	522	333	462	360	289	254	187	171	181	348	479	291
4	18	147	11	11	1	4	5	3	8	-	-	-
5	542	557	389	306	164	194	187	375	153	125	622	263
Total	2,193	2,086	1,733	1,321	897	799	767	1,019	837	981	1,577	1,161
<u>Little Polovina</u>												
1	12	7	12	5	0	2	4	0	2	-	-	-
2	162	143	107	83	59	88	46	62	75	88	72	78
3	73	51	71	28	43	14	24	14	15	31	34	34
4	29	27	14	11	0	4	1	5	3	-	-	-
5	254	150	75	38	50	17	6	53	52	108	127	101
Total	530	378	279	165	152	125	81	134	147	227	233	213
<u>Polovina</u>												
1	75	27	8	15	3	4	3	3	1	-	-	-
2	168	150	89	89	44	51	35	40	50	54	55	67
3	65	43	68	25	31	4	13	8	19	42	40	26
4	0	25	1	1	2	0	0	7	1	-	-	-
5	253	185	177	43	61	80	41	80	64	170	189	184
Total	561	430	343	173	141	139	92	138	135	266	284	277
<u>Polovina Cliffs</u>												
1	48	38	52	33	15	7	19	2	8	-	-	-
2	494	408	315	295	192	245	186	200	249	262	291	441
3	202	192	256	105	150	49	70	85	75	193	159	140
4	5	68	16	3	7	4	3	3	6	-	-	-
5	81	47	74	65	58	101	67	107	71	97	100	114
Total	830	753	713	501	422	406	345	397	409	552	550	695

^{1/} See footnote at end of table.

Table A- 7.--Adult male seals counted, by class,^{1/} rookery, and year, St. Paul Island,
June 1966-77--Continued

Rookery and class of male	Year											
	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977
	-----Number-----											
<u>Tolstoi</u>												
1	65	80	49	40	25	12	15	33	13	-	-	-
2	622	455	350	411	269	270	273	291	305	269	387	434
3	233	251	309	130	240	198	187	136	124	329	262	291
4	0	24	25	0	0	10	3	2	3	-	-	-
5	131	472	150	133	125	140	96	115	90	508	327	262
Total	1,051	1,282	883	714	659	630	574	577	535	1,106	976	987
<u>Zapadni Reef</u>												
1	13	13	3	3	1	7	0	0	1	-	-	-
2	142	125	72	67	43	63	59	57	79	78	117	107
3	65	52	75	46	43	41	33	27	26	64	43	55
4	0	13	3	1	0	0	3	0	2	-	-	-
5	146	64	59	4	28	38	24	56	34	113	84	63
Total	366	267	212	121	115	149	119	140	142	255	244	225
<u>Little Zapadni</u>												
1	70	42	27	37	15	17	10	6	8	-	-	-
2	339	328	218	219	148	166	154	169	184	176	223	198
3	150	184	234	127	175	119	108	73	83	181	171	151
4	0	28	9	18	2	12	2	0	22	-	-	-
5	133	120	84	61	44	36	45	83	43	136	81	122
Total	692	702	572	462	384	350	319	331	340	493	475	471
<u>Zapadni</u>												
1	149	74	55	51	42	19	18	13	13	-	-	-
2	716	611	508	465	315	296	315	324	329	334	486	443
3	275	277	357	219	251	225	167	164	173	269	212	238
4	0	82	34	10	5	12	7	2	19	-	-	-
5	521	353	300	504	202	414	338	210	245	625	512	330
Total	1,661	1,397	1,254	1,249	815	966	845	713	779	1,228	1,210	1,011
<u>Grand total</u>												
	12,950	11,298	9,534	7,539	6,207	5,990	5,240	5,437	5,442	8,031	8,673	8,273

^{1/} See Table A- 3 or glossary for a description of the classes of adult male seals.

Table A-8.--Harem and idle male seals counted in mid-July, Pribilof Islands, Alaska, 1968-77.

Year	St. Paul Island		St. George Island		Both islands	
	Harem	Idle	Harem	Idle	Harem	Idle
	-----Number-----		-----Number-----		-----Number-----	
1968	<u>1/</u> 6,176	<u>1/</u> 3,100	1,748	1,283	7,924	4,383
1969	<u>2/</u> 5,928	<u>2/</u> 2,535	1,457	677	7,385	3,212
1970	<u>3/</u> 4,945	<u>3/</u> 1,666	1,466	803	6,411	2,469
1971	<u>3/</u> 4,200	<u>3/</u> 1,900	1,235	534	5,435	2,434
1972 ^{4/}	<u>5/</u> 3,738	<u>5/</u> 2,384	1,153	328	4,891	2,712
1973	<u>5/</u> 4,906	<u>5/</u> 2,550	875	375	5,781	2,925
1974	<u>6/</u> 4,563	<u>6/</u> 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

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

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

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

4/ Values for St. Paul Island are 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 are extrapolated from July counts on Zapadni and South Rookeries and counts on Zapadni and South Rookeries and the total count on St. George Island in 1971.

5/ Estimates of the total number of harem and idle males on St. Paul Island were extrapolated from counts on Zapadni, Little Zapadni, Zapadni Reef, and Tolstoi Rookeries in June and July of 1973 and on all rookeries of St. Paul Island in June 1973.

6/ The total number of harem and idle males on St. Paul Island were estimated from counts on Reef, Gorbach, and Ardiguen Rookeries in June and July of 1974 and on all rookeries of St. Paul Island in June 1974.

Table A- 9.--Dead seal pups counted, by rookery section, Pribilof Islands, Alaska, 11-26 August 1977.

Island and rookery	Section														Total
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	
	-----Number-----														
<u>St. Paul Island</u>															
Morjovi	1/299	85	90	147	145	104	-	-	-	-	-	-	-	-	870
Vostochni	79	49	90	89	66	557	207	193	89	46	78	98	277	103	2,021
Little Polovina	69	34	-	-	-	-	-	-	-	-	-	-	-	-	103
Polovina Cliffs	74	75	73	92	93	94	232	-	-	-	-	-	-	-	733
Polovina	99	61	-	-	-	-	-	-	-	-	-	-	-	-	160
Ardiguen ^{2/}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	112
Gorbatch	242	197	175	27	93	126	-	-	-	-	-	-	-	-	860
Reef	109	176	135	113	138	171	220	57	32	66	16	-	-	-	1,233
Kitovi	3/ 94	7	89	69	72	-	-	-	-	-	-	-	-	-	331
Lukanin	109	141	-	-	-	-	-	-	-	-	-	-	-	-	250
Tolstoi	173	188	175	153	403	554	663	982	-	-	-	-	-	-	3,291
Little Zapadni	53	168	229	283	219	181	-	-	-	-	-	-	-	-	1,133
Zapadni Reef	281	146	-	-	-	-	-	-	-	-	-	-	-	-	427
Zapadni	127	459	459	808	258	188	190	70	-	-	-	-	-	-	2,559
Total															14,083
<u>St. George Island</u>															
North	57	69	59	102	19	102	-	-	-	-	-	-	-	-	408
Zapadni ^{4/}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	92
South	37	41	20	-	-	-	-	-	-	-	-	-	-	-	98
East Reef ^{2/}	-	-	-	-	-	-	-	-	-	-	-	-	-	-	60
East Cliffs	58	82	-	-	-	-	-	-	-	-	-	-	-	-	140
Staraya Artil	342	68	-	-	-	-	-	-	-	-	-	-	-	-	410
Total															1,208
Grand total															15,291

1/ Includes 72 dead pups counted on point south of Sea Lion Neck.

2/ No numbered sections.

3/ Includes 23 dead pups counted in Kitovi Amphitheater.

4/ Partial count, does not include rookery study area above cliffs. Counts on rookery's three sections were combined.

Table A-10--Dead seal pups counted,^{1/} by rookery, Pribilof Islands, Alaska, 1967-77.

Island and rookery	1967	1968	1969	1970	1971	1972	1973 ^{2/}	1974 ^{2/}	1975	1976	1977
	-----Number-----										
<u>St. Paul Island</u>											
Morjovi	1,072	2,285	734	1,618	4,773	2,187	-	-	1,765	1,829	870
Vostochni	1,969	4,195	1,711	3,330	8,280	4,701	-	-	3,259	3,826	2,021
Little Polovina	233	509	200	337	1,207	372	-	-	252	316	103
Polovina Cliffs	825	1,616	836	1,636	5,445	1,566	-	-	1,529	1,862	733
Polovina	319	487	327	475	980	345	-	-	419	378	160
Ardiguen	90	118	112	75	373	161	-	111	142	212	112
Gorbatch Reef	874	1,446	823	974	2,405	1,332	-	1,188	1,025	1,341	860
	2,008	3,064	1,365	2,221	4,103	1,686	-	1,580	1,837	2,055	1,233
Kitovi	522	755	652	679	1,854	559	-	-	787	846	331
Lukanin	240	597	460	401	1,224	494	-	-	505	385	250
Tolstoi	2,251	3,315	2,778	3,580	5,147	3,540	3,613	-	4,141	4,241	3,291
Little Zapadni	1,098	1,781	798	1,386	3,223	1,686	1,783	-	1,204	1,977	1,133
Zapadni Reef	380	685	177	308	673	505	661	-	508	638	427
Zapadni	2,195	4,445	2,306	3,561	6,752	3,515	3,851	-	3,252	3,770	2,559
Counted total	14,076	25,298	13,279	20,581	46,439	22,649	9,908	2,879	20,625	23,676	14,083
Estimated oversight 5%	704	1,265	664	1,029	2,322	1,132	495	144	1,031	1,184	704
Total	14,780	26,563	13,943	21,610	48,761	23,781	10,403	3,023	21,656	24,860	14,787
<u>St. George Island</u>											
North	971	1,567	444	866	1,862	1,032	1,153	545	1,230	791	408
Zapadni	578	1,197	260	636	1,058	464	450	474	814	653	190
East	201	824	187	522	638	372	506	334	536	391	200
Staraya Artil	770	1,055	640	1,243	1,662	616	552	^{3/} -	709	454	410
Counted total	2,520	4,643	1,531	3,267	5,220	2,484	2,661	1,353	3,289	2,289	1,208
Estimated oversight 5%	126	232	76	163	261	124	133	68	165	114	60
Total	2,646	4,875	1,607	3,430	5,481	2,608	2,794	1,421	3,454	2,403	1,268
<u>Pribilof Islands</u>											
counted total	16,596	29,941	14,810	23,848	51,659	25,133	12,569	4,232	23,914	25,965	15,291
Estimated oversight 5%	830	1,497	740	1,192	2,583	1,256	628	212	1,196	1,298	764
Total	17,426	31,438	15,550	25,040	54,242	26,389	13,197	4,444	25,110	27,263	16,055

^{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/} Dead pups were not counted.

