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Fur Seal Investigations, Pribilof Islands, Alaska, 1963

by Alton Y. Roppel, Ancel M. Johnson,
and Douglas G. Chapman

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ABSTRACT

Of 42,386 male seals killed on the Pribilof Islands in 1963, 39,685 were taken during the male kill from 2 July to 5 August and 2,701 during the kill of females 13 August to 12 September. Age classification in percent was: 5, 45, 45, and 5, for ages 2, 3, 4, and 5. At least 3,150 male seals were taken as a result of early season removal of the maximum length limit of 48-3/4 inches. The peak of the kill occurred 22-26 July. The kill of 18,481 4-year-old males by 5 August agreed with the forecast of 18,750. A kill of 37,500 3-year-old males by 31 July was predicted; 17,986 were taken by 5 August. The forecast for 1964 is 50,000 males by 5 August. Harem and idle bulls counted were 11,283 and 9,540. Based on tag recoveries from males ages 3 and 4, the number of pups born in 1958 and 1959 were 729,000 and 778,000; from female data, the estimates were 872,376 and 859,371. Based on marked to unmarked ratios obtained from shearing and sampling pups, the estimate of the number of pups born on the Pribilof Islands in 1963 is 316,000. A total of 43,952 females were taken. Three- and four-year-old females seemed to return to rookery areas rather than to hauling grounds as in the past. Reproductive studies showed that 2 of 170 4-year-old females examined were primiparous and had given birth to their first pup in 1963, that all (140) of the 3-year-old females examined were nulliparous, and that 24 percent of the 3-year-olds and 70 percent of the 4-year-olds would have been bred in 1963. Because only 3 and 32 percent of the 4- and 5-year-old females examined in 1962 had given birth to pups that year, many 3- and 4-year-old females apparently do not conceive or most of the fetuses carried by young females die early in life. Recoveries of marked animals included 3,703 with tags, 2,077 with checkmarks only, 84 with tags attached in 1961 and 1962 to animals presumed to be yearlings, and 37 with Soviet tags. Twenty-five thousand seal pups and 701 yearlings were tagged. The heads of 21,919 seal pups were sheared. Land pup mortality was 39,239. Surveys of yearlings tagged as pups in 1962 were made to provide an index to survival from birth to age 1. A correlation between mean weight as pups and return at age 3 is suggested. Tagged pups continue to weigh less than untagged pups. The average difference was 0.57 kg.

INTRODUCTION

The fur seal populations in the North Pacific seem to be almost ideal subjects for testing population principles among large mammals. A large part of the population is present at one time on small islands, there is an intensive harvest, and the seals can be marked and measured. Further, there is good communication between biologists of different countries working on the different islands and at sea.

Allen (1954, p. 35 and 37) called attention to some pertinent principles of population management in the following statements: "Few people appreciate the drastic waxing and waning of animal numbers with the cycle of the seasons.

"We cannot manage or even harvest, . . . to best advantage until we have a realistic conception of the annual destruction and replacement of numbers.

"Most large-scale errors in handling wildlife resources have stemmed from a failure to comprehend the forces at work in populations.

Note.--Alton Y. Roppel and Ancel M. Johnson, Wildlife Biologists (Research), Bureau of Commercial Fisheries Marine Mammal Biological Laboratory, U.S. Fish and Wildlife Service, Seattle, Wash.; and Douglas G. Chapman, Laboratory of Statistical Research, University of Washington, Seattle, Wash.

Logic applying to an individual frequently has little relationship to the thrift and survival of a life community."

On the Pribilof Islands, biologists and biometricians have the opportunity to guide the management of fur seals according to population principles. Despite occasional hesitation and uncertainty, the female population is being reduced to test the theory that the seal herd was no longer growing and that it would reach its maximum yield at a lower level.

The survival of year classes has been both high and low since the reduction of females began in 1956. The area occupied by rookeries is apparently decreased but, until recently, population estimates did not indicate that the population was reduced. Sources of error, mostly inflationary, in the information used to make population estimates are now being tested. The annual mortality in the sea and, therefore, the survival to age 3, when the year class first enters the harvest, cannot yet be predicted.

The problems of predicting survival and of estimating accurately the number of adult females and the number of pups produced are the most important ones that research on fur seals must solve. The following pages record the progress made on these problems and on related studies in 1963.

The 1963 field season on the Pribilof Islands extended from June to October. Arrivals, departures, and affiliations of research workers follows:

Name	Arrival	Departure	Affiliation	Work
Richard S. Peterson[1]	10 June	7 Oct.	Bureau of Commercial Fisheries and Johns Hopkins University	Behavior of fur seals
Peter A. Dzikiewicz[1]	24 June	9 Sept.	Bureau of Commercial Fisheries	Fur seal research, general
Robert L. DeLong[1]	" "	" "	"	"
Kenneth E. Thompson[1]	" "	26 Aug.	"	"
Alton Y. Roppel	1 July	3 Sept.	"	"
Richard K. Stroud[1]	" "	9 "	"	"
Frank B. Reberger[1]	" "	16 "	"	"
John C. Haxton[1]	" "	" "	"	"
Ancel M. Johnson	22 "	29 Aug.	"	Population dynamics of fur seals
Mark C. Keyes	8 July	19 Aug.	"	Mortality of fur seals
Charles A. Rohrmann[1]	" "	24 Sept.	"	"
Ford Wilke	9 Sept.	30 Sept.	"	Fur seal research, general
George Schaller	17 June	27 June	Independent	Fox census
Paul A. Colinvaux	" "	26 July	Duke University	Evolution of Bering Sea land bridge
Edwin Horn	" "	" "	"	"
William Horn	" "	" "	"	"
Alex Peden	5 Aug.	12 Aug.	University of British Columbia	Collect tide pool fishes

Name	Arrival	Departure	Affiliation	Work
Lee Eberhardt	7 Aug.	12 Aug.	General Electric (AEC)	Collect reindeer flesh, bones, and stomach contents for analysis of radioactivity
Don Watson	" "	" "	"	"
Dennis Bordukofsky[1]	-	-	St. Paul Island resident	Behavior of fur seals
David Galaktionoff[1]	-	-	"	Fur seal research, general
Patrick Kozloff[1]	-	-	"	"
Agafon Krukoff, Jr.[1]	-	-	"	"
Lavrenty Stepetin[1]	-	-	"	"
Herman Lestenkof[1]	-	-	St. George Island resident	"
Innokenty C. Lestenkof[1]	-	-	"	"

[1] Temporary employees.

POPULATION

MALES

Age Classification

The male seals killed on the Pribilof Islands in 1963 are classified by age in appendix tables 4, 5, 6, and 7. The length limits originally prescribed for taking males were 42 to 48-3/4 inches, tip of nose to tip of tail. The maximum length limit, however, was removed early in the season to permit the killing of an abundance of overlimit animals of commercial quality. The number of males of each age class that were taken as a result of the change has been conservatively estimated at: 450 3-year-olds, 2,200 4-year-olds, and 500 5-year-olds.

The practice of confining the kill of male seals within minimum and maximum length limits has protected most 2-year-olds and has assured replenishment of the breeding stock through escapement of overlimit 4-year-olds. The large number of idle bulls present in the herd, however, indicates that the killing of males has been too restrictive in recent years. Where the ratio of idle to harem bulls in 1930 was 1 to 4 on land, it is now about 1 to 1. Because the number of idle bulls seemed excessive, the male killing season was extended well into August in most years since 1956 to reduce recruitment of males into the breeding reserve. But the effect of the extended season was moderated by concurrent use of a maximum length limit, especially in years when there were large returns of one or more age classes. Length data from known-age males have shown that some 3-year-olds and many 4-year-olds are longer than 48-3/4 inches.

When the maximum length limit is removed because it is too restrictive, an alternative guide for killing should be provided. Absence of secondary sex characteristics may be an acceptable substitute. When present, the most obvious secondary sex characteristic is the mane, which is easily identified by the long, silver-colored guard hairs on the neck. Most or all 6-year-old males have a developing mane; some 5-year-old males may have a rudimentary mane. Underfur length, however, is about the same regardless of age or size of the animal.

A satisfactory solution to regulation of male escapement may be to use a maximum length limit when additional breeding stock is needed and to use absence of the mane when elimination of all available 4-year-olds is desirable. Presumably, fewer breeding males are needed as the number of females are reduced.

Age classification of the male kill was determined from a sample of 3,789 canine teeth collected on St. Paul Island and from 1,592 collected on St. George Island. Sampling of the kill was carried out from 2 July through 5 August on both islands and from 13 to 26 August on St. Paul Island and 13 to 30 August on St. George Island. An additional 634 males were taken during the 27 August to 12 September period of the female kill on St. Paul Island. They were not sampled for age. The kill of male seals, by year class, is shown in table 1 for the years 1947-61. Tables 2 and 3 illustrate the male age classification in percent for 1954-63, and the cumulative numbers of males killed each year from 1955 to 1963, St. Paul Island.

Table 1.--Kill of male seals, by year class, Pribilof Islands, Alaska, 1947-61

Year class	St. Paul Island					St. George Island					Grand total[1]
	Age when killed				Total	Age when killed				Total	
	2	3	4	5		2	3	4	5		
1947.....	-	30,110	23,697	854	54,661	-	7,043	3,731	123	10,897	65,558
1948.....	486	25,714	19,995	103	46,298	114	5,546	3,926	22	9,608	55,906
1949.....	-	29,697	12,326	249	42,272	303	7,116	2,570	280	10,269	52,541
1950.....	855	40,656	15,365	332	57,208	1,104	8,475	4,793	147	14,519	71,727
1951.....	1,384	32,350	18,083	3,057	54,874	288	7,907	5,310	681	14,186	69,060
1952.....	1,735	30,733	31,410	675	64,553	545	8,998	8,459	506	18,508	83,061
1953.....	839	38,312	8,855	54	48,060	295	10,611	3,330	100	14,336	62,396
1954.....	2,918	23,473	5,599	554	32,544	535	6,651	2,779	162	10,127	42,671
1955.....	1,015	27,863	10,555	115	39,548	555	7,246	2,825	260	10,886	50,434
1956.....	885	10,671	2,762	532	14,850	171	2,251	1,387	218	4,027	18,877
1957.....	2,590	24,283	15,344	773	42,990	242	5,098	4,492	244	10,076	53,066
1958.....	1,977	48,458	14,149	1,587	66,171	431	9,413	3,707	540	14,091	80,262
1959[2].....	2,820	26,456	14,184	-	43,460	891	5,890	4,690	-	11,471	54,931
1960[2].....	1,619	14,310	-	-	15,929	636	4,332	-	-	4,968	20,897
1961[2].....	1,098	-	-	-	1,098	921	-	-	-	921	2,019

[1] Does not include Pribilof seals taken at sea or on breeding islands owned by the Soviet Union, nor 6-year-old and unclassified males totaling 5,406.

[2] Incomplete returns.

Table 2.--Kill of 3- and 4-year-old male seals at various dates, St. Paul Island, 1954-63

Date	Kill level	Age in years	
		3	4
	Number of seals	Percent	Percent
1954 4 July	10,000	44	54
11 "	20,000	49	49
18 "	30,000	56	41
27 "	49,699	65	31
1955 9 "	10,000	50	48
16 "	20,000	53	46
22 "	30,000	56	42
31 "	49,977	62	36
1956 6 "	10,000	24	64
11 "	20,000	30	62
16 "	30,000	33	60
26 "	50,000	41	52
15 Aug.	75,736	51	42
1957 13 July	10,000	53	41
24 "	20,000	63	33
5 Aug.	30,000	67	28
10 "	34,055	69	26
1958 10 July	10,000	74	26
18 "	20,000	78	22
28 "	30,000	80	19
31 "	33,325	82	17
1959 14 "	10,000	38	57
27 "	20,000	45	50
31 "	22,286	46	47
1960 21 "	10,000	80	17
1 Aug.	20,000	83	12
7 "	28,819	84	10
1961 9 July	10,000	61	37
18 "	20,000	62	37
24 "	30,000	66	32
2 Aug.	50,000	70	27
15 "	67,169	72	23
1962 12 July	10,000	49	47
20 "	20,000	54	42
26 "	30,000	59	37
5 Aug.	39,983	62	34
1963 16 July	10,000	33	59
25 "	20,000	43	50
5 Aug.	30,000	47	46

Table 3.--Cumulative number of male seals killed, St. Paul Island, 1955-63[1]

Date		Age in years		Date		Age in years		Date		Age in years	
		3	4			3	4			3	4
1955	1 July.....	1,574	1,962	1958	1 July...	1,991	732	1961	6 July...	4,119	2,315
	6 "	3,341	3,643		6 " ...	3,988	1,383		11 " ...	6,770	4,316
	11 "	5,929	6,248		11 " ...	8,038	2,658		16 " ...	9,993	6,021
	16 "	10,416	8,999		16 " ...	12,917	3,912		21 " ...	15,492	8,302
	21 "	15,358	11,648		21 " ...	17,688	4,839		26 " ...	22,609	10,851
	26 "	21,707	15,638		26 " ...	22,661	5,279		31 " ...	29,523	12,488
	31 "	30,733	18,083		31 " ...	27,216	5,556		5 Aug....	38,908	14,072
									10 " ...	43,629	14,780
									15 " ...	48,458	15,344
1956	1 July.....	1,079	3,056	1959	1 July...	584	1,474	1962	6 July...	1,639	2,028
	6 "	2,671	7,060		6 " ...	1,364	3,028		11 " ...	4,485	4,335
	11 "	6,145	12,677		11 " ...	2,625	4,665		16 " ...	7,643	6,636
	16 "	9,808	17,954		16 " ...	4,189	6,425		21 " ...	11,226	8,663
	21 "	14,589	22,159		21 " ...	6,096	7,949		26 " ...	17,301	10,832
	26 "	20,726	25,999		26 " ...	8,327	9,721		31 " ...	20,267	12,047
	31 "	26,590	28,560		31 " ...	10,203	10,446		5 Aug....	25,098	13,422
	5 Aug.....	31,701	29,853								
	10 "	35,502	30,663								
	15 "	38,290	31,448								
1957	1 July.....	1,360	1,071	1960	1 July...	699	368	1963	6 July...	1,381	2,668
	6 "	2,994	2,161		6 " ...	1,751	676		11 " ...	2,498	4,331
	11 "	4,507	3,296		11 " ...	3,274	988		16 " ...	3,155	5,531
	16 "	6,777	4,651		16 " ...	5,529	1,385		21 " ...	6,047	7,882
	21 "	9,380	5,602		21 " ...	7,904	1,717		26 " ...	8,915	10,373
	26 "	13,350	6,784		26 " ...	10,978	1,968		31 " ...	11,596	12,283
	31 "	16,804	7,547		31 " ...	15,312	2,347		5 Aug....	13,954	13,791
	5 Aug.....	19,823	8,196		5 Aug....	21,610	2,657				
	10 "	23,473	8,855		10 "	24,201	2,757				

[1] Sealing began 2 July in 1961, 1962, and 1963; 27 June all other years.
1955 Male kill ended 31 July
1956 " " " 15 August
1957 " " " 10 "
1958 Male kill ended 31 July
1959 " " " " "
1960 " " " 7 August
1961 Male kill ended 15 August
1962 " " " 5 "
1963 " " " " "

The peak of the kill occurred during round 6 (22-26 July) when 5,809 males were taken on St. Paul Island (fig. 1). The percent cumulative kill, by date, age, and island is shown in figure 2.

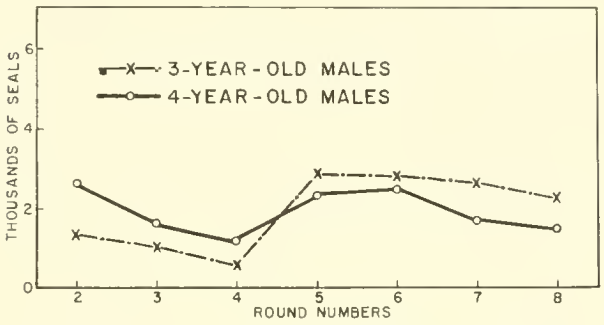

Figure 1.--Kill of 3- and 4-year-old male seals, by round, St. Paul Island, 1963.

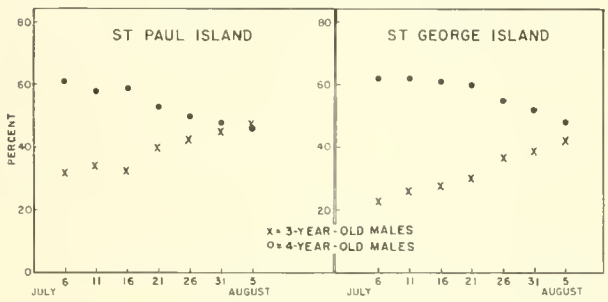

Figure 2.--Percent 3- and 4-year-old male seals in cumulative kill, by date, Pribilof Islands, Alaska, 1963.

From 2 July to 5 August, 39,685 male seals were taken on the Pribilof Islands. An additional 2,701 males were taken during the kill of female seals 13 August to 12 September. The total kill of 18,481 4-year-old males by 5 August agreed closely with the forecast of 18,750 for a kill ending between 31 July and 15 August. The data, however, do not permit an accurate forecast of the kill of 3-year-old males. Approximately 18,000 were taken by 5 August; a kill of 37,500 3-year-olds by 31 July or 50,000 by 15 August was predicted.

Bull Counts

Both harem and idle bulls decreased for the second successive year since 1961. The 1963 bull counts are given in table 4 by island and by rookery. All bull counts since 1911 are presented in appendix table 19.

Table 4.--Harem and idle bull counts, by rookery, Pribilof Islands, Alaska, 1963

Date	Rookery	Bulls		Total
		Harem	Idle	
	St. Paul Island			
10 July	Gorbatch.....	771	708	1,479
	Ardiguen.....	125	85	210
	Reef.....	1,310	1,000	2,310
	Total.....	2,206	1,793	3,999
11 July	Polovina.....	239	563	802
	Polovina Cliffs	713	447	1,160
	Little Polovina	281	395	676
	Total.....	1,233	1,405	2,638
12 July	Morjovi.....	724	935	1,659
	Vostochni.....	1,591	1,021	2,612
	Total.....	2,315	1,956	4,271
13 July	Tolstoi.....	893	728	1,621
	Lukanin.....	221	225	446
	Kitovi.....	547	147	694
	Total.....	1,661	1,100	2,761
14 July	Zapadni.....	984	750	1,734
	Little Zapadni.	565	409	974
	Zapadni Reef...	248	237	485
	Total.....	1,797	1,396	3,193
St. Paul Island total.		9,212	7,650	16,862
	St. George Island			
15 July	Staraya Artil..	300	354	654
15 July	East Reef.....	152	303	455
	East Cliffs....	245	125	370
	Total.....	397	428	825
16 July	North.....	781	600	1,381
17 July	Zapadni.....	313	398	711
	South.....	280	110	390
	Total	593	508	1,101
St. George Island total		2,071	1,890	3,961
Pribilof Islands total		11,283	9,540	20,823

Harem bulls on St. Paul Island decreased by 10.9 percent of the 1962 count; those on St. George Island decreased by 11.6 percent. The total number of harem bulls on the Pribilof Islands was 89 percent of the 1962 count.

The idle bulls on St. Paul Island showed a decrease of 16 percent; those on St. George Island decreased by 28.7 percent. The total number of idle bulls on the Pribilof Islands was 18.9 percent less than the count in 1962.

Counts of harem and idle bulls were made on East Rookery, St. George Island, at intervals ranging from 4 to 7 days from 6 July to 16 August. The counts are given in table 5.

Table 5.--Counts of harem and idle bulls, East Rookery, St. George Island, 6 July to 16 August 1963

Date	Bulls		Total
	Harem	Idle	
6 July.....	449	306	755
10 ".....	416	354	770
15 ".....	397	428	825
19 ".....	388	353	741
24 ".....	316	336	652
29 ".....	277	162	439
5 Aug.....	131	87	218
10 ".....	109	50	159
16 ".....	32	44	76

FEMALES

A total of 270,054 females have been taken on land since inception of the herd reduction program in 1956. The land kill, plus an additional unknown number of females eliminated through natural mortality, presumably has resulted in an appreciable decrease in the number of pups born. Intermittent herd reduction, however, has made it difficult to detect any influences that removal of females may have had so far. Had it been practical and economical, elimination of 250,000 females the first year (1956) would have provided a starting point from which various factors could have been traced more accurately. Weaknesses in the tagging program have also contributed to inaccuracies because associated errors tend to inflate population estimates.

It was calculated that the herd, when reduced to and kept at a certain level below its peak, will produce a maximum annual sustained yield of 60,000 males and 30,000 females harvested for their skins. The maximum sustained yield is expected to result from reduced mortality of the young, elimination of wide fluctuations in survival of the year classes, and a possible rise in pregnancy rates, particularly among 3- and 4-year-old females. Three- and four-year-old females born on western Pacific islands currently have much higher pregnancy rates than do those born on the Pribilof Islands. The actual yield of females may be appreciably less than 30,000 when calculated from more recent data.

Over 34,000 of the females killed on the Pribilof Islands during the period 1956-62 were examined, and their general reproductive conditions correlated with age. Each female was classified as nulliparous, primiparous, or multiparous, depending upon whether she had given birth to none, one, or two or more pups in her lifetime. Her current reproductive condition (post partum or nonpost partum) was also noted. The principal objective was to establish pregnancy rates by age class and for breeding-age females as a group. The problem of determining what proportion of females from the rookeries and what proportion from the hauling grounds would constitute a mixture representative of all the females has not been solved. Nearly 100 percent of the females taken from the rookeries during the peak of breeding (July) were pregnant when examined or had given birth a few days before. In contrast, as few as 21 percent of the females found on the hauling grounds in August had borne pups in the year examined. No changes in general reproductive condition of females taken on land from 1956 to 1962 have been observed.

Methods Used in Current Studies

Unlike those age 5 and older, 3- and 4-year-old females taken in the kill may be representative of all females of these ages present on land because they do not begin to appear on the Pribilof Islands until early August or about 2 weeks after the peak of breeding. Also, because most 3- and 4-year-old females have yet to give birth to their first pup, they are free to wander between the rookeries and hauling grounds. Thus, females of these ages are perhaps representative of their respective age classes regardless of where they are collected. For these reasons, studies of females were modified in 1963 to include a detailed analysis of reproductive activity of known-age 3- and 4-year-old females taken in the kill.

Sampling of the kill was continued for age classification, and teeth were processed as in the past, except that those age 8 and older were grouped as age 8+. Teeth in this group will be sectioned later, and the ages read internally. In other years, ages were read externally through age 10; those 11 and older were grouped as 10+ and sectioned later.