Table A-11.--Seals marked as pups and recovered at ages 2-5 years,
St. Paul Island, 27 June to 29 July 1977.

Hind flipper mark <u>1</u> /	Age (Years)	Total (Number)	Island of marking
RH1	2	55	St. Paul
LH1	2	18	St. George
RH3	3	760	St. Paul
RH2	4	406	St. Paul
LH2	4	31	St. George
RH1	5	46	St. Paul
LH1	5	6	St. George

1/ Seals marked by clipping cartilagenous tip of the 1st, 2nd,
or 3rd digit from the left or right hind flipper:

[LH1, LH2, LH3] -- LH refers to the left hind flipper;
1, 2, 3 refer to the 1st, 2nd, or 3rd digit,
respectively.

[RH1, RH2, RH3] -- RH refers to the right hind flipper;
1, 2, 3 refer to the 1st, 2nd, or 3rd digit,
respectively.

Table A-12.--Soviet tags recovered in the United States harvest of male fur seals, St. Paul Island, 27 June to 29 July 1977.

Date	Tag number	Age (years)	Sex	Island of tagging	Rookery of recovery
28 July	OM-378	2	M	Medny	Zapadni
14 July	OM-1252	2	M	Medny	Zapadni
27 July	OM-1348	2	M	Medny	Tolstoi-Zapadni Reef
27 July	MB-1506	3	M	Bering	Tolstoi-Zapadni Reef
27 July	MM-1296,MM-1296	3	M	Medny	Tolstoi-Zapadni Reef
21 July	MM-1340	3	M	Medny	Zapadni
5 July	MM-1344	3	M	Medny	Northeast Point
15 July	MM-2374	3	M	Medny	Lukanin-Kitovi
27 July	KB-1604	4	M	Bering	Tolstoi-Zapadni Reef
27 July	KB-1609	4	M	Bering	Tolstoi-Zapadni Reef
15 July	KM-1603	4	M	Medny	Reef
29 July	KM-1605	4	M	Medny	Lukanin-Kitovi

Table A-13. --Seal pups tagged and marked, Pribilof Islands, Alaska, 1966-75

Year	Series	St. Paul Island (Number)	St. George Island	Location of tag	Checkmarks or marks
1966	S 1-2500		2,499	Left front flipper	Tip of left front flipper sliced off
	S 2501-12500	10,000		Right front flipper	Tip of 2d digit on right hind flipper sliced off
	Marked	9,578		Not tagged	Tip of 3d digit on right hind flipper sliced off
	Marked		2,503	---do.---	Tip of 2d digit on left hind flipper sliced off
1967	T 9-2500		2,492	Right front flipper	Tip of right front flipper sliced off
	T 5001-15000	9,980		-----do.-----	Do.
1968	U 1-2500		2,475	Left front flipper	"V" notch near tip left front flipper
	U 2501-12500	9,200		-----do.-----	Do.
1969	Marked	20,000		Not tagged	Tip of 1st digit (big toe) on left hind flipper sliced off
	Marked		5,000	---do.---	Tip of 1st digit (big toe) on right hind flipper sliced off
1970	Marked	20,030		Not tagged	Tip of 2d digit on left hind flipper sliced off
	Marked		5,000	---do.---	Tip of 2d digit on right hind flipper sliced off
1971	Marked	19,995		Not tagged	Tip of 3d digit on left hind flipper sliced off
	Marked		5,000	---do.---	Tip of 3d digit on right hind flipper sliced off
1972	Marked	20,019		Not tagged	Tip of 1st digit (big toe) on right hind flipper sliced off
	Marked		5,000	---do.---	Tip of 1st digit (big toe) on left hind flipper sliced off
1973	Marked	20,000		Not tagged	Tip of 2d digit on right hind flipper sliced off
	Marked		5,000	---do.---	Tip of 2d digit on left hind flipper sliced off
1974 ^{1/}	Marked	20,000		Not tagged	Tip of 3d digit on right hind flipper sliced off
1975	Marked	10,000		Not tagged	Tip of 1st digit (big toe) on right hind flipper sliced off
	Marked		5,000	Not tagged	Tip of 1st digit (big toe) on left hind flipper sliced off

1/ Seal pups were not marked on St. George Island.

Table A-14 .--Seal pups marked by freeze marking, St. Paul Island, 1966-76

Year	Rookery	Marks or symbols used	Seals effectively marked (Number)	Location of marks
1966	Zapadni Reef	S or ∞ ^{1/}	40 ($\sigma\sigma$ and ♀♀)	Dorsal surface of front flipper (manus)
1966	Zapadni Reef	---do.---	40 ($\sigma\sigma$ and ♀♀)	Dorsal surface of forearm (antebrachium)
1967	Zapadni Reef	T, H, L, or H ^{2/}	115 ($\sigma\sigma$ and ♀♀) ^{3/}	Do.
1969	Reef	Bar (-) and angle (<) numbering system ^{4/}	192 $\sigma\sigma$ and 183 ♀♀	Dorsal surface of left forearm (antebrachium) and head
1969	Gorbatch	-----do.-----	200 $\sigma\sigma$ and 200 ♀♀	Do.
1970	Reef	-----do.-----	245 $\sigma\sigma$ and 189 ♀♀	Dorsal surface of right forearm (antebrachium) and head
1970	Gorbatch	-----do.-----	246 $\sigma\sigma$ and 218 ♀♀	Do.
1973	Reef	-----do.-----	9 ($\sigma\sigma$ and ♀♀)	Dorsal surface of left front flipper (manus)
1973	Reef	-----do.-----	9 ($\sigma\sigma$ and ♀♀)	Dorsal surface of right front flipper (manus)
1974	Zapadni Reef	-----do.-----	90 ($\sigma\sigma$ and ♀♀)	Dorsal surface of left front flipper (manus) and chest
1975	Zapadni Reef	Solid Circle (●)	40 ($\sigma\sigma$ and ♀♀)	Dorsal surface of left and right front flippers (manus) and chest
1976	Kitovi	Bar (-) and angle (<) numbering system ^{4/}	40 ($\sigma\sigma$ and ♀♀)	Dorsal surface of left and right shoulder

^{1/} For photographs of branded animals, see Fur Seal Investigations, 1966, Marine Mammal Biological Laboratory, Seattle, Wash.

^{2/} For photograph of a branded animal, see Fur Seal Investigations, 1967, Marine Mammal Biological Laboratory, Seattle, Wash.

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

^{4/} For system of identification symbols used, see Fur Seal Investigations, 1969, Marine Mammal Biological Laboratory, Seattle, Wash.

Table A-15--Northern fur seals tagged as pups on the Pribilof Islands (St. Paul and St. George), Commander Islands (Bering and Medney), and Robben Island, and dates first observed on San Miguel Island, California, 1969-77

Tag number	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	Sex	Island of origin	Date tagged
E-2818	21 July	---	11 Aug.	22 July	29 June	6 July	---	4 Aug.	17 July	---	F	Bering	1960
T-19022	---	---	---	29 Oct.	23 July	---	---	---	---	---	F	Medny	1965
N-41314	21 July	---	---	---	24 Aug.	---	---	---	22 July	---	F	St. Paul	1961
N-16387	---	25 July	14 July	23 June	27 July	---	---	9 Aug.	---	---	F	St. Paul	1961
N-19851	---	12 Sept.	12 Aug. ^{1/}	24 July	29 June	21 July	---	---	---	---	F	St. Paul	1961
N-25437	---	25 July	2 Aug.	9 July	26 July	4 Aug.	---	---	---	---	F	St. Paul	1961
M-53901	---	31 July	23 July	14 June	---	---	---	---	---	---	F	St. Paul	1960
O-26056	---	25 July	18 July	29 July	3 Sept. ^{2/}	22 July	---	28 July	29 July	---	F	St. Paul	1962
R-8179	---	1 Oct.	---	---	---	---	---	---	---	---	F	St. Paul	1965
J-4937	---	18 Aug. ^{3/}	14 Aug.	14 June	24 Aug.	---	---	---	---	---	F	St. George	1957
N-29437	---	---	20 July	---	---	---	---	---	---	---	F	St. Paul	1961
N-48079	---	---	11 Aug.	---	---	---	---	---	---	30 July	F	St. Paul	1961
N-2114	---	---	---	14 June	31 July	4 Aug.	---	27 July	24 July	---	F	St. George	1961
N-31432	---	---	---	7 July	12 July	3 July	---	26 Aug.	---	---	F	St. Paul	1961
Q-20975	---	---	---	10 July	---	---	---	---	---	---	F	St. Paul	1964
R-8844	---	---	---	8 Aug.	27 Aug.	19 July	---	27 July	18 July	---	F	St. Paul	1965
T-24	---	---	---	7 Aug.	12 July	25 July	---	---	---	---	F	St. George	1967
T-9697	---	---	---	19 Aug.	2 Aug.	---	---	11 Aug.	7 Sept.	---	F	St. Paul	1967
T-12129	---	---	---	25 Aug.	26 July	21 July	---	---	---	---	F	St. Paul	1967
U-6971	---	---	---	21 Aug.	26 July	10 July	---	31 July	2 Aug.	---	F	St. Paul	1968
O-48131	---	---	---	---	3 Sept.	---	---	---	---	---	F	St. Paul	1962
T-6003	---	---	---	---	5 Sept.	10 July	12 Aug.	---	---	---	F	Robben	1965
T-8572	---	---	---	---	23 July	23 July	---	---	---	21 Aug	F	St. Paul	1967
Y-7104	---	---	---	---	30 Aug.	13 July	10 June	3 July	11 July	6 Aug	F	Robben	1966
BB-1364	---	---	---	---	7 Sept.	---	9 Aug.	---	---	8 Sept	F	Bering	1969
AM-8302	---	---	---	---	---	---	14 Aug.	28 July	18 July	---	F	Medny	1968
U-6974 ^{4/}	---	---	---	---	---	---	5 July	---	---	7 Sept	F	St. George	1968
U-579	---	---	---	---	---	---	1 Sept.	---	---	---	F	St. George	1968
CM-3667	---	---	---	---	---	---	---	3 July	---	---	F	Medny	1970
ET-593	---	---	---	---	---	---	---	17 July	---	---	F	Robben	1971
H-2314	---	---	---	---	---	---	---	20 Aug.	---	---	F	Robben	1963
T-19022	---	---	---	---	---	---	---	20 Aug.	---	---	F	Medny	1965
DT-TINRO ^{5/}	---	---	---	---	---	---	---	14 Aug.	21 July	---	F	---	---
I-3698 ^{6/}	---	---	---	---	---	---	---	---	5 Sept.	---	F	St. Paul	1956

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 #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-16--Northern fur seals checkmarked as pups on the Pribilof Islands (St. Paul and St. George) and the dates they were observed on San Miguel Island, California, 1977.^{1/}

Checkmark	Date observed	% mange	Whisker color	Island of origin	Date marked
Tip of 2nd digit on rt. hind flipper sliced off	25 Aug	5	Black & white	St. Paul	1973
-do-	26 Aug	None	-do-	-do-	-do-
Tip of 1st digit on left hind flipper slice off	25 Aug	10	-do-	St. George	1972
Tip of 1st digit on rt. hind flipper sliced off	26 Aug	40	-do-	St. Paul	-do-
-do-	-do-	15	-do-	-do-	-do-
Tip of 1st digit on left hind flipper sliced off	25 Aug	80	White	-do-	1971
Tip of 2nd digit on rt. hind flipper sliced off	-do-	80	-do-	St. George	1970
Tip of 2nd digit on left hind flipper sliced off	26 Aug	20	-do-	St. Paul	1970
-do-	-do-	None	-do-	-do-	-do-
Tip of 1st left digit on left hind flipper sliced off	-do-	10	-do-	-do-	1969
-do-	-do-	None	-do-	-do-	-do-
Tip of 1st rt. digit on rt. hind flipper sliced off	30 Aug	None	-do-	St. George	1969

^{1/} In addition to checkmarks, female ages were determined by whisker color and relative body size. Individuals were distinguished by their relative amount of "mange".

Table A-17--Northern fur seals tagged on San Miguel Island in 1968 and the dates first observed, 1969-77.^{1/}

Tag number	Tag placement	Date observed 1969	Date observed 1970	Date observed 1971	Date observed 1972	Date observed 1973	Date observed 1974	Date observed 1975	Date observed 1976	Date observed 1977
-3793	R	---	21 ---	13 July	11 July	---	---	---	---	12 Aug.
-3789	R	---	21 July	24 July	23 July	31 July	---	---	---	---
UC-3924	L	15 Aug.	31 July	9 July	18 Aug.	3 Aug.	---	---	---	---
-3927	R	31 July	23 July	9 July	26 July	21 July	---	---	---	---
-3932	R	16 Aug.	29 July	2 July	---	---	27 July	8 Aug.	10 July	18 Aug.
-3933	L	17 Aug.	12 Aug.	2 July	13 July	---	---	---	20 July	---
-3934	L	---	---	---	---	---	---	---	29 Aug.	---
-3936	L	---	---	10 Aug.	---	---	28 July	---	---	---
-3937	R	---	---	24 July	31 July	22 July	19 Aug.	---	10 July	18 Aug.
-3938	L	16 Aug.	10 Aug.	8 June	26 Aug.	---	---	---	---	---
-3939	R	31 July	17 Aug.	2 July	29 June	---	---	---	---	---
-3940	L	31 July	29 July	---	---	---	---	---	---	---
-3941	R	31 July	14 Aug.	---	---	---	---	---	---	---
-3942	R	31 July	17 July	22 July	1 Sept.	---	---	20 Aug.	25 Aug.	18 Aug.
-3943	L	31 July	20 July	22 July	14 July	---	---	---	29 July	---
-3944	R	15 Aug.	17 July	2 July	---	18 July	---	31 Aug.	5 Aug.	---
-3945	L	14 Aug.	20 July	14 June	27 June	---	15 July	9 July	14 July	12 Aug.
-3951	L	---	21 July	22 July	12 July	---	---	---	---	---
Missing	R									
UC-3955	R	25 July	31 July	2 July	15 July	---	---	---	---	---
-3956	L	---	4 Aug.	2 July	---	---	---	---	---	---
-3957 ^{2/}	R	7 Aug.	---	---	---	---	---	---	---	---
-3959	R	25 July	---	---	---	---	---	---	---	---
-3961	R	12 Sept.	---	---	---	---	---	---	---	---
-3963	R	---	---	---	---	---	---	---	2 Aug.	---
-3964	L	15 Aug.	2 Aug.	21 July	12 July	1 Aug.	---	---	---	---
-3965	R	12 Aug.	24 Aug.	26 July	10 Aug.	---	---	---	---	---
-3968	R	---	18 July	6 July	---	---	---	---	---	---
-3971	L	---	21 July	7 July	---	---	---	---	---	---
-3972	L	1 Oct.	16 Aug.	22 July	---	---	---	---	---	---
-3973	R	31 July	1 Sept.	30 July	5 Aug.	---	---	---	---	---
-3974	L	---	---	---	---	---	15 July	8 Aug.	---	22 Aug.

^{1/} A total of 36 pups (3700 series) and 33 adult females (3900) series were tagged on 20 July 1968.^{2/} See footnote at end of table.

Table A-17 --Northern fur seals tagged on San Miguel Island in 1968 and the dates first observed, 1969-77--Continued.

Tag number	Tag placement	Date observed 1969	Date observed 1970	Date observed 1971	Date observed 1972	Date observed 1973	Date observed 1974	Date observed 1975	Date observed 1976	Date observed 1977
-3975	R	---	---	---	---	5 Aug.	---	---	4 Aug.	---
-3976	R	2 Sept.	---	---	---	---	---	11 Aug.	---	---
-3977	L	31 July	---	---	---	---	---	---	---	---
-3978	L	---	22 July	---	---	---	---	---	---	---
UC-3980	R	---	31 July	10 July	30 Aug.	---	15 July	---	24 July	---
-3981	L	1 Aug.	9 July	5 July	11 July	---	---	---	---	---
-3982	L	31 July	31 July	7 July	27 July	4 Aug.	---	---	---	---
-3984	L	---	20 Aug.	9 July	---	---	---	---	18 July	---
-3985	L	31 July	---	23 July	---	---	---	---	---	---
-3986	R	17 Aug.	---	17 July	---	---	---	---	---	---
-3987	L	---	---	6 July	14 July	2 Aug.	---	---	---	---
-3988	R	---	10 Aug.	10 July	---	---	---	---	---	---
-3989	L	16 Aug.	9 July	5 July	27 July	11 June	10 Aug.	7 Aug.	---	---
-3990	R	10 Aug.	8 July	9 July	27 June	11 July	7 Sept.	---	---	---
-3991	R	7 Aug.	20 July	28 July	---	---	---	---	---	---
-3992	L	---	20 July	27 July	12 July	4 Aug.	---	28 July	---	21 Aug.
-3993	R	16 Aug.	11 Sept.	4 July	---	---	---	21 Aug.	10 July	---
-3994	L	---	17 Aug.	4 July	---	---	27 July	17 July	6 Sept.	---
-3995	L	---	16 Aug.	---	11 Aug.	---	11 Aug.	17 July	---	---
-3996	R	---	21 July	---	13 Aug.	---	28 July	---	---	---
-3997	L	---	---	24 July	---	---	---	26 July	6 Sept.	---
-3998	R	---	---	21 July	---	4 July	---	10 July	---	---
-3999	R	---	---	15 Aug.	---	---	13 Aug.	---	---	---
-4000	L	---	---	3 Aug.	---	---	17 Aug.	---	---	---

1/ A total of 36 pups (3700 series) and 33 adult females (3900) series were tagged on 20 July 1968,

2/ Left flipper injured, not tagged.