The females used for studies of reproduction were also weighed and their body lengths recorded. A behavior study begun on a section

Table 6.--Kill of female seals, by year class,[1] Pribilof Islands, Alaska, 1939-62

Year class	Age in years									
	1	2	3	4	5	6	7	8	9	10
1939.....	-	-	-	-	-	-	-	-	-	17
1940.....	-	-	-	-	-	-	-	-	8	15
1941.....	-	-	-	-	-	-	-	16	7	15
1942.....	-	-	-	-	-	-	15	13	7	39
1943.....	-	-	-	-	-	12	8	10	41	36
1944.....	-	-	-	-	3	11	9	57	43	10
1945.....	-	-	-	4	4	8	45	43	11	27
1946.....	-	-	-	4	4	60	54	11	38	762
1947.....	-	1	-	1	37	84	46	48	1,136	1,773
1948.....	-	-	-	84	75	94	77	1,766	3,120	678
1949.....	-	-	30	34	161	118	2,155	3,550	559	1,173
1950.....	-	10	17	92	210	2,949	4,031	654	1,289	345
1951.....	4	-	8	85	4,618	6,343	1,328	1,958	492	2,292
1952.....	-	-	16	6,422	11,465	3,408	3,515	526	3,127	1,687
1953.....	-	1	2,132	5,806	4,056	2,958	493	2,843	2,247	87
1954.....	-	132	1,150	8,493	3,771	683	3,057	2,809	68	
1955.....	-	11	11,468	7,285	1,047	4,810	2,869	97		
1956.....	-	601	2,072	614	4,520	3,444	1,859			
1957.....	150	281	352	6,912	6,303	4,080				
1958.....	76	79	4,651	8,683	8,697					
1959.....	27	508	4,563	8,044						
1960.....	120	431	2,979							
1961.....	37	724								
1962.....	7									

[1] Includes pelagic kill of United States and Canada, 1958-63. In addition to the females listed, 50, 145 age 11 and older (10+), 17, 790 age 9 and older (8+), and 601 unclassified were taken.

of Kitovi Rookery in 1961 was completed in 1963. A separate report on this study will be made.

Age Classification

As in 1961 and 1962, scarcity of females on the hauling grounds caused a need to drive animals from rookeries to achieve the quota of 43,750. Commercial killing of females since 1956 has been partly responsible for the lack of surplus females, especially by removing, from the hauling grounds, an accumulation of animals older than age 10. Most of these females apparently were no longer producing young. Additional females have been lost through natural mortality.

Regardless of the effects of herd reduction, it is difficult to understand why young females are not more abundant on the hauling grounds. Only 646 females of ages 3 and 4 were taken in 11 hauling ground drives on St. Paul Island by 20 August. In contrast, 16,498 3- and 4-year-old females were taken from hauling grounds by the same date in 1958. Possibly the herd reduction program, apart from eliminating females, has also caused young females from recent year classes to behave differently from those born previously. Behavior studies and observations of rookery areas on St. Paul Island in 1963 showed that many 3- and 4-year-old females were on the rookeries in August. The data in table 8 support the general observations in that they show little difference in the age compositions of females taken from hauling grounds and from the rookeries. Whether this condition is normal or is a result of a reduction in the total number of females is not known because comparative data are not available.

Females killed on St. Paul Island are classified by age in appendix tables 8 and 9; those taken on St. George Island are in appendix tables 10 and 11. Year class contributions to the female kills on the Pribilof Islands are given in table 6 for the years 1939-62. Table 7

Table 7.--Percent age composition of female seals sampled from the kills, Pribilof Islands, Alaska, 1958-63

Year and island	Age in years									
	2	3	4	5	6	7	8	9	10	10+
	Percent									
1958										
St. Paul	2	37	29	13	11	3	1	1	2	1
St. George	1	20	22	17	13	9	4	3	2	9
1959										
St. Paul	1	6	25	14	11	12	6	4	4	17
St. George	-	6	20	14	10	13	7	6	5	19
1960										
St. Paul	1	8	14	23	14	9	8	7	4	12
St. George	-	3	9	20	12	8	10	9	5	24
1961										
St. Paul	1	10	16	10	11	6	6	7	5	28
St. George	1	11	15	10	10	7	6	7	6	27
1962										
St. Paul										
July-August	1	14	26	15	6	5	4	3	3	23
September	-	2	9	13	10	9	10	8	4	35
St. George	1	12	24	14	8	5	5	3	3	25

	Age in years						
	2	3	4	5	6	7	8+
	Percent						
1963							
St. Paul							
July-August	1	5	18	21	10	4	41
September	3	7	14	17	8	5	46
St. George	2	10	23	18	10	4	33

Table 8.--Age classification of female seals killed, by source, St. Paul Island, 1963

	Age in years						
	2	3	4	5	6	7	8+
Hauling ground areas:							
Number.....	49	341	1,415	1,799	826	419	3,766
Percent.....	1	4	16	21	9	5	44
Rookery areas:							
Number.....	247	834	1,965	2,224	1,182	573	6,947
Percent.....	2	6	14	16	8	4	50
Mixed areas:							
Number.....	203	902	2,530	2,927	1,142	414	4,170
Percent.....	2	7	21	24	9	3	34

shows the percent age composition of female seals sampled from the kills on the Pribilof Islands from 1958 to 1963.

Reproduction

The genital tracts of 3- and 4-year-old females taken in the kill were classified in the laboratory according to whether the female had given birth to none, one, or two or more pups in her lifetime. Presence of a placental scar (site of umbilical cord attachment) in one uterine horn confirmed birth of a pup in 1963. The fresh ovaries were examined for Graafian follicles, then sectioned to detect developing corpora lutea and to measure follicles 5 mm. or larger in diameter. A developing corpus luteum presumably indicates that ovulation and conception have occurred. Graafian follicles, if present, suggest that the female is sexually mature and is nearly ready to ovulate. According to Craig,[1] the ovaries of immature females "are structureless, containing no corpora lutea, corpora albicantia, or Graafian follicles. A female preparing to ovulate for the first time will usually have equal numbers of follicles in each ovary." Craig classifies the latter as "maturing" females. Of "maturing" females, Craig states that "Graafian follicles are first seen in March, and increase in size and number until the time of ovulation in late August or early September, 1 to 2 months later than subsequent ovulations."

[1] Allison M. Craig. 1963. Key to the reproductive condition of female fur seals (Callorhinus ursinus) and the reproductive cycle of mature female fur seals. Fisheries Research Board of Canada, Biological Station, Nanaimo, B.C. [Manuscript report.]

The results of examining 310 pairs of ovaries from known-age 3- and 4-year-old females taken on St. Paul Island in 1963 are summarized in table 9. Two of the 170 4-year-old females were primiparous and had given birth to their first pup in 1963; all (140) of the 3-year-old females examined were nulliparous.

Both ovaries of all but 3 of the 310 females examined contained developing follicles or follicles that were resorbing as a result of ovulation. If the presence of follicles in both ovaries usually results in ovulation the same year, many of the 3- and 4-year-old females either do not conceive or a large proportion of the fetuses die early in life or both. For example, of 295 5-year-old females examined in 1962, 94 or 32 percent had given birth to pups that year; only 13 or 3 percent of 398 4-year-old females had given birth. The difference between the observed pregnancy rates of 4- and 5-year-old females examined in 1962 and the potential pregnancy rates of 3- and 4-year-old females examined in 1963 may also be influenced by unrepresentative sampling and year to year variation in fecundity.

The ovarian tissue of 3- and 4-year-old females examined in 1963 differed in texture, presumably as a result of hormones associated with ovulation or conception. Ovaries with developing corpora lutea were firm; ovaries of females that had never ovulated were soft and fragile. The ovaries of older females are firm and, in addition, are laced with connective tissue formed by corpora albicantia.

The reproductive conditions of Soviet-tagged females taken in the kill on St. Paul Island are given in table 10.

Table 9.--Ovarian activity of 3- and 4-year-old female fur seals, St. Paul Island, 1963

Age	Postovulation[1]		Preovulation[2]		Active[3]		Inactive[4]		Total
Year	Number	Percent	Number	Percent	Number	Percent	Number	Percent	
3	9	7	24	17	104	74	3	2	140
4	59	35	59	35	52	30	-	-	170
Percent	-	22	-	27	-	50	-	1	-
Total	68	-	83	-	156	-	3	-	310

[1] Evidence of ovulation based on a developing corpus luteum in one ovary.
[2] One or more Graafian follicles each 5 mm. or larger in diameter. Measurements were taken after the ovaries were sectioned.
[3] Both ovaries with Graafian follicles, all less than 5 mm. in diameter.
[4] One or both ovaries without Graafian follicles.

Table 10.--Reproductive condition of Soviet-tagged females, St. Paul Island, 1963

Date	Tag number	Age	Rookery of recovery	Island of tagging	Reproductive condition	Condition of uterus	Placental scar	Developing corpus luteum	
								Location	Size
		Year							Mm.
5 Sept.	C-49130	2	POL	Commanders	N[1]	----	-	-	-
10 Sept.	K-14811	2	NEP	Bering	do	----	-	-	-
3 Sept.	C-27580	3	TZR	Medny	do	----	-	-	-
30 Aug.	C-27950	3	REEF	"	do	----	-	-	-
23 Aug.	C- 7711	4	POL	Robben	do	----	-	-	-
10 Sept.	C-13366	4	NEP	Commanders	do	----	-	left ovary	9x9
23 Aug.	B- 2761	5	POL	"	P[2]	POL[3]	left cornu	right ovary	9x9

[1] N = nulliparous.
[2] P = primiparous.
[3] POL = post partum-left cornu.

TAG RECOVERIES AND TAGGING

Tag Recoveries

In general, tagged male seals were killed only if they were equal in size to untagged male seals. The one exception in 1963 was the killing of a few tagged 5- and 6-year-old males for experimental purposes. Most seals of these ages escape because they are usually too large. All females longer than 42 inches, tip of nose to tip of tail, driven in 1963 were killed.

A total of 2,077 checkmarks from seals that had lost their tags were recorded; 3,703 tags were recovered. These data are summarized in table 11 by sex, age, and island. Additional details on tag recoveries are in appendix table 12.

Thirty-four seals selected and tagged as yearlings in 1961 (M-series) and 50 selected and tagged as yearlings in 1962 (N-series) were recovered from seals killed on the Pribilof Islands in 1963. The recovery information is summarized in table 12 and given in detail in appendix table 13.

Information on 37 Soviet-tagged seals killed on the Pribilof Islands in 1963 is summarized in table 13. Appendix table 14 provides additional details.

Tagging--Pups

The number of pups tagged in 1963 is listed in table 14, by rookery; a record of pups tagged on the Pribilof Islands since 1941 is given in appendix table 17.

As discussed on page 19 of this report, there are several reasons why pup population estimates based on a tagging program may be inflated. Perhaps the most important of these reasons is extra mortality of tagged pups or mortality caused directly by the tagging program. Accordingly, the tagging program was reduced in 1963 in the belief that more time devoted to each pup would result in gentler handling and in better placement of the tags. Significant reduction in extra mortality should follow.