Table A-18--Adult female northern fur seals tagged at Adams Cove, San Miguel Island, on 9 October 1975 and the dates first observed in 1976 and 1977.^{1/}

Tag number	Date first observed	
	1976	1977
SMI 201	23 Aug.	-
202		
203		21 Sept.
204		
205		
206	-	-
207		
208	-	-
209		
210	-	-
211	12 Aug.	-
212		
213	-	-
214		
215	17 July	8 Sept.
216		
217	12 July	4 Sept.
218		
219	11 July	-
220		
221		
222	-	-
223	-	4 Sept.
224		
225	Tag lost in sand of Arroyo west of Mallo Roses, Adams Cove	
226	11 July	18 Aug.
227		
228	25 Aug.	-
229		
230		
231	-	-
232	-	18 Aug.
233		
234	-	-
235		
236	22 Aug.	-
237		

Table A-18.--Adult female northern fur seals tagged at Adams Cove, San Miguel Island, on 9 October 1975 and the dates first observed in 1976 and 1977.^{1/} (Continued)

Tag number	Date first observed	
	1976	1977
SMI 238	2 Aug.	6 Aug.
239		
240	-	-
241		
242	-	12 Aug.
243		
244	12 July	18 Aug.
245		
246	-	20 Aug.
247		
248	11 July	-
249		
250	-	20 Aug.
251		
252	-	19 Aug.
253		
254		
255	-	-
256		
257	-	-
258		
259	-	-
260		
261	-	-
262	-	10 July
263		
264	10 July	18 Aug.
265		
266	26 July	12 Aug.
267		
268	29 July	-
269		
270	29 July	12 Aug.
271		
272	23 July	20 Aug.
273		
274	5 Sept.	-
275		

Table A-18.--Adult female northern fur seals tagged at Adams Cove, San Miguel Island, on 9 October 1975 and the dates first observed in 1976 and 1977.^{1/} (Continued)

Tag number	Date first observed	
	1976	1977
SMI 276	21 Aug.	3 Sept.
277	Tag destroyed	
278		
279	5 Aug.	-
280		
281	23 July	4 Sept.
282		
283	24 July	12 Aug.
284		
285	25 Aug.	-
286		
287	-	-
288		
289	-	30 July
290		
291	-	-
292		
293	10 Aug.	-
294		
295	22 July	-
296		
297	29 Aug.	-
298		
299	8 Aug.	30 July
300		
301	21 Aug.	-
302		

^{1/} Fifty adult females were tagged.

Table A-19--Northern fur seals tagged as pups on 7 and 8 October 1975 at Adams Cove, San Miguel Island, California, and date first observed in subsequent years at Adams Cove₁/.

Tag number	Sex	Date first observed, 1977
SMI ² / ₁	M	6 Aug
-do-	F	12 Aug
SMI41	F	18 Aug
Tag lost	M	20 Aug
SMI ² / ₁	F	20 Aug
-do-	M	26 Aug
-do-	F	30 Aug
-do-	F	-do-
-do-	F	-do-
SMI75	F	2 Sept
SMI ² / ₁	F	3 Sept
-do-	F	-do-

1/ One hundred pups were tagged. None were seen in 1976; 1977 represents the first observed of these marked animals.

2/ Tag numbers could not be determined with current observational techniques, Animals were recognized by prefix SMI and checkmark location.

Table A-20.--Northern fur seal pups tagged in
Adams Cove, San Miguel Island, California, on 15 September 1977.

Tag number	Flipper tagged	Sex	Weight (kg.)	Checkmark	Remarks
SMI 901	R	M	12.5	LHD5	
902	L	F	11.5	"	
903	L	F	11.0	"	
904	L	F	9.0	"	
905	L	F	13.0	"	
906	R	M	12.5	"	
907	L	F	6.5	"	
908	L	F	10.0	"	
909	L	F	9.0	"	
910	L	F	9.5	"	
911	L	F	11.0	"	
912	L	F	10.0	"	
913	L	F	8.0	"	
914	R	M	12.0	"	
915	R	M	11.5	"	
916	R	M	11.0	"	
917	L	F	10.0	"	
918	R	M	13.5	"	
919	R	M	13.5	"	
920	L	F	11.5	"	
921	L	F	10.5	"	
922	L	F	10.0	"	
923	L	F	12.0	"	
924	L	F	11.0	"	
925	R	M	9.5	"	
926	L	F	7.5	"	
927	R	M	11.5	"	
928	L	F	8.0	"	
929	L	F	10.0	"	
930	L	F	7.0	"	
931	R	M	14.0	"	

Table A-20.--Northern Fur Seal Pups tagged in
Adams Cove, San Miguel Island, California, on 15 September 1977.
(Continued)

Tag number	Flipper tagged	Sex	Weight (kg.)	Checkmark	Remarks
SMI 932	L	F	8.0	LHD5	
933	L	F	8.5	"	
934	R	M	8.0	"	
935	L	F	11.5	"	
936	L	F	10.0	"	
937	L	F	8.0	"	
938	R	M	14.0	"	
939	R	M	11.5	"	
940	R	M	9.5	"	
941	L	F	8.5	"	
942	R	M	8.0	"	
943	L	F	13.5	"	
944	L	F	8.5	"	
945	R	M	13.0	"	
946	R	M	10.5	"	
947	L	F	8.5	"	
948	L	F	9.0	"	
949	R	M	12.5	"	
950	L	F	10.0	"	
951	L	F	7.0	"	
952	L	F	9.5	"	
953	L	F	10.0	"	
954	R	M	12.0	"	
955	R	M	13.0	"	
956	R	M	14.0	"	
957	L	F	10.5	"	
958	L	F	10.0	"	
959	L	F	11.5	"	
960	Tag destroyed				
961	L	F	9.0	"	
962	L	F	10.5	"	
963	L	F	14.0	"	

Table A-20.--Northern fur seal pups tagged in
Adams Cove, San Miguel Island, California, on 15 September 1977.
(continued)

Tag number	Flipper tagged	Sex	Weight (kg.)	Checkmark	Remarks
SMI 964	R	M	5.0	LHD5	
965	L	F	10.5	"	
966	R	M	11.0	"	
967	R	M	14.0	"	
968	L	F	11.5	"	
969	R	M	11.0	"	
970	R	M	11.5	"	
971	R	M	12.0	"	
972	L	F	13.0	"	
973	L	F	13.5	"	
974	R	M	15.0	"	
975	L	F	14.0	"	
976	R	M	13.0	"	
977	L	F	9.0	"	
978	L	F	9.5	"	
979	R	M	12.5	"	
980	R	M	14.5	"	
981	Tag destroyed				
982	R	M	12.5	"	
983	L	F	11.5	"	
984	L	F	10.5	"	
985	L	F	9.5	"	
986	R	M	9.5	"	
987	R	M	10.0	"	
988	R	M	10.0	"	
989	L	F	8.0	"	
990	R	M	8.0	"	Clinched over top
991	R	M	10.0	"	
992	R	M	10.0	"	
993	R	M	12.0	"	
994	L	F	7.0	"	
995	L	F	14.0	"	

Table A-20.--Northern fur seal pups tagged in
Adams Cove, San Miguel Island, California on 15 September 1977.
(Continued)

Tag number	Flipper tagged	Sex	Weight (kg.)	Checkmark	Remarks
SMI 996	R	M	7.0	LHD5	
997	L	F	9.0	"	
998	R	M	12.0	"	
999	R	M	11.5	"	
1000	L	F	8.5	"	
SMI 678	L	F	10.0	"	
679	R	M	9.5	"	

Table A-21.--Northern fur seal pups tagged on
Castle Rock adjacent to San Miguel, California, on 14 September
1977.

Tag number	Flipper tagged	Sex	Weight (kg.)	Checkmark	Remarks
SMI 801	L	F	11.0	LHD5	
802	L	F	9.5	"	
803	L	F	9.5	"	
804	R	M	9.5	"	
805	R	M	14.0	"	
806	L	F	11.0	"	
807	Tag destroyed				
808	R	M	13.0	"	
809	R	M	10.0	"	
810	R	M	11.0	"	
811	L	F	10.5	"	
812	R	M	13.0	"	
813	R	M	10.0	"	
814	R	M	10.5	"	
815	L	F	9.0	"	
816	L	F	9.5	"	
817	L	F	11.5	"	
818	L	F	10.0	"	
819	R	M	11.0	"	
820	R	M	9.5	"	
821	R	M	10.5	"	
822	R	M	12.0	"	
823	R	M	10.5	"	
824	L	F	11.0	"	
825	R	M	10.5	"	
826	L	F	7.0	"	
827	L	F	9.5	"	
828	R	M	7.5	"	
829	L	F	11.5	"	
830	L	F	10.0	"	
831	L	F	9.5	"	

Table A-21.--Northern fur seal pups tagged on
Castle Rock adjacent to San Miguel Island, California, on 14 September
1977.
(Continued)

Tag number	Flipper tagged	Sex	Weight (kg.)	Checkmark	Remarks
SMI 832	Tag destroyed				
833	R	M	11.5	LHD5	
834	R	M	10.5	"	
835	R	M	7.5	"	
836	L	F	9.5	"	
837	R	M	10.0	"	
838	R	M	9.5	"	
839	L	F	9.5	"	
840	L	F	10.0	"	
841	L	F	9.5	"	
842	L	F	11.5	"	
843	R	M	10.0	"	
844	L	F	6.5	"	
845	R	M	7.5	"	
846	R	M	11.0	"	
847	L	F	9.0	"	
848	R	M	11.0	"	
849	L	F	8.5	"	
850	L	F	8.5	"	
851	L	F	9.5	"	
852	L	F	8.0	"	
853	R	M	9.5	"	
854	L	F	10.0	"	
855	L	F	12.0	"	
856	R	M	10.5	"	
857	L	F	8.0	"	
858	R	M	12.0	"	
859	R	M	11.5	"	
860	R	M	10.5	RHD5	
861	L	F	9.5	LHD5	
862	L	F	12.5	"	
863	L	F	8.5	"	

Table A-21.--Northern fur seal pups tagged on
Castle Rock adjacent to San Miguel Island, California, on 14 September
1977.
(Continued)

Tag number	Flipper tagged	Sex	Weight (kg.)	Checkmark	Remarks
SMI 864	R	M	11.0	LHD5	
865	L	F	6.0	"	
866	L	F	10.5	"	
867	R	M	11.5	"	
868	R	M	10.5	"	
869	L	F	10.5	"	
870	R	M	13.0	"	
871	L	F	9.5	"	
872	L	F	8.0	"	
873	R	M	12.5	"	
874	R	M	8.5	"	
875	R	M	10.0	"	
876	L	F	9.5	"	
877	R	M	8.5	"	
878	L	F	6.5	"	
879	L	F	8.5	"	
880	L	F	9.5	"	
881	R	M	10.0	"	
882	L	F	9.5	"	
883	L	F	11.5	"	
884	L	F	10.0	"	
885	R	M	8.0	"	
886	R	M	10.5	"	
887	L	F	9.0	"	
888	L	F	8.0	"	
889	R	M	9.0	"	
890	R	M	11.0	"	
891	L	F	8.5	"	
892	L	F	9.5	"	
893	R	M	12.5	"	
894	L	F	11.5	"	
895	R	M	9.5	"	