Of 25,000 P-series tags attached to pups in 1963, 20,000 were used on St. Paul Island and 5,000 were used on St. George Island. Of the 20,000 tags used on St. Paul Island, half were attached to pups during normal tagging time (August) and half were used in late September. Mortality rates of the two groups will be compared in 1966 when the survivors return at age 3. Older and larger pups may survive the effects of tagging better than pups tagged earlier in life. A tagging program in late September, however, has two disadvantages. First, the pups are more difficult to handle because they are larger and stronger; and second, the pups are spending long periods of time in the water by late September. These conditions make it more difficult to tag large numbers of pups in late September than in late August. The advantages of the two tagging dates might be satisfactorily combined in an early September tagging program.

Tagging of the first 10,000 pups on St. Paul Island was completed in 8 days (260 man hours) during 12-21 August. The second 10,000 pups were tagged in 5 days (432 man hours) during 20-26 September. On St. George Island,

Table 11.--Summary of tagged and tag-lost seals recovered, by age and sex, Pribilof Islands, Alaska, 1963

Series	Age	Tagged seals: St. Paul Island	Tagged seals: St. George Island	Tagged seals: Combined total	Tag-lost seals: St. Paul Island	Tag-lost seals: St. George Island	Tag-lost seals: Combined total	Grand total
	Years							
				2 July to 5 August				
					Male			
N	2	21	32	53	105	20	125	178
M	3	1,098	260	1,358	479	167	646	2,004
L	4	607	159	766	453	144	597	1,363
K	5	99	16	115	120	31	151	266
J	6	33	-	33	-	1	1	34
Total		1,858	467	2,325	1,157	363	1,520	3,845
					Female			
N	2	-	-	-	2	-	2	2
M	3	2	-	2	-	-	-	2
L	4	1	1	2	2	-	2	4
K	5	4	-	4	2	-	2	6
J	6	5	-	5	6	-	6	11
I	7	2	-	2	-	-	-	2
H	8	2	-	2	-	-	-	2
G	9	-	-	-	2	-	2	2
F	10	1	-	1	3	-	3	4
E	11	2	-	2	-	-	-	2
B	15	2	-	2	-	-	-	2
A	16	1	-	1	-	-	-	1
Total		22	1	23	17	-	17	40
				13 August to 12 September				
					Male			
N	2	38	43	81	9	4	13	94
M	3	38	21	59	10	6	16	75
L	4	20	11	31	17	3	20	51
K	5	4	-	4	3	1	4	8
Total		100	75	175	39	14	53	228
					Female			
N	2	31	13	44	54	1	55	99
M	3	152	42	194	59	40	99	293
L	4	185	54	239	156	60	216	455
K	5	301	74	375	82	25	107	482
J	6	80	19	99	-	17	17	116
I	7	35	10	45	-	-	-	45
H	8	78	2	80	-	-	-	80
G	9	17	-	17	-	-	-	17
F	10	4	-	4	-	-	-	4
E	11	39	1	40	-	-	-	40
CS	14	11	-	11	-	-	-	11
B	15	20	-	20	-	-	-	20
A	16	5	-	5	-	-	-	5
Total		958	215	1,173	351	143	494	1,667

Table 12.--Summary of seals selected and tagged as yearlings in 1961 (M-series) and 1962 (N-series) and recovered from the kill, Pribilof Islands, Alaska, 1963

St. Paul Island				St. George Island			
Males		Females		Males		Females	
Age	No.	Age	No.	Age	No.	Age	No.
	M-series, 1961 tagging						
3	11	3	2				
4	3	4	16	No M-series recovered			
		5	2				
Total	14		20				
	N-series, 1962 tagging						
2	36	2	2	2	8	2	1
		3	1	3	2		
Total	36		3		10		1

Table 13.--Summary of Soviet tags recovered from the kill, Pribilof Islands, Alaska, 1963

St. Paul Island				St. George Island			
Males		Females		Males		Females	
Age	No.	Age	No.	Age	No.	Age	No.
2	11	2	2	2	7	5	1
3	3	3	2	4	2		
4	5	4	2				
		5	1				
		6	1				
Total	19		8		9		1

5,000 pups were tagged in about 2-1/2 days (126 man hours) 17 August to 1 September. Each tag was attached to the rear edge of the left fore flipper where furred skin ends and bare skin begins. One-half to three-fourths inch of the tip of the same flipper was sliced off as a checkmark. Tag and checkmark locations of fur seal pups tagged since 1947 are shown in appendix figure 1.

Tagging--Yearlings

D. G. Chapman estimated that mortality from birth to age 1 could be separated from mortality from birth to age 3 if 5,000 yearling seals could be tagged. This assumes a high mortality during the first year of life and a lower rate thereafter. Lack of sufficient numbers of yearlings on land, however, has prevented the tagging of 5,000 in one season. All yearling tagging has been done on St. Paul Island.

Although Wilke and Banner[2] collected information in 1941 from 41 males and 6 females tagged as pups in 1940, the selection and tagging of yearling seals was not tried until 1961.[3] That year, body weight and pelage characteristics were used to identify yearlings from seals of other ages. In 1962, yearlings were selected on the basis of length. Only females measuring 95 cm. or less and males measuring 100 cm. or less were considered yearlings. These maximum length limits were derived from measurements of tagged yearlings obtained in 1941 and 1961.

Fifty-seven seals tagged in 1961 and 50 tagged in 1962 have been killed subsequently. Age determination from canine teeth revealed that only 24 percent of the former were actually yearlings when tagged; 94 percent of the latter were yearlings. Thus, body length is more reliable as an indicator of age than is body weight. Details on the recovery in 1963 of selected yearlings tagged in 1961 and 1962 are given in appendix table 13.

Methods.--Four to six men surrounded all seals on a certain section of the rookery or hauling ground, then the animals were allowed to proceed toward the sea a few at a time. This method permitted yearlings to be selected tentatively on the basis of body size and pelage coloration. Seals extracted from the group with a noose attached to an 8-foot pole were restrained on the ground for measurement. Two tags, one to each front flipper, were attached to each seal believed to be a yearling. Measurements were taken to the nearest one-quarter inch and later converted to centimeters. The animals were sexed only by examination of genital openings, although a general difference in the width of canine teeth and overall body and head shape exists between the sexes at this early age.

Results.--Information on selected and known-age yearlings tagged in 1961, 1962, and 1963 is summarized in table 15. Additional details for those tagged in 1963 are given in table 16.

Distribution of body lengths for selected and known-age yearlings is given in figures

[2] Ford Wilke and A. Henry Banner. 1941. Recovery of branded yearlings. Bureau of Commercial Fisheries, Marine Mammal Biological Laboratory, U.S. Fish Wildlife Service, Seattle, Wash. [Typed manuscript.]

[3] R. S. Peterson. 1961. Report and analysis of yearling recoveries and tagging, St. Paul Island, 1961. Bureau of Commercial Fisheries, Marine Mammal Biological Laboratory, U.S. Fish Wildlife Service, Seattle, Wash. [Typed manuscript.]

Table 14.--Fur seal pup tagging, Pribilof Islands, Alaska, 1963

Date	Rookery	Proportion allotment	Number and series allotment	Tags spoiled	Pups
St. Paul Island		Percent		Number	Number
			First tagging		
16 and 21 Aug.	Reef	24.0	2,400 P8901-11300	3	2,397
14 Aug.	Polovina	10.5	1,050 P13701-14750	3	1,047
12 Aug.	Little Polovina	3.0	300 P15801-16100	-	300
18 Aug.	Northeast Point	25.0	2,500 P16401-18900	-	2,500
15 Aug.	Tolstoi	9.5	950 P21401-22350	-	950
12-13 Aug.	Lukanin-Kitovi	8.5	850 P23301-24150	-	850
16-17 Aug.	Zapadni	10.5	1,050 P 5001-6050	1	1,049
17 Aug.	Zapadni Reef	9.0	900 P 7101-8000	-	900
		Total		7	9,993
			Second tagging		
23 Sept.	Reef	24.0	2,400 P11301-13700	3	2,397
26 Sept.	Polovina	10.0	1,000 P14801-15800	2	998
24 Sept.	Little Polovina	3.0	300 P16101-16400	-	300
24 Sept.	Northeast Point	25.0	2,500 P18901-21400	3	2,497
25 Sept.	Tolstoi	9.5	950 P22351-23300	-	950
25 Sept,	Lukanin- Kitovi	9.0	900 P14751-14800[1] and P24151-25000	-	900
20 Sept.	Zapadni	10.5	1,050 P 6051-7100	4	1,046
20 and 23 Sept.	Zapadni Reef	9.0	900 P 8001-8900	3	897
		Total		15	9,985
St. George Island					
22 and 24 Aug.	Zapadni	28.0	1,400 P1-1400	1	1,399
1 Sept.	North	38.0	1,900 P3101-5000	2	1,898
1 Sept.	Staraya	12.0	600 P1401-2000	2	598
17 and 25 Aug.	East	22.0	1,100 P2001-3100	2	1,098
		Total		7	4,993
		Grand total		29	24,971

1 Numbers 14751-14800 scheduled for Polovina Rookery were used on Lukanin-Kitovi.

Table 15.--Selected and known-age yearlings tagged, St. Paul Island, 1961-63

Year	Tag series and numbers[1]	Selected yearlings			Known-age yearlings given an additional tag		
		Males	Females	Total	Males	Females	Total
1961	M 1- 2,000	139	601	740	10	4	14
1962	N50,001-51,000	523	278	801	98	30	128
1963	O50,001-51,000	467	234	701	84	14	98

[1] Tags within the range of numbers given were used.

Table 16.--Number of seals selected for yearling tagging, by sex and rookery, St. Paul Island, 1963

[Number in parentheses indicate known-age yearlings; 16 seals identified as yearlings by checkmarks and tag scars are included]

Rookery	Males	Females	Totals
Zapadni.....	27 (4)	20 (0)	47 (4)
Zapadni Reef...	157 (16)	53 (3)	210 (19)
Reef.....	38 (15)	53 (4)	91 (19)
Northeast Point	108 (13)	47 (3)	155 (16)
Polovina.....	13 (2)	6 (0)	19 (2)
Tolstoi.....	71 (27)	33 (3)	104 (30)
Lukanin-Kitovi.	53 (7)	22 (1)	75 (8)
Total.....	467 (84)	234 (14)	701 (98)

3 and 4. The mean body lengths given in the figures compare favorably with data from 1962. Two known-age males exceeded the 100-cm. maximum length established for the tagging of selected yearling males. Two selected yearling females longer than 95 cm. were tagged on the basis of overall appearance.

Body lengths of selected and known-age yearling males and females are compared in figure 5. Although the length distribution of selected yearlings follows that of known-age animals, especially for males, bias may exist as a result of imposing maximum length limits.

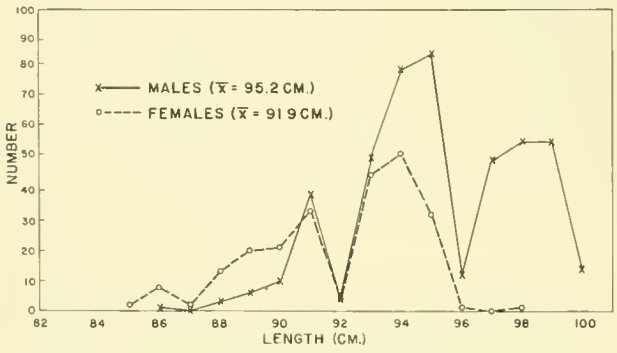

Figure 3.--Length classes of 701 selected yearlings, St. Paul Island, 1963.

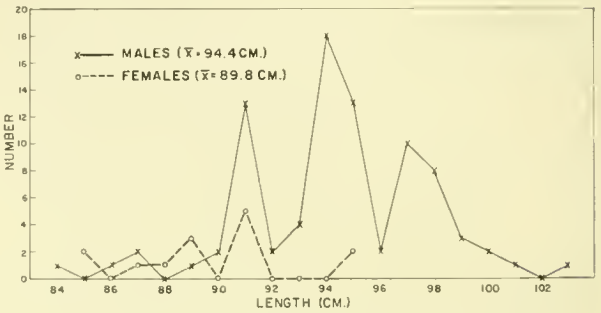

Figure 4.--Length classes of 98 known-age yearlings, St. Paul Island, 1963.

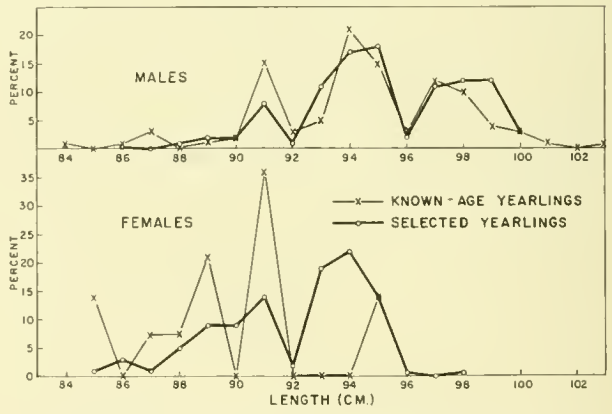

Figure 5.--Comparison of length classes of selected and known-age yearlings, St. Paul Island, 1963.

The homing tendency of known-age yearlings captured in 1963 is given in table 17 by rookery. Sixty-eight percent of the yearlings had returned to their "home" rookery. This figure compares with 80 percent in 1962 and 75 percent in 1961.

Discussion.--In 1963, yearlings were first tagged on 19 September. This was probably a week too early, since the availability of yearlings increased markedly by 30 September. The fourth week in September appears to be the optimum time to begin yearling tagging. Yearlings apparently prefer to haul

Table 17.--Homing tendency of known-age yearling seals, by sex and rookery, St. Paul Island, 1963

Rookery of tagging	Males			Females		
	Total recoveries	Recovered home rookery		Total recoveries	Recovered home rookery	
	Number	Number	Percent	Number	Number	Percent
Zapadni	4	3	75	-	-	-
Little Zapadni, Zapadni Reef	15	7	47	1	1	100
Reef	11	8	73	4	4	100
Tolstoi	22	18	82	3	3	100
Lukanin-Kitovi	6	4	67	1	-	-
Northeast Point	10	5	50	3	2	67
Polovina	2	1	50	-	-	-
Total	70	46	-	12	10	-
Percent	-	-	66	-	-	83

out to the rear of rookery areas, and also on certain hauling grounds. The tagging program and surveys in 1963 clearly established the following areas as favorites for yearlings:

(a) NEP - Sea lion Neck and Vostochni Rookery
(b) REEF - Above Castle Rock
(c) TOL - Eastern end and the area around rocks 15-16
(d) ZAP-REEF - Hauling ground and rookery
(e) ZAP - Area from rock 17 to rock 23

On several occasions, yearlings were seen along the shoreline with seals of other ages. They could not be captured because they escaped into the sea.

Because too frequent driving of the hauling grounds and rookeries reduces the number of yearlings available for capture, tagging should be done on only 3 days each week (such as Monday, Wednesday, and Friday). If yearling surveys (see following section) are conducted during the same period, tagging operations should be reduced to 2 days a week. The best areas can be completely covered in 1 day.

The overall restrictions of rookery accessibility, yearling behavior, and limited time holds the maximum number of yearlings obtainable to about 150 per day, 300 per work week, or 1,000-1,200 over a 5- or 6-week period. Apparently 5,000 yearlings cannot be tagged in one season.

The tagging program has provided some information on the movement of yearlings about the island: Three tagged on Northeast Point Rookery were recaptured 2, 12, and 28 days later at Zapadni Reef, Reef, and Northeast Point Rookeries, respectively; one tagged on Kitovi Rookery was recaptured 3 days later on Little Zapadni Rookery. Several yearlings were recaptured 2 days later near where they were tagged. Two of the known-age yearlings given additional tags were recaptured.

Sex ratios among yearlings examined in 1941,[4] 1961,[5] 1962, and 1963 are given in table 18. The discrepancy between sex ratios among selected yearlings was a result of the

[4] See footnote 2, page 15.
[5] See footnote 3, page 15.

Table 18.--Sex ratios among selected and known-age yearlings, St. Paul Island, Alaska, 1941 and 1961-63

[Numbers in parentheses are the total numbers of males and females from which the sex ratios were derived]

Year	Selected yearlings	Known-age yearlings
1941...	.....	684♂♂::100♀♀(41::6)
1961...	233♂♂::100♀♀(139::601)	475♂♂::100♀♀(19::4)
1962...	171♂♂::100♀♀(529::310)	327♂♂::100♀♀(98::30)
1963...	200♂♂::100♀♀(467::234)	600♂♂::100♀♀(84::14)

use in 1961 of body weight rather than length as the criterion of age. Although preferable over body weight, body length, as now used, is apparently not an accurate guide for selecting yearling females. Among known-age yearlings handled in 3 years, males have out-numbered females by an average of over 4 to 1 while among seals selected as yearlings the ratio was about 2 to 1. This means that over one-third of the selected females were actually older than yearlings. Only a reduction in the maximum length limit for females will reduce the error caused by the overlap in body lengths of yearlings and 2-year-old females.

Survey--Yearlings

There is no known way to predict accurately the number of 3-year-old seals that will return to the Pribilof Islands each year. In recent years, the return has varied from nearly 50,000 from the 1953 year class to less than 13,000 from the 1956 year class. If the assumption that each age class suffers its greatest mortality during its first winter at sea is correct, the relative abundance on land each fall of yearlings tagged as pups may provide an index to survival from birth to age 1. Thus, a means of roughly predicting the return of 3-year-olds will be available. As a beginning to this approach, five weekly counts of tagged yearlings were made on St. Paul Island in 1963.

Methods.--Two to three men walked slowly in a line perpendicular to the water's edge, forcing seals from the rookery or hauling ground to move toward the sea within sight of two or three observers. The observers captured each tagged yearling seen, recorded the tag number and sex, then released the animal. Descriptions of rookery and hauling ground sampling areas used for the surveys are given in table 19. The first survey, made prior to the selection of sampling areas, required nearly 2 days to complete; each of four subsequent surveys made required about 7 hours.

Results.--The tagged yearlings found on each area are listed in table 20 by date and sex. Yearlings were apparently most abundant during 27 September to 11 October. Of the 73 tagged yearlings captured, 65 were males and 8 were females. This preponderance of eight males to one female is greater than the average of four males to one female found among tagged yearlings captured during tagging in 1961, 1962, and 1963.

The mean number of tagged yearlings caught per hour increased from 0.80 in 1961 to 3.06 in 1962; the ratio in 1963 was 2.33 per hour. A similar comparison results even if other than total periods are used. Using 27 September through 11 October, for instance, the mean values for the years 1961, 1962, and 1963 were 1.00, 3.34, and 2.87, respectively.

Table 19.--Description of rookery and hauling ground sampling areas surveyed for tagged yearling counts, St. Paul Island, 1963

Rookery[1]	Area description
NEP.....	Sea Lion Neck and Morjovi to Rock 36; Vostochni from Rock 53 to Rock 62.
POL.....	Cliffs area north from access road; also "field" hauling ground.
KIT.....	Hauling ground east to Rock 8.
GOR.....	Rock 9 to Rock 1.
REEF....	Rock 8 to Rock 28.
TOL.....	Rock 2 to Rock 15.
ZAP REEF	Hauling ground.
L. ZAP..	Hauling ground to Rock 15.
ZAP.....	Southwest Bay to Rock 25.

[1] NEP through REEF were surveyed in the morning; TOL through ZAP were surveyed in the afternoon.

Discussion.--About the same number of tagged yearlings were counted each week from 27 September to 11 October. The reduced number of yearlings found on 17 October agreed with the observation that few seals were using the hauling grounds after 15 October. Seals were numerous on the rookeries, however.

Use of specific areas for each survey tended to equalize the number of seals handled in each drive and permitted a survey of all areas in 1 day. Surveys were postponed during bad weather because many seals remain in the sea during periods of heavy rainfall.

Yearlings and 3-year-old seals are tagged on the same flipper; however, 3-year-old seals have a different checkmark and tag series and are usually larger than yearlings. When necessary, the checkmark can be used to identify small 3-year-old seals without capturing them.

The survey crew must be supervised to ensure that the data on age, sex, and abundance of yearlings are accurately determined and recorded. In addition, yearling surveys must be coordinated with other activities on the rookeries so that the seals are not disturbed for at least 1 day before a survey.

A series of surveys similar to those in 1963 should be made in 1964 to establish more clearly the best period for surveying tagged yearlings. Comparable results in 1963 and 1964 would suggest that three counts from 27 September to 11 October would be satisfactory.

Tag loss and the proportional return of yearlings to land must be constant from year to year if the counts are to provide a satisfactory index to the survival of an age class

Table 20.--Tagged yearlings counted, by rookery, date, and sex, St. Paul Island, 1963

Rookery	17-18 September		27 September		3 October		11 October		17 October	
	♂	♀	♂	♀	♂	♀	♂	♀	♂	♀
NEP.....	3	-	4	-	4	1	6	-	1	-
POL.....	1	-	1	-	-	-	1	-	-	-
GOR.....	-	-	-	-	-	-	1	-	-	-
REEF.....	1	-	2	-	1	-	1	-	1	1
KIT.....	1	1	-	1	-	1	3	-	-	-
TOL.....	1	-	3	-	6	2	4	-	4	-
ZR.....	1	-	5	-	3	-	1	-	-	-
L. ZAP.....	-	-	-	-	-	-	-	-	-	-
ZAP.....	-	-	1	-	-	-	2	-	2	1
Total....	8	1	16	1	14	4	19	-	8	2

from birth to age 1. Only after the annual counts are correlated with the return of the same age classes at age 3 can the technique be evaluated as an indicator of returns at age 3.

Appraisal of Problems Involved in Tagging and Tag Recoveries

Several factors that bias population estimates were presented in the report for 1959.[6] Additional factors and the results of studying these problems have been given in subsequent reports[7,8] and in Roppel, Johnson, Bauer, Chapman, and Wilke (1963).

Following is a summary of the factors studied since 1959 and the changes made or needed to improve the tagging and tag recovery program:

Mortality differential between sexes.--Reliable information on differences in mortality between males and females is difficult to obtain. Because the heaviest mortality occurs at sea and before age 3, the best source of information on differential mortality should be from the pelagic research kill. The data collected to date, however, are inconclusive because the number of 1- and 2-year-old seals taken at sea has been inadequate.

Segregation by sex at the time of tagging.--An analysis of 8,522 tags recovered during the years 1956-59 from E, F, G, H, and I series showed that the sexes are not segregated at the time of tagging.

Effects of tagging.--Stress, physical injury from handling and from tags and checkmarks, and fatigue due to driving pups are possible causes of extra mortality among tagged pups. This extra mortality, however, is difficult to assess because much of it may be delayed until after the pups have gone to sea.