Table A-21.--Northern fur seal pups tagged on
 Castle Rock adjacent to San Miguel Island, California on 14 September
 1977.
 (Continued)

Tag number	Flipper tagged	Sex	Weight (kg.)	Checkmark	Remarks
SMI 896	R	M	9.0	LHD5	
897	L	F	8.0	"	
898	R	M	11.0	"	
899	L	F	6.5	"	
900	R	M	12.0	"	
SMI 676	R	M	10.5	"	
677	L	F	10.0	"	

Table A-22. Frequency Distribution by Age and Sex of Fur Seals Taken at Sea from 1958 to 1974.
 Joint U.S.A./Canada Pelagic Data (Combined Years Summary)

Area	Age (years)																										10+ ^{1/}	UN ^{2/}	Total				
	Pup	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25				26			
CALIFORNIA																																	
JANUARY	-	-	2	2	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5
MALE	-	1	2	28	30	26	25	52	67	50	55	40	34	41	34	47	21	14	12	5	2	2	1	2	-	-	-	-	-	-	2	593	
FEMALE	-	5	6	57	86	110	110	140	136	111	109	103	82	59	71	68	59	30	17	15	3	3	3	-	-	-	1	-	24	1408			
FEBRUARY	-	-	1	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3		
MALE	-	5	6	57	86	110	110	140	136	111	109	103	82	59	71	68	59	30	17	15	3	3	3	-	-	-	1	-	24	1408			
FEMALE	-	5	6	57	86	110	110	140	136	111	109	103	82	59	71	68	59	30	17	15	3	3	3	-	-	-	1	-	24	1408			
MARCH	-	2	1	4	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	10		
MALE	-	3	20	39	82	88	73	73	66	44	51	48	45	35	36	29	24	19	11	5	3	4	1	-	-	-	-	-	9	808			
FEMALE	-	3	20	39	82	88	73	73	66	44	51	48	45	35	36	29	24	19	11	5	3	4	1	-	-	-	-	-	9	808			
APRIL	-	4	2	7	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	16		
MALE	-	2	13	15	31	30	30	20	29	16	11	25	18	12	19	18	12	9	6	4	5	-	-	-	1	-	-	-	4	330			
FEMALE	-	2	13	15	31	30	30	20	29	16	11	25	18	12	19	18	12	9	6	4	5	-	-	-	1	-	-	-	4	330			
MAY	-	6	4	5	3	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	19		
MALE	-	11	16	34	37	24	22	11	16	10	16	17	22	7	15	14	12	16	10	4	3	1	-	2	-	-	-	-	1	321			
FEMALE	-	11	16	34	37	24	22	11	16	10	16	17	22	7	15	14	12	16	10	4	3	1	-	2	-	-	-	-	1	321			
JUNE	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3		
MALE	-	-	1	17	20	6	7	5	5	7	3	4	2	4	1	4	3	1	3	-	-	-	-	-	-	-	-	-	-	-	93		
FEMALE	-	-	1	17	20	6	7	5	5	7	3	4	2	4	1	4	3	1	3	-	-	-	-	-	-	-	-	-	-	-	93		
DECEMBER	-	-	-	-	1	-	-	1	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	3		
FEMALE	-	-	-	-	1	-	-	1	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	3		
COMBINED MONTHS	-	15	10	20	10	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	56		
MALE	-	25	58	190	287	284	267	275	343	238	245	237	203	158	176	180	132	89	59	33	16	10	5	4	1	-	1	-	40	3556			
FEMALE	-	25	58	190	287	284	267	275	343	238	245	237	203	158	176	180	132	89	59	33	16	10	5	4	1	-	1	-	40	3556			
TOTAL	-	40	68	210	297	285	267	275	343	238	245	237	203	158	176	180	132	89	59	33	16	10	5	4	1	-	1	-	40	3612			

^{1/} seals 10 years of age or older

^{2/} age unknown

Table A-22. Frequency Distribution by Age and Sex of Fur Seals Taken at Sea from 1958 to 1974.
 Joint U.S.A./Canada Pelagic Data (Combined Years Summary) -- Continued

Area	Age (years)																										10+ ^{1/}	UN ^{2/}	Total		
	Pup	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25				26	
GULF OF ALASKA																															
FEBRUARY																															
MALE	-	12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	12		
FEMALE	-	10	-	-	1	1	-	-	-	-	4	1	7	3	7	4	5	4	3	-	1	-	-	-	-	-	-	-	51		
MARCH																															
MALE	-	26	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	28		
FEMALE	-	12	1	-	1	-	1	5	4	6	12	14	17	42	36	26	35	28	13	14	2	4	1	-	-	-	-	-	277		
APRIL																															
MALE	-	5	6	13	4	3	4	6	8	3	3	3	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	59		
FEMALE	-	4	-	6	4	3	5	9	20	28	31	37	35	33	23	24	5	12	2	1	-	1	-	-	-	-	-	-	287		
MAY																															
MALE	-	9	13	57	30	4	2	11	11	6	2	2	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	153		
FEMALE	-	2	3	13	32	38	49	63	94	74	87	95	101	78	71	47	38	25	12	12	6	2	1	-	1	-	-	-	953		
JUNE																															
MALE	-	-	23	55	38	7	2	2	-	1	2	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	131		
FEMALE	-	-	4	21	61	56	61	58	56	66	56	38	43	33	31	28	27	10	8	5	3	1	1	1	1	-	1	-	677		
JULY																															
MALE	-	1	6	10	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	18		
FEMALE	-	2	2	21	24	12	7	1	2	-	2	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	74		
AUGUST																															
FEMALE	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1		
COMBINED MONTHS																															
MALE	-	53	48	137	73	14	8	19	19	10	7	6	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	5	401	
FEMALE	-	30	10	61	123	110	123	136	176	174	192	185	204	191	168	129	110	79	38	32	11	8	3	1	1	1	1	-	1	23	2320
TOTAL	-	83	58	198	196	124	131	155	295	184	199	191	204	192	169	129	110	79	38	32	11	8	3	1	1	1	1	-	1	28	2721

^{1/} seals 10 years of age or older

^{2/} age unknown

Table A-22. Frequency Distribution by Age and Sex of Fur Seals Taken at Sea from 1958 to 1974.
 Joint U.S.A./Canada Pelagic Data (Combined Years Summary) -- Continued

Area	Age (years)																										10+ ^{1/}	UN ^{2/}	Total
	Pup	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25			
WESTERN ALASKA																													
MAY																													
MALE	-	-	-	1	-	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
FEMALE	-	-	-	-	2	-	1	2	3	1	-	-	2	2	1	1	2	-	-	-	1	-	-	-	-	-	-	-	
JUNE																													
MALE	-	3	7	39	9	9	2	6	-	4	3	1	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-		
FEMALE	-	-	-	17	35	31	35	51	63	55	43	48	41	27	25	18	17	15	11	3	1	-	-	-	-	-	-		
JULY																													
MALE	-	-	4	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
FEMALE	-	-	1	5	11	4	6	4	3	-	1	-	1	1	3	2	2	2	-	-	-	-	-	-	-	-	-		
AUGUST																													
MALE	-	1	4	1	-	-	-	-	-	-	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
FEMALE	-	1	13	26	17	7	1	5	1	1	1	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1		
SEPTEMBER																													
MALE	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
FEMALE	-	-	6	5	6	2	-	-	-	1	3	-	2	1	1	-	-	2	1	-	1	-	-	-	-	-	-		
OCTOBER																													
FEMALE	-	-	-	1	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
COMBINED MONTHS																													
MALE	-	4	17	45	9	10	2	7	-	4	4	1	1	2	-	-	-	-	-	-	-	-	-	-	-	-	-		
FEMALE	-	1	20	54	74	44	43	62	70	58	47	50	48	31	30	22	21	20	12	3	3	-	-	-	-	-	-		
TOTAL	-	5	37	99	83	54	45	69	70	62	51	51	49	33	30	22	21	20	12	3	3	-	-	-	-	-	-		

83

^{1/} seals 10 years of age or older

^{2/} age unknown

1958	3	14	40	33	13	4	8	2	2	1	4	3	3	3	7	7	7	-	-	-	-	-	-	-	-	-	-
1959	3	1	44	100	120	132	113	132	174	88	81	12	88	80	27	43	21	31	15	8	4	3	3	-	-	-	-
1960	3	10	82	60	78	8	22	4	7	4	7	3	-	-	7	-	-	-	-	-	-	-	-	-	-	-	-
1961	-	-	3	8	17	8	15	8	72	8	77	1	1	1	9	3	2	1	3	3	-	-	-	-	-	-	-
1962	-	-	2	2	1	3	7	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1963	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Year	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
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TABLE A-22. Frequency Distribution by Age and Sex of Fur Seals Taken at Sea from 1958 to 1974.
 Joint U.S.A./Canada Pelagic Data (Combined Years Summary) -- Continued

Table A-23. Frequency Distribution by Age and Sex of Fur Seals Taken at Sea from 1958 to 1974.
Joint U.S.A./Canada Pelagic Data (Combined Years Summary)