From 1955 through 1962, about 30 men tagged 50,000 to 60,000 pups each year. Because the rather high-speed operation caused mortality and resulted in poor tag placement, only 25,000 pups were tagged in 1963. Barricades were used only on the larger rookeries. Tables were not used at all, thereby avoiding the need to drop or throw the pups after they were tagged. Pups were driven very little. A 3- to 7-man crew tagged half (12,500) the pups; 10,000 pups were tagged by 14 men and 2,500 were tagged by 10 men. These changes probably improved tagging quality and eliminated most of the immediate extra mortality of tagged pups.

Application of tags.--Prior to 1963, tag placement ranged from very poor to excellent, depending upon the skill of the person doing the tagging and speed of the operation. To avoid muscle and bone, tags should be attached

[6] Carl E. Abegglen, Alton Y. Roppel, and Ford Wilke. 1959. Alaska Fur Seal Investigations, Pribilof Islands, Alaska, Report of field activities, June-September 1959. Marine Mammal Biological Laboratory, Seattle, Wash. [Manuscript report.]

[7] Carl E. Abegglen, Alton Y. Roppel, and Ford Wilke. 1960. Alaska Fur Seal Investigations, Pribilof Islands, Alaska, Report of field activities, June-October 1960. Marine Mammal Biological Laboratory, Seattle, Wash. [Manuscript report.]

[8] Carl E. Abegglen, Alton Y. Roppel, Ancel M. Johnson, and Ford Wilke. 1961. Fur Seal Investigations, Pribilof Islands, Alaska, Report of field activities, June-November 1961. Marine Mammal Biological Laboratory, Seattle, Wash. [Manuscript report.]

Table 21.--Checkmarks overlooked compared to the number available,[1] Pribilof Islands, Alaska, 1961-63

Year and checkmark type	St. Paul Island			St. George Island		
	Checkmarks available	Checkmarks overlooked		Checkmarks available	Checkmarks overlooked	
	Number	Number	Percent	Number	Number	Percent
1961						
"V" notch.....	1,558	481	30.9	-	-	-
Slice.....	64	17	26.6	-	-	-
1962						
"V" notch.....	574	258	44.9	88	21	23.9
Slice.....	737	115	15.6	127	9	7.1
1963						
"V" notch.....	224	119	53.1	45	7	15.6
Slice.....	932	211	22.6	311	21	6.8

[1] These data are from male seals taken from 2 July to 15 August in 1961 and from 2 July to 5 August in 1962 and 1963.

a half to three-quarters of an inch from the rear edge of the front flipper where furred skin ends and bare skin begins. Tags attached this close to the edge, however, are vulnerable to loss because there is only a narrow strip of skin holding them in place. Tags clinched through muscle tissue are held more firmly in place, but shock, infection, slowed growth, and death of the pups may result.

In 1963, application of fewer tags and use of a small tagging crew improved quality of tagging. Preliminary results of post mortem examinations indicate that most of the tagged pups found dead died from causes other than tagging.

Application of checkmarks.--The veining chisels formerly used to make the "V" notch checkmark were replaced in 1961 with veterinary ear notching instruments. The latter tool is superior because it remains sharp through thousands of "cuts" and makes uniform checkmarks. Quality of checkmarks made with the ear notching instrument will be appraised when pups from the 1962 year class return as 2-year-olds in 1964 and as 3-year-olds in 1965.

For making the slice type of checkmark, knives were replaced with sheep shears in 1963. Although satisfactory checkmarks can be made with knives, use of sheep shears avoids the need for a wooden surface to cut against. Also, the sheep shears do not dull as easily as knives.

Quality of tags.--The new style 49M tags supplied by the manufacturer for pup tagging in 1963 were very satisfactory. Less than 50 of 25,000 tags failed to be clinched when first used. In 1960, several hundred of 60,000 tags used could not be clinched. Although most of these clinched after straightening, the entire 1960 lot of tags was generally unsatisfactory.

Recovery of tags and checkmarks.--Since 1960, all carcasses have been re-examined on St. Paul Island in a search for tags and checkmarks overlooked by the tag-recovery crew. While less than 0.5 percent of the available tags have been overlooked, checkmarks are most difficult to detect. Some comparisons of recovered and overlooked checkmarks are made in table 21. Carcasses were first re-examined on St. George Island in 1962.

Tagged seals without checkmarks.--Table 22 shows the results of some appraisals on the number of tagged seals without checkmarks. Replacement of veining chisels and knives with veterinary ear-notching instruments and sheep shears is expected to eliminate vague checkmarks.

Results of Double Tagging

In 1958 (K-series tags), 5,000 seal pups were double tagged on St. Paul Island to provide a basis for determining the rate of tag loss. Recoveries of survivors in 1961, 1962, and 1963 are listed in table 23.

Table 22.--Tagged male and female seals without checkmarks, Pribilof Islands, Alaska, 1963

Year and checkmark type	Tagged seals examined	Tagged seals without checkmarks	
	Number	Number	Percent
	St. Paul Island		
1962			
"V" notch..	91	6	6.6
Slice.....	66	2	3.0
1963			
"V" notch..	52	4	7.7
Slice.....	923	21	2.3
	St. George Island		
1963			
"V" notch..	43	1	2.3
Slice.....	344	4	1.2

Analysis of the data showed that the rate of tag loss among males differed from year to year ($P < .005$), but that the difference in rate of loss between males and females recovered in 1962 and 1963 was not significant ($P > .25$).

Therefore, data for the sexes were combined and the probabilities of tag loss among double-tagged seals calculated for the years 1961-63 (table 24). The probabilities of tag loss among recoveries of all males double tagged and single tagged on St. Paul Island in 1958 are also included in the table. Males that had lost their single tag were identified by their checkmarks. The estimates from both groups were similar in that the rate of tag loss increased with age from about 25 percent at age 3 to 50 percent at age 5.

Homing Tendency

Homing tendency of tagged male and female seals is shown in table 25 by age and in table 26 by rookery.

Table 23.--Summary of double-tagged seals recovered from the kill, St. Paul Island, 1961-63

Condition	Year			Total
	1961	1962	1963	
	Age 3	Age 4	Age 5	
	Males			
Both tags present	285	52	5	342
Loss of one tag..	157	68	13	238
Loss of both tags	-	1	1	2
	Females			
Both tags present	4	19	18	41
Loss of one tag..	2	17	28	47
Loss of both tags	-	-	-	-
	Both sexes			
Both tags present	282	71	23	383
Loss of one tag..	159	85	41	285
Loss of both tags	-	1	1	2

Table 24.--Probability of tag loss among double-tagged seals of both sexes and among double- and single-tagged males, St. Paul Island, 1961-63

	Year		
	1961	1962	1963
	Age 3	Age 4	Age 5
From 670 double-tagged seals of both sexes...	0.216	0.374	0.471
From 582 double- and 4,806 single-tagged males.....	.267	.344	.546

Table 25.--Homing tendency of male and female seals, by age, Pribilof Islands, Alaska, 1963

Males				Females			
Age	Total recoveries	Recovered home rookery		Age	Total recoveries	Recovered home rookery	
Years	Number	Number	Percent	Years	Number	Number	Percent
2	134	53	40	2	44	34	77
3	1,417	702	50	3	195	159	81
4	797	462	58	4	240	196	82
5	119	94	79	5	379	323	85
6	33	22	70	6	103	81	79
				7	47	42	89
				8	82	64	78
				9	17	10	59
				10	3	1	33
				10+	80	60	75

Table 26.--Homing tendency of male and female seals, by rookery, Pribilof Islands, Alaska, 1963

Rookery of tagging	Males			Females		
	Total recoveries	Recovered home rookery		Total recoveries	Recovered home rookery	
	Number	Number	Percent	Number	Number	Percent
		St. Paul Island				
NEP.....	462	343	74	328	317	97
TOL.....	249	60	24	22	7	32
L-K.....	168	82	49	19	-	-
ZAP-1.....	492	331	67	203	169	83
REEF.....	441	177	40	252	192	76
POL.....	263	116	44	159	109	68
			Mean			Mean
Total.....	2,075	1,109	53	983	794	81
		St. George Island				
ZAP-2.....	99	40	40	37	27	73
NOR.....	176	109	62	122	114	93
EAST.....	84	54	64	17	8	47
STAR.....	66	21	32	31	27	87
			Mean			Mean
Total.....	425	224	53	207	176	85

MORTALITY

In recent years, counts of dead pups on land have varied from 119,505 in 1956, to 37,740 in 1958, to 74,702 in 1960 and, finally, to 39,239 in 1963. Mortality of pups on land, although considerable, is much less than that which occurs at sea.

Wide fluctuations in the annual male kill are the result of variation in ocean mortality. Therefore, a basis for predicting ocean mortality must be established if accurate forecasts of the kill are to be made.

As an approach to this problem, a veterinarian was added to the staff of the Marine Mammal Biological Laboratory in 1962 to investigate causes of mortality on land and to determine if some land-originated factor or factors can be linked to ocean mortality. If such factors exist, their identification and a means of measuring their influence on ocean survival would be a valuable contribution toward an understanding of the population dynamics of fur seals.

Veterinary studies in 1963 included pathology, bacteriology, parasitology, nutritional requirements of pups, and anatomy and physiology of the fur seal. A separate report will be made on these studies.

Table 27.--Dead-pup counts, Pribilof Islands, Alaska, 1963

Rookery	Dead pups
St. Paul Island	
Northeast Point:	
Morjovi	2,348
Vostochni	5,057
Polovina:	
Little Polovina	923
Polovina Cliffs	2,160
Polovina	1,237
Reef:	
Ardiguen	141
Gorbatch	2,431
Reef	5,688
Kitovi	881
Lukanin	546
Tolstoi	3,274
Zapadni:	
Little Zapadni	2,580
Zapadni Reef	718
Zapadni	4,614
Counted total	32,598
5-percent addition	1,630
Estimated total	34,228
St. George Island	
North	2,525
Zapadni	704
East	502
Staraya Artil	1,041
Counted total	4,772
5-percent addition	239
Estimated total	5,011
Summary - 1963	
Pribilof Islands counted total	37,370
5-percent addition	1,869
Estimated total	39,239

Total Dead-Pup Counts

Pup mortality in 1963 decreased by 28 percent of the 1962 count on St. Paul Island and by 19 percent on St. George Island (table 27). The 1963 level is only slightly above that of 1958, the lowest year since the beginning of complete dead-pup counts in 1953. Dead-pup counts made since 1941 are presented in appendix table 15.

A record of tagged pups found dead on Pacific coast beaches since 1948 is given in table 28. The data, however, are not usable for estimating ocean mortality because the sample is small and there is no certainty that recovery effort and the rate that seals wash ashore are consistent each year.

Table 28.--Tag recoveries from dead pups or yearlings reported by the public along the Pacific coast, 1948-63

Year recovered	Tag series	Number
1948	A	4
1949	B	2
1950	CS	29
1953	E	1
1954	F	18
1955	G	8
1956	H	3
1957	I	3
1958	J	21
1959	K	24
1960	L	11
1961	M	21
1962	N	22
1963	O	5

Dead-Pup Counts on Sample Areas

Counts of dead pups on the sample areas were continued in 1963 as a part of the annual dead-pup counts (tables 29 and 30).