Area	Age (years)																										10+ ^{1/}	UN ^{2/}	Total		
	Pup	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25				26	
COMBINED AREAS																															
JANUARY																															
MALE	-	32	14	6	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	56
FEMALE	-	47	6	49	76	62	69	95	102	89	88	60	65	57	47	57	34	25	18	8	5	3	2	2	-	-	-	-	-	2	1068
TOTAL	-	79	20	55	80	62	69	95	102	89	88	60	65	57	47	57	34	25	18	8	5	3	2	2	-	-	-	-	2	1124	
FEBRUARY																															
MALE	-	76	14	10	4	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	106	
FEMALE	-	85	15	79	77	139	150	183	169	138	156	140	116	81	92	94	81	43	32	20	9	5	4	-	1	-	1	-	28	1988	
TOTAL	-	161	29	89	81	139	152	183	169	138	156	140	116	81	92	94	81	43	32	20	9	5	4	-	1	-	1	-	28	2094	
MARCH																															
MALE	-	178	42	37	26	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	288	
FEMALE	-	236	57	104	198	194	162	164	142	113	138	112	116	115	94	69	83	60	39	24	6	9	3	-	-	-	-	11	22	2261	
TOTAL	-	414	97	141	214	187	162	164	142	113	138	112	116	115	94	69	83	60	39	24	6	9	3	-	-	-	-	11	24	2549	
APRIL																															
MALE	-	151	74	92	47	7	4	6	9	3	3	3	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	4	404	
FEMALE	-	205	113	204	246	189	195	179	229	186	140	131	138	105	86	103	52	41	27	11	12	3	1	-	1	-	-	1	29	2627	
TOTAL	-	356	187	296	293	196	199	185	238	189	143	134	138	105	87	103	52	41	27	11	12	3	1	-	1	-	-	1	33	3031	
MAY																															
MALE	-	110	86	120	50	9	4	12	11	6	2	2	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6	419	
FEMALE	-	130	141	234	251	175	177	164	174	130	147	140	153	102	102	83	66	44	27	21	13	5	1	2	2	-	-	6	14	2506	
TOTAL	-	240	227	354	301	184	181	176	185	136	149	142	153	103	102	83	66	44	27	21	13	5	1	2	2	-	-	6	20	2925	
JUNE																															
MALE	-	18	50	108	53	17	7	9	-	7	5	2	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	280	
FEMALE	-	13	13	82	149	114	120	129	171	148	111	102	93	165	64	54	50	29	31	10	6	1	1	1	-	1	-	1	20	1539	
TOTAL	-	31	63	190	202	131	127	138	171	155	116	104	93	167	65	54	50	29	31	10	6	1	1	1	-	1	-	1	22	1819	
JULY																															
MALE	-	3	38	97	42	19	9	13	4	3	4	1	3	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	1	238	
FEMALE	-	4	7	72	136	166	136	118	130	114	92	87	77	90	83	53	44	29	17	12	6	4	3	3	-	-	-	-	4	1485	
TOTAL	-	7	45	169	178	185	145	131	134	117	96	88	80	90	83	54	44	29	17	12	6	4	3	3	-	-	-	-	5	1723	
AUGUST																															
MALE	-	2	79	46	23	12	4	8	9	5	2	4	3	2	2	1	1	1	-	-	-	-	-	-	-	-	-	-	-	205	
FEMALE	-	1	49	148	214	226	175	161	147	129	160	149	156	112	89	111	75	56	34	20	19	5	1	1	1	-	-	17	2256		
TOTAL	-	3	128	194	237	238	179	169	156	134	162	153	159	114	91	112	76	57	34	20	19	5	1	1	1	-	-	17	2461		
SEPTEMBER																															
MALE	-	3	21	15	5	1	1	1	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	51	
FEMALE	1	1	25	50	48	48	30	35	33	24	44	38	27	19	24	18	14	8	3	2	6	1	-	1	-	-	-	1	502		
TOTAL	1	4	46	65	53	49	31	36	36	26	44	38	27	19	24	18	14	8	3	2	6	1	-	1	-	-	-	1	553		
OCTOBER																															
MALE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
FEMALE	-	1	2	4	7	5	-	1	4	-	3	5	3	3	4	1	2	1	-	1	-	-	-	-	-	-	-	-	-	47	
TOTAL	-	1	2	4	7	5	-	1	4	-	3	5	3	3	4	1	2	1	-	1	-	-	-	-	-	-	-	-	-	47	
NOVEMBER																															
MALE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
FEMALE	-	1	-	-	-	1	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	
TOTAL	-	1	-	-	-	1	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	
DECEMBER																															
MALE	-	1	1	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	
FEMALE	1	3	8	15	10	4	10	10	11	3	6	7	4	1	5	3	1	4	2	2	2	1	1	2	-	-	-	-	-	115	
TOTAL	1	4	9	16	11	4	10	10	11	3	6	7	4	1	5	3	1	4	2	2	2	1	1	2	-	-	-	-	-	119	
COMBINED MONTHS																															
TOTAL MALE	-	574	419	532	255	207	31	59	36	26	16	12	6	5	3	2	1	1	-	-	-	-	-	-	-	-	-	-	15	2051	
TOTAL FEMALE	2	727	436	1041	1402	1313	1224	1239	1313	1074	1085	971	948	850	690	646	502	340	230	131	73	37	18	10	5	1	1	19	137	16398	
GRAND TOTAL	2	1301	855	1573	1657	1520	1255	1298	1349	1100	1101	983	954	855	693	648	503	341	230	131	73	37	18	10	5	1	1	19	152	18449	

1/ seals 10 years of age or older

2/ age unknown

TABLE A-24.--Frequency Distribution by Sex of Fur Seals Taken at Sea from 1958 to 1974. Joint U.S.A./Canada Pelagic Data
(Combined Years Summary)

Area	Month												Total
	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEP	OCT	NOV	DEC	
<u>AREA 1 - CALIFORNIA</u>													
MALE	5	3	10	16	19	3	-	-	-	-	-	-	56
FEMALE	593	1408	808	330	321	93	-	-	-	-	-	3	3556
TOTAL	598	1411	818	346	340	96	-	-	-	-	-	3	3612
<u>AREA 2 - OREGON, WASHINGTON AND BRITISH COLUMBIA</u>													
MALE	51	91	250	329	244	33	1	1	-	-	-	4	1004
FEMALE	475	529	1176	2010	1213	111	2	-	-	-	3	112	5631
TOTAL	526	620	1426	2339	1457	144	3	1	-	-	3	116	6635
<u>AREA 3 - GULF OF ALASKA</u>													
MALE	-	12	28	59	153	131	18	-	-	-	-	-	401
FEMALE	-	51	277	287	953	677	74	1	-	-	-	-	2320
TOTAL	-	63	305	346	1106	808	92	1	-	-	-	-	2721
<u>AREA 4 - WESTERN ALASKA</u>													
MALE	-	-	-	-	3	86	8	8	2	-	-	-	107
FEMALE	-	-	-	-	18	540	46	78	31	4	-	-	717
TOTAL	-	-	-	-	21	626	54	86	33	4	-	-	824
<u>AREA 5 - EASTERN BERING SEA</u>													
MALE	-	-	-	-	-	27	211	196	49	-	-	-	483
FEMALE	-	-	-	-	1	118	1363	2177	471	43	1	-	4174
TOTAL	-	-	-	-	1	145	1574	2373	520	43	1	-	4657
<u>COMBINED AREAS</u>													
MALE	56	106	288	404	419	280	238	205	51	-	-	4	2051
FEMALE	1068	1988	2261	2627	2506	1539	1485	2256	502	47	4	115	16398
TOTAL	1124	2094	2549	3031	2925	1819	1723	2461	553	47	4	119	18449

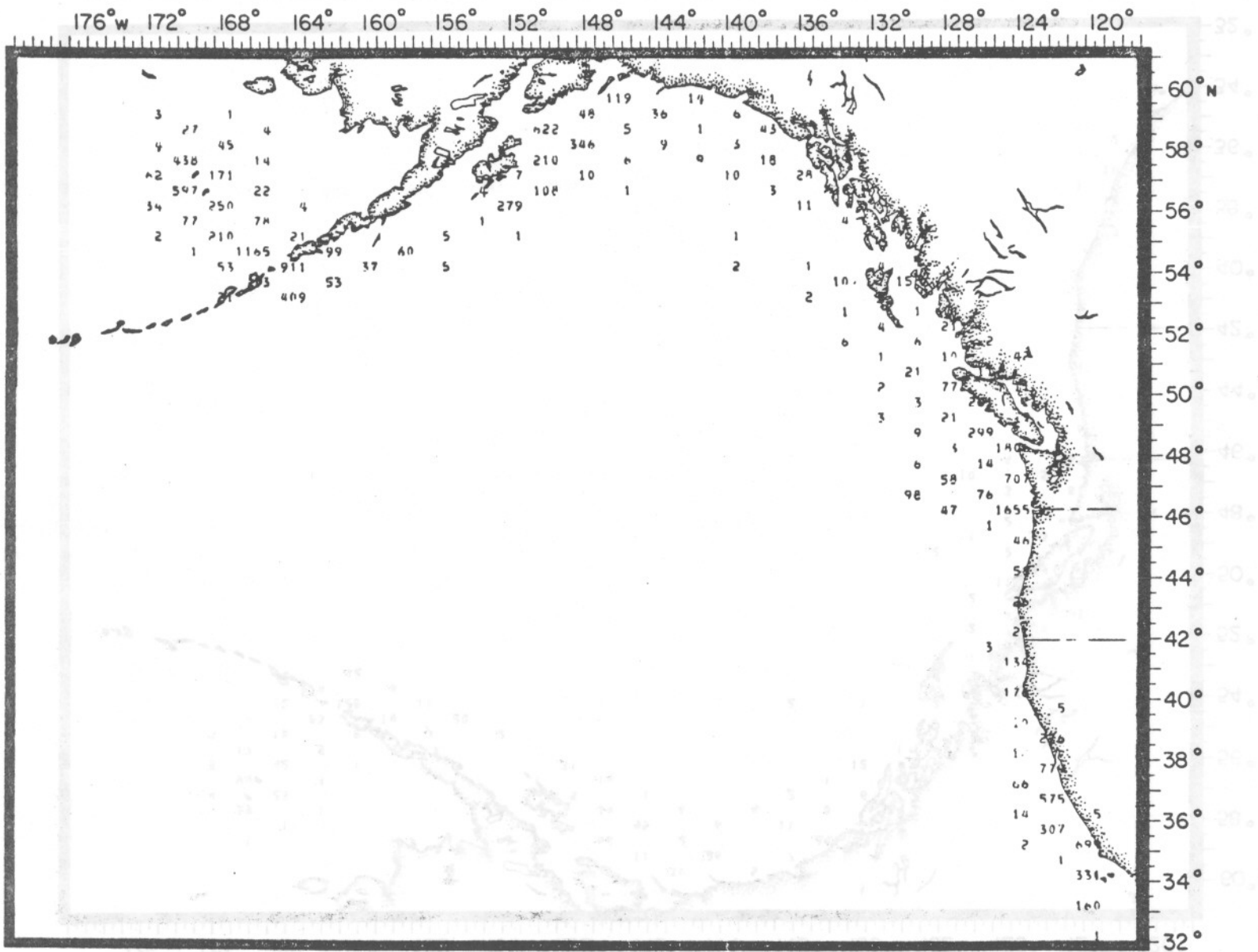


Figure A-1.--Distribution (1° lat. x 2° long.) of 16,398 female fur seals collected by the United States and Canada during 1958-74.