Table 29.--Dead-pup counts, sample areas, St. Paul Island, 1963

Rookery	Dead pups
Northeast Point:	
Morjovi	874
Vostochni	1,237
Polovina:	
Little Polovina	496
Polovina	991
Polovina Cliffs	413
Reef:	
Gorbatch	908
Reef, Area 1 (North)	499
Reef, Area 2 (South)	1,187
Tolstoi	1,007
Zapadni:	
Little Zapadni	940
Zapadni	2,018
Total	10,570

Estimates From Tagged Males

The tag lost to tagged ratios for 3-, 4-, and 5-year-old males were similar for both islands. Differences between islands in the tag lost to tagged ratios among 2-year-old males and females were observed. The ratio for males taken on St. Paul Island was 5.00:1 and for those taken on St. George Island, 0.62:1. The ratios for females were 1.74:1 for St. Paul Island and 0.08:1 for St. George Island.

The proportion of 2-year-old males that were marked was also different for the two islands. Of 667 killed on St. Paul Island, 126 or 19 percent were tagged or had lost their tags; only 52 or 11 percent of 489 2-year-old males taken on St. George Island were marked. There is no apparent reason for these discrepancies other than the possibility that some natural marks or scars were mistaken for the true "V-notch" checkmark of the 2-year-old. Changes in the 1963 data will be made, however, only if data collected in 1964 indicate a valid reason for doing so.

Table 30.--Percent of complete rookery dead-pup counts represented by sample-area counts, St. Paul Island, 1956-63

Rookery	1956	1957	1958	1959	1960	1961	1962	1963
	Percent							
Morjovi	42.0	33.1	29.8	30.8	45.1	44.8	40.1	37.2
Vostochni	20.6	25.1	14.4	29.0	22.7	23.0	21.8	24.5
Little Polovina[1]	51.6	55.5	61.3	56.0	51.4	49.0	-	53.7
Polovina[1]	26.3	36.6	48.5	42.3	65.7	67.6	-	41.3
Gorbatch	33.1	31.0	68.8	38.6	30.0	30.1	45.6	37.4
Reef	30.2	25.6	46.3	31.0	26.7	28.2	24.5	29.6
Tolstoi	52.3	43.8	48.4	44.9	35.9	40.4	44.3	30.8
Little Zapadni	39.2	28.3	30.0	31.6	30.7	32.2	33.0	36.4
Zapadni	51.3	52.2	50.9	47.7	51.5	49.7	44.4	43.7

[1] Sample areas not counted separately in 1962.

POPULATION ESTIMATES

The data for making estimates of the pup population are derived from three sources: (1) The proportion of each age class taken in the kill that was tagged or had lost tags; (2) the marked to unmarked ratio in samples of live pups; and (3) the total count of pups on one rookery. Estimates based on the recovery of tags and checkmarks from the kill have been made since 1947. Sampling of live pups began in 1961 and has been continued as an experimental technique for estimating the number of pups the year they are born. A total count of live pups on a single rookery was attempted in 1963 for the first time since 1951.

Because male seals from a given year class are taken at various ages (2-6) over a period of 5 successive years, all or parts of the kill and tag recovery data can be used to estimate the size of the pup population from which the animals were derived. The estimates of each year class shown in table 31 were based on the kill of each age class in 1963. Data recovered from the 1958-60 year classes at ages 3 and 4 were combined to make the estimates given in table 32. The combined kill and tag recovery data obtained from a year class at all ages can also be used to make pup population estimates.

Table 31.--Estimates of the pup population at time of tagging based on recovery of tagged and tag-lost male seals, Pribilof Islands, Alaska, 2 July to 5 August, 1963

Year class	Killed 2 July to 5 August 1963 (n)	Tagged (t)	Tagged and tag-lost recoveries (s)	Population estimate (N)
	Number	Number	Number	Number
1958.....	2,061	49,917	266	385,500
1959.....	18,394	49,881	1,363	672,700
1960.....	17,986	59,981	2,004	538,100
1961.....	1,156	49,921	178	322,700

Table 32.--Estimates of pup population at time of tagging based on recovery of tagged and tag-lost 3- and 4-year-old male seals, Pribilof Islands, Alaska, 1958-60 year classes

Year class	Killed at ages 3 and 4 (n)	Tagged (t)	Tagged and tag-lost recoveries (s)	Population estimate (N)
	Number	Number	Number	Number
1958.....	74,890	49,917	5,409	691,018
1959.....	48,596	49,881	3,324	729,057
1960[1]....	17,986	59,981	2,004	538,094

[1] Date from age 3 only.

The estimates were made using the modified Petersen formula:

$$N = \frac{(n+1)(t+1)}{(s+1)}$$

Where: n = number of animals killed from age class,
t = number of tags applied to year class,
s = number of tagged and tag-lost animals recovered, and
N = estimated number of pups at time of tagging.

Several conditions suggest that the most reliable of the three estimates is that which uses the data collected at ages 3 and 4. These are: (1) Lower and upper length limits restrict the kill to large 2-year-old and small 5- and 6-year old seals, (2) 2-, 5-, and 6-year-old seals may not be accurately represented in collections of teeth because seals of these ages make up only about 10 percent of the kill; 3- and 4-year-old males are well represented, (3) the clubbers may unconsciously select tagged 2-, 5-, and 6-year-old seals for killing, but allow untagged animals of the same sizes to escape.

The estimates of the total number of pups born (table 33) show a substantial decrease

Table 33.--Estimates of the number of pups born, Pribilof Islands, Alaska, year classes 1951-61

Year class	Estimated number of pups alive at time of tagging	Dead pup count	Estimated number of pups born
1951...	484,000	86,000	[1] 570,000
1952...	529,000	87,000	[1] 616,000
1953...	704,000	91,000	[1] 795,000
1954...	727,000	111,000	[1] 838,000
1955...	778,000	90,000	[1] 868,000
1956...	872,000	120,000	[1] 992,000
1957...	637,000	75,000	[1] 712,000
1958...	[2] 691,000	38,000	729,000
1959...	[2] 729,000	49,000	778,000
1960...	[2] 538,000	75,000	613,000
1961...	[3] 323,000	71,000	394,000

[1] Douglas G. Chapman. 1961. Preliminary report on the population analysis of Pribilof fur seal herd. In Carl E. Abegglen, Alton Y. Roppel, Ancel M. Johnson, and Ford Wilke. Fur seal investigations, Pribilof Islands, Alaska, Report of Field Activities, June-November 1961. Marine Mammal Biological Laboratory, Seattle, Wash. /Manuscript Report./

[2] Table 32 of this report, above.

[3] Table 31 of this report, above.

in 1960 and 1961. As previously pointed out, however, the estimate for 1961 is based on questionable data recovered at age 2.

Estimates From Tagged Females

As for males, the tag lost to tagged ratios among females taken on the two islands were compared. The ratios were similar for 4- and 5-year-old females, but were higher for 2-year-old females taken on St. Paul Island and higher for 3-year-olds killed on St. George Island. Only 14 2-year-old females with tags or checkmarks were recovered on St. George Island. This number is not adequate to provide a valid comparison. There is no apparent reason for the difference among 3-year-old females. Because errors, if they exist, could not be identified, changes in the total recoveries were not made.

Estimates of the pup populations given in table 34 are based on data obtained from the kill of female seals. Estimates of the 1958 and 1959 year classes are much higher than are those based on data obtained from the kill of males. The estimates for the 1960 and 1961 year classes are only slightly higher than estimates based on data from males.

Table 34.--Estimates of the fall pup population from female tag recoveries, Pribilof Islands, Alaska, year classes 1958-61

Year class	Killed 13 August to 12 September 1963 (n)	Tagged (t)	Tagged and tag-lost recoveries (s)	Population estimate (N)
	Number	Number	Number	Number
1958....	8,440	49,917	482	872,376
1959....	7,855	49,881	455	859,371
1960....	2,912	59,981	293	594,311
1961....	699	49,921	99	349,454

Estimates From Pup Sampling

Since 1961 the pup population has been estimated from a marked to unmarked ratio obtained by sampling the live pups on all St. Paul Island rookeries. The marked pups used for the ratio in 1961 and in 1962 were those tagged with monel tags during the regular tagging program. The tagged pups, however, were difficult to identify during sampling and were concentrated in certain locations on the rookeries. These disadvantages were eliminated in 1963 by shearing the fur from the heads (fig. 6) of 21,919 pups and by distributing the marking effort throughout the rookeries. Also, the pups were marked in late July and early August when they are not yet moving about the rookery and before many have begun to enter the water. Before shearing, a total of 20,000 marked pups were proportioned to the rookeries according to the distribution of the harem bulls. On most rookeries, however, the allotment was exceeded.

As in previous years, the pup population was sampled by obtaining a marked to unmarked ratio from groups of 25 pups counted at regular intervals along lines located on the ground perpendicular to the water's edge. The population was sampled 19-21 August and again on 26 and 27 August to determine the effect of time on the estimate and to determine if the estimates from the two periods were consistent.

During the second sampling period, counting was more difficult, and the number of available samples decreased because the pups were more active in going to and into the water.

The estimates from the two periods differ by only 5,625 or 2.4 percent of the average of 229,900 (table 35). The estimates for individual rookeries differ by amounts varying from 4 to 21 percent of the average estimate for that rookery.

The number of pups per harem bull was determined from the average of the two estimates (table 36). There were no exceptionally large differences between rookeries; only for two rookeries did the number of pups per harem bull differ from the mean by more than five.

Table 37 lists estimates of the St. Paul Island pup population for 1961, 1962, and 1963 by rookery. Estimates for the 3 years are of the same general magnitude even though the method was changed.

The live pups on Little Polovina were counted 11 August in 1963 as a check on the accuracy of estimates from pup sampling. Beginning at one end of the rookery, successive pods of pups were rounded up and individuals of each released slowly between two observers for counting. Few pups willingly entered the water on 11 August. The counts of the two observers averaged 7,230. This count is believed to have an error of less than ± 10 percent. Experience gained in counting live pups should result in less error in the future. The estimate for

Figure 6.--Pup shearing, St. Paul Island, 1963.

Little Polovina from pup sampling was 6,500, 89.9 percent of the counted total.

Annual counts of the live pups on Kitovi amphitheater have been made since 1959. In 1963, the count was 1,106 and the average estimate from pup sampling 1,200, a difference of less than 10 percent.

The estimate of the pup population at the time of sampling on St. Paul Island was increased from 229,900 to 255,700 to compensate for the difference between the count and the sampling estimate on Little Polovina. An estimate of 316,000 for both islands was obtained by dividing 255,700 by 0.81, the average percentage share of harem bulls found on St. Paul Island. No corrections were made for pups that died before shearing, possibly 20,000 or more.

The count of live pups on Little Polovina, the harem-bull count, and the dead-pup count can be used to make two additional estimates of the pup population.

Assuming that the number of pups per harem bull is a constant, an estimate of the total number of pups can be calculated from the ratio:

$$\frac{n}{hb} : \frac{N}{HB} \qquad (1)$$

Where:

- n = number of pups counted on Little Polovina
- hb = number of harem bulls on Little Polovina
- HB = total number of harem bulls on all St. Paul Island rookeries
- N = total pup population on St. Paul Island

The estimated pup population for St. Paul Island from these data is 237,000.

Assuming that the mortality rate of pups on land is constant for all rookeries for any one year, an estimate of the pup population can be calculated from the following equation:

$$an = .0362\, aN \qquad (2)$$

Where:

- a = land mortality rate for a year
- n = counted pups on Little Polovina
- 0.0362 = the average proportion of total land mortality occurring on Little Polovina based on dead-pup counts from 1953 through 1963
- N = total pup population on St. Paul Island

Equation (2) becomes: $n = .0362N$, from which N is estimated to be 200,000.