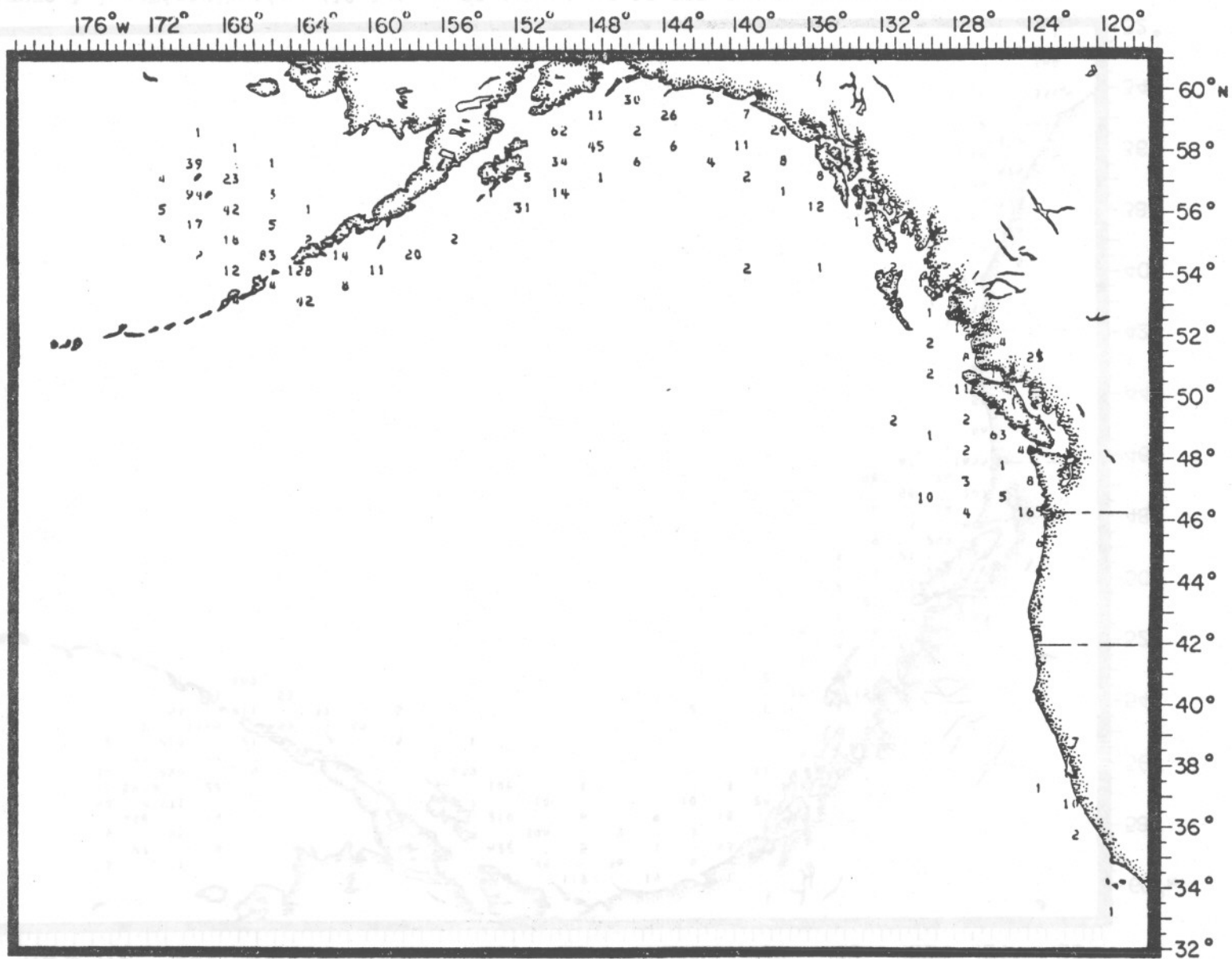


Figure A-2.--Distribution (1° lat. x 2° long.) of 2,051 male fur seals collected by the United States and Canada during 1958-74.

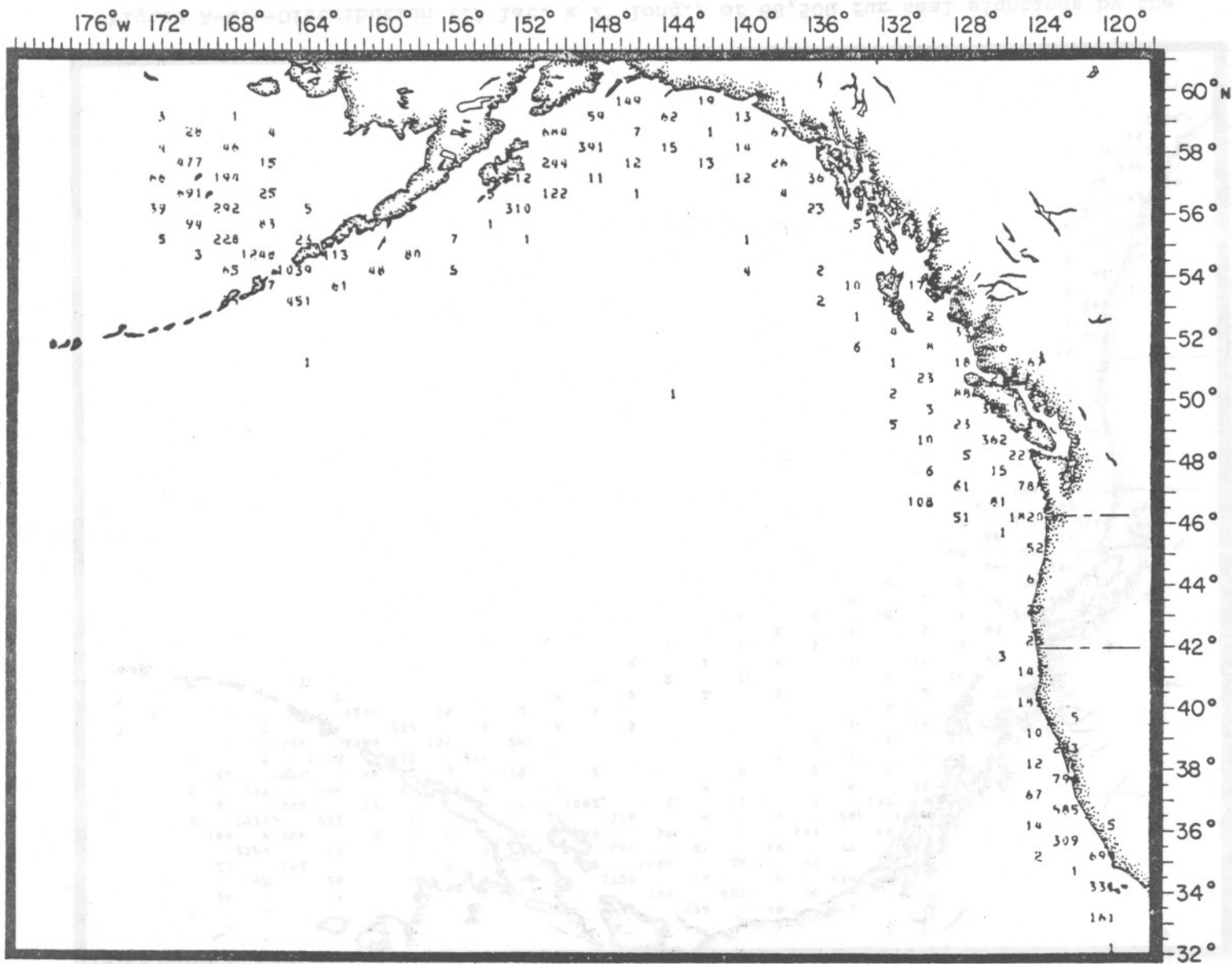


Figure A-3.--Distribution (1° lat. x 2° long.) of 18,449 male and female fur seals collected by the United States and Canada during 1958-74.

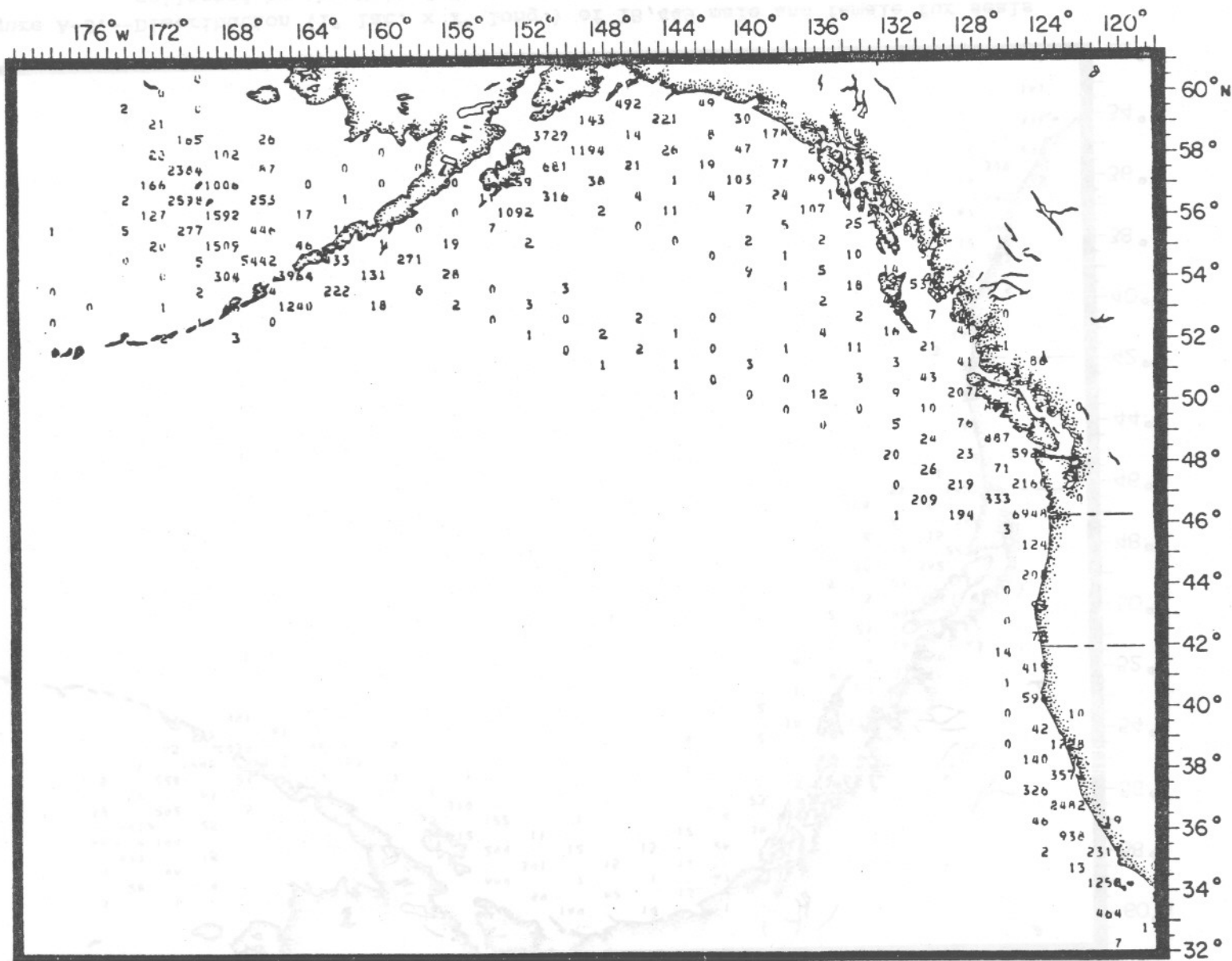


Figure A-4.--Distribution (1° lat. x 2° long.) of 68,500 fur seal sightings by the United States and Canada during 1958-74.

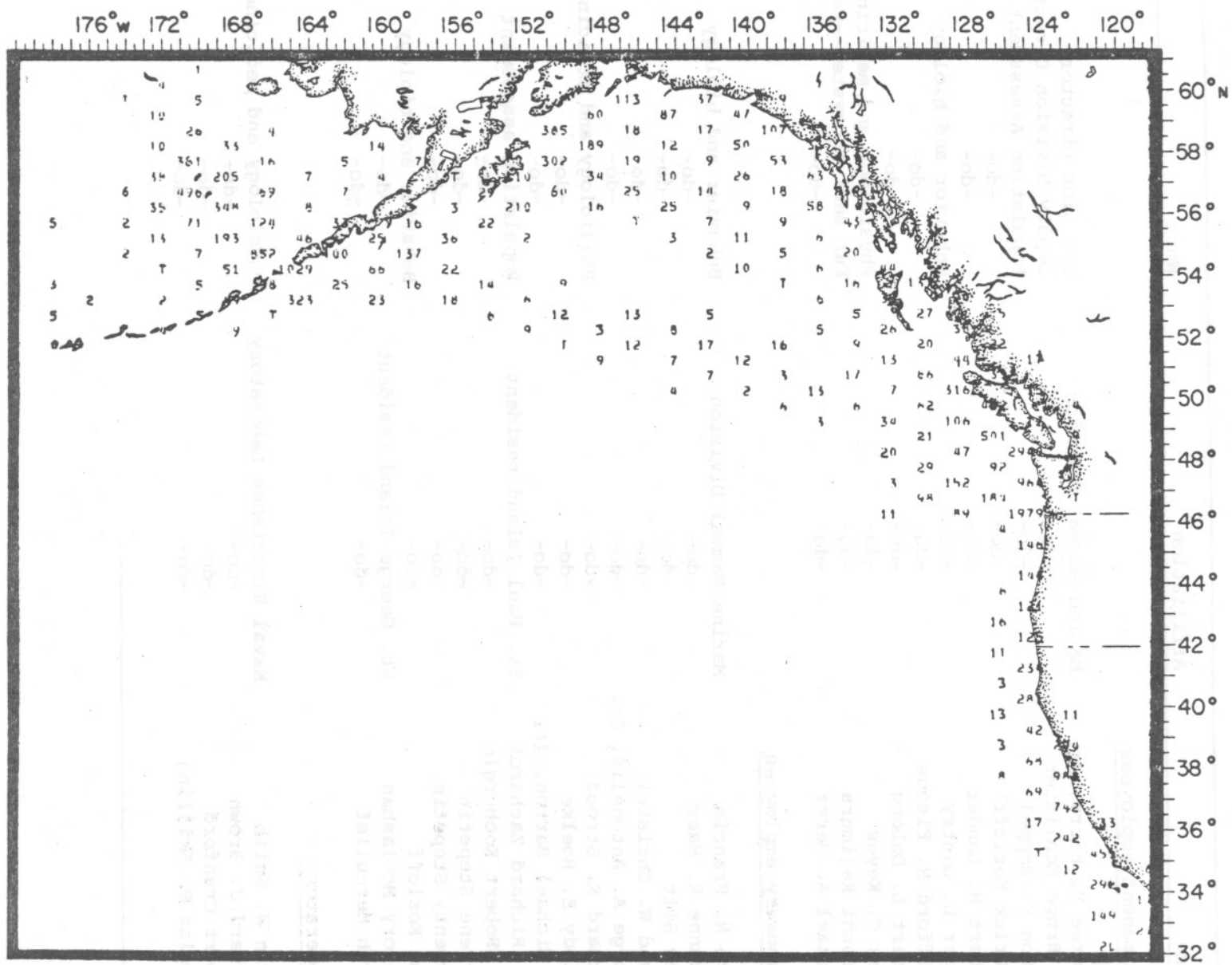


Figure A-5.--Distribution (1° lat. x 2° long.) of 21,575 hours of sighting effort by the United States and Canada during 1958-74.

Appendix B

Persons engaged in fur seal research in 1977

Name	Affiliation	Work
<u>Permanent employees</u>		
George Y. Harry, Jr.	Marine Mammal Division	Division Director
W. Bruce McAlister	-do-	Deputy Division Director
Alton Y. Roppel	-do-	Population Assessment
Patrick Kozloff	-do-	-do-
Robert H. Lander	-do-	-do-
Roger L. Gentry	-do-	Behavior and biology
Clifford H. Fiscus	-do-	-do-
Robert L. DeLong	-do-	-do-
Mark C. Keyes	-do-	Physiology and medicine
Hiroshi Kajimura	-do-	Fur seal ecosystem--pelagic
Michael A. Perez	-do-	-do-
<u>Temporary employees</u>		
John M. Francis	Marine Mammal Division	Behavior and biology
Suzanne K. Macy	-do-	-do-
John Holt	-do-	-do-
David W. Christel	-do-	-do-
George A. Antonelis, Jr.	-do-	-do-
Richard K. Stroud	-do-	Physiology and medicine
Melody E. Roelke	-do-	-do-
D. Michael Barton, Jr.	-do-	-do-
M. Richard Zacharof	St. Paul Island resident	Population assessment
M. Robert Kochergin	-do-	-do-
Darlene Stepetin	-do-	-do-
Lavrenty Stepetin	-do-	-do-
John Kozloff	-do-	Behavior and biology
Gregory McGlashan	St. George Island resident	-do-
Sarah Merculief	-do-	-do-
<u>Cooperators</u>		
Alvin W. Smith	Naval Bioscience Laboratory	Physiology and medicine
Richard J. Brown	-do-	-do-
Robert Cranford	-do-	-do-
Douglas E. Skilling	-do-	-do-

Persons engaged in fur seal research in 1977--Continued

Name	Affiliation	Work
<u>Cooperators</u>		
Eugene T. Lyons	University of Kentucky	Hookworm biology
Arnoldus S. Blix	University of Oslo and	Thermoregulation in
	University of Alaska	newborn fur seals
Hans Grave	University of Oslo	-do-
<u>Visiting scientists</u>		
Michael Bigg	Fisheries Research Board of Canada	--
Gerald Conlogue	Washington State University	--
Bernard Easterday	National Institutes of Health, Washington, D.C.	--
Raymond Pawlisch	-do-	--
Al Webb	-do-	--

Appendix C

Table C-1.--Seals entangled in net fragments and other materials, United States male seal harvest, St. Paul Island, Alaska, 1967-77.

Year	Number of entangled seals	Percent of harvest
1967	75	0.17
1968	75	0.21
1969	67	0.21
1970	101	0.28
1971	113	0.41
1972	139	0.42
1973	135	0.47
1974	211	0.64
1975	268	0.92
1976	118	0.51
1977	327	1.15