The validity of the two assumptions necessary to make the estimates from equations (1) and (2) is not known.

Discussion of Estimates

A difference in the mortality rate of tagged and untagged animals is thought to be the only important, unmeasured factor that may affect pup population estimates based on tag recovery data. Differences in weight of tagged and untagged pups and 3-year-old males have

Table 35.--Estimates of the fall pup population from marked to unmarked ratios obtained after shearing, St. Paul Island, year class 1963

Rookery	Seals sheared	First sampling period, 19-21 August			Second sampling period, 26-27 August			Average of two estimates [1]
		Samples	Mean proportion sheared in sample	Estimated pup population at time of shearing	Samples	Mean proportion sheared in sample	Estimated pup population at time of shearing	
	Number	Number	Percent	Number	Number	Percent	Number	Number
Reef	2,900	108	.0893	32,489	89	.0863	33,608	33,000
Gorbatch-Ardiguen	2,491	69	.1020	24,414	57	.1193	20,880	22,600
Polovina	600	25	.1440	4,167	16	.1425	4,211	4,200
Polovina Cliffs	1,645	73	.0789	20,849	54	.0896	18,353	19,600
Little Polovina	627	22	.0964	6,507	15	.0960	6,531	6,500
Morjovi	1,738	64	.1019	17,059	59	.0990	17,559	17,300
Vostochni	3,664	130	.1114	32,896	97	.1002	36,563	34,700
Tolstoi	2,165	76	.0995	21,765	74	.0849	25,513	23,600
Zapadni	2,396	96	.0783	30,587	84	.0700	34,229	32,400
Little Zapadni	918	72	.0656	14,002	57	.0674	13,626	13,800
Zapadni Reef	943	18	.1667	5,658	22	.1382	6,824	6,200
Lukanin	549	15	.0960	5,719	22	.1182	4,645	5,200
Kitovi	1,283	45	.1147	11,189	45	.1236	10,384	10,800
Total	21,919	813		227,301	691		232,926	229,900

1 Average of first and second estimate to nearest 100. Pups of the year class that died on land before shearing are not included.

Table 36.--Estimates of the number of pups per harem bull, St. Paul Island, 1963

Rookery	Estimated pup population at time of shearing[1]	Harem bulls	Pups per harem bull[2]
	Number	Number	Number
Reef.....	33,000	1,310	25
Gorbatch-Ardiguen.	22,600	896	25
Polovina.....	4,200	239	18
Polovina Cliffs...	19,600	713	27
Little Polovina...	6,500	281	23
Morjovi.....	17,300	724	24
Vostochni.....	34,700	1,591	22
Tolstoi.....	23,600	893	26
Zapadni.....	32,400	984	33
Little Zapadni....	13,800	565	24
Zapadni Reef.....	6,200	248	25
Lukanin.....	5,200	221	24
Kitovi.....	10,800	547	20
Total.....	229,900	9,212	25

[1] Average estimates from table 35, page 28.
[2] Pups of the year class that died on land before shearing are not included.

Table 37.--Estimates of the numbers of pups based on marked to unmarked ratios obtained after tagging in 1961 and 1962 and after shearing in 1963, St. Paul Island, year classes 1961-63

Rookery	1961[1]	1962[1]	1963[1]
Reef.....	85,700	52,800	55,600
Polovina.....	21,600	22,900	23,800
Little Polovina	7,500	7,200	6,500
Northeast Point	47,400	36,700	52,000
Tolstoi.....	34,800	19,300	23,600
Little Zapadni.	18,900	19,200	20,000
Zapadni-Zapadni Reef.....	38,000	33,600	32,400
Lukanin-Kitovi.	22,100	11,900	16,000
Total.....	276,000	203,600	229,900

[1] Pups of the year class that died on land before tagging or shearing are not included.

shown that seals are affected by tagging. However, a means of measuring the quantitative affect of tagging on the mortality rate is not apparent. Mortality of tagged animals above that of untagged seals would inflate pup population estimates based on tag recovery data.

In sampling pups for a marked to unmarked ratio, observers may unconsciously ignore unmarked animals in favor of the more prominent marked seals. If true, the pup population will be underestimated. The reliability of estimates based on sampling was partially checked in 1963 by counting all live pups on Little Polovina Rookery. The number of pups estimated from sampling was only 89.9 percent of the number counted. Accordingly the estimate of the total number of pups on St. Paul Island was adjusted upward. Counts of live pups on several St. Paul Island rookeries are planned for 1964 to provide a more representative correction factor.

Two estimates of the total pup population on St. Paul Island were calculated on the basis of the complete count of pups on Little Polovina Rookery. These estimates, however, are based on two questionable assumptions: (1) That the number of pups per harem bull is a constant and (2) that the mortality rate of pups on land is constant for all rookeries for any one year.

Choice of one estimate as the best among those available is a matter of preference, depending on how much importance is placed on known or possible bias inherent in each. That the actual pup population in 1963 lies between the estimate from tag recoveries (613,000 for 1960) and the estimate from live pup sampling (316,000 for 1963) can safely be assumed. Although the estimate from live pup sampling has been corrected on the basis of bias known to exist on one rookery, the magnitude may be underestimated. A 20-percent bias would increase the pup population on the Pribilof Islands in 1963 to 355,000, and 30 percent, to 405,000. An error greater than 30 percent for all rookeries is believed to be highly improbable.

A maximum limit of error in an estimate based on tag recoveries cannot be determined.

The figure of 400,000 is presented as the best estimate of the 1963 pup population.

SEAL-PUP WEIGHTS

Since 1957, seal pups have been weighed annually on St. Paul Island to determine if individuals from a given year class vary in weight (body condition) from those of another. Differences, if they exist, may be useful in forecasting the survival (return) of year classes through age 4. Although data from year classes 1957-59 suggest a positive correlation between mean weight of pups and return of male seals (table 38), the technique cannot be fully evaluated until the return from more year classes is complete.

Important secondary information has been obtained from the weighing program through the discovery that tagged pups weigh less than untagged pups. This weight loss has been observed each year (average 0.57 kg.) from 1957 through 1963 and in two additional weighings

Table 38.--Mean weight of untagged pups and male return, Pribilof Islands, Alaska, year classes 1957-59

[Numbers in parentheses are the number of pups in each sample]

Year class	Mean weight		Return of males
	Males	Females	
	Kg.	Kg.	Thousands
1957....	8.7 (391)	7.7 (351)	53
1958....	11.4 (127)	9.9 (121)	80
1959....	9.4 (444)	8.1 (386)	55

conducted 29 and 51 days after the first in 1962. A complete analysis of the 1962 and 1963 data was made by comparing the mean weight of tagged and untagged pups by analysis of variance where the numbers in the groups (to be compared) were equal. The approximate method (Snedecor, 1956) using unweighted means was used where the numbers in the groups (to be compared) were unequal. The comparisons were made within each of the three groups of pups weighed in 1962.

The results of the analysis showed that tagged pups weighed less than untagged pups ($P<.01$) for all three groups weighed in 1962 and for the single group weighed in 1963. The effect of weight loss on survival of tagged pups is unknown.

The mean weight of tagged and untagged seal pups are given in table 39 by rookery and by sex for 1963 and in table 40 by sex for the years 1957-63.

The pups have been weighed approximately 1 week after tagging during the period 30 August to 2 September. Appendix table 13 lists the numbers and corresponding weights of tagged pups by rookery and by sex.

Table 39.--Mean seal pup weights, St. Paul Island, 1963

Rookery	Males				Females			
	Untagged		Tagged		Untagged		Tagged	
	Weight	Seals in sample	Weight	Seals in sample	Weight	Seals in sample	Weight	Seals in sample
	Kg.	Number	Kg.	Number	Kg.	Number	Kg.	Number
NEP.....	9.14	75	8.82	75	8.38	75	7.61	74
REEF.....	9.42	75	8.26	75	8.29	75	7.46	72
ZAP.....	8.94	75	8.24	74	7.60	75	7.28	75
POL.....	8.17	75	7.95	75	7.60	75	6.91	75

Table 40.--Mean seal pup weights[1] approximately 1 week after tagging, St. Paul Island, 1957-63

[In Kilograms]

Group	1957	1958	1959	1960	1961	1962	1963
Males:							
Tagged.....	7.9 (262)	-	9.0 (182)	9.2 (211)	8.0 (186)	8.4 (300)	8.3 (299)
Untagged.....	8.7 (391)	11.4 (127)	9.4 (444)	9.8 (372)	8.5 (381)	9.2 (300)	8.9 (300)
Females:							
Tagged.....	7.4 (196)	-	8.0 (188)	8.4 (254)	7.2 (167)	7.6 (300)	7.3 (296)
Untagged.....	7.7 (351)	9.9 (121)	8.1 (386)	9.1 (363)	8.0 (466)	8.2 (300)	8.0 (300)

[1] Numbers in parentheses are the number of pups in each sample.

MEASUREMENTS OF 3-YEAR-OLD MALES

The mean lengths and weights of tagged and untagged 3-year-old males are presented by round for the years 1962 and 1963 in table 41. The measurements of tagged and untagged males were compared by the approximate method (Snedecor, 1956) using unweighted means. The effect of tagging, of rounds, and of the interaction between rounds and tagging were separated by the analysis. Untagged seals were significantly longer than tagged seals for both years ($P<.01$). The average difference in length was 1.67 cm. Untagged seals were also heavier than tagged seals in 1962 and 1963 ($P<.01$). In 1963, however, the interaction between effects of tagging and of rounds was significant. The interaction resulted from the aberrant data of round 7 when the weight of tagged seals was greater than that of untagged ones. It seems to have no biological importance. The F value for the effect of tagging was much larger (28.71) than that (2.80) for the interaction. Therefore, the significant interaction is ignored and the conclusion reached that there was a real difference between the weights of tagged and untagged seals in 1963. Present equipment does not allow accurate weighing of large numbers of seals on the killing fields, but there is no reason to expect bias in comparing weights of tagged and untagged seals.

Length classes of tagged 3-year-old male seals sampled from the kill are given by date in appendix table 12.

Table 41.--Mean weights and lengths of tagged and untagged 3-year-old male seals, by round, St. Paul Island, 1962-63

[Numbers in parentheses are the number of seals in each sample]

Round	1962[1]				1963			
	Tagged		Untagged		Tagged		Untagged	
	Weight	Length	Weight	Length	Weight	Length	Weight	Length
	Kg.	Cm.	Kg.	Cm.	Kg.	Cm.	Kg.	Cm.
2.....	-	-	-	-	24.8 (96)	112.02	25.7 (135)	113.94
3.....	-	-	-	-	25.9 (47)	112.73	27.0 (109)	113.43
4.....	-	-	-	-	26.7 (46)	113.13	29.4 (59)	117.27
5.....	26.7 (113)	111.0	28.0 (356)	113.05	27.6 (175)	112.89	29.1 (284)	114.69
6.....	26.5 (260)	113.0	27.0 (610)	113.30	27.3 (234)	112.68	28.1 (279)	114.60
7.....	26.8 (144)	113.34	27.6 (306)	114.33	28.1 (225)	112.86	27.9 (269)	113.65
8.....	27.2 (76)	111.68	27.4 (579)	113.10	27.2 (182)	112.52	27.9 (253)	113.83

[1] Data for rounds 2-4 (2-21 July) were omitted because untagged seals only were weighed and measured.

RELATED STUDIES

LIVE-PUP COUNTS

Live pup counts were made 5 August on selected areas of Tolstoi and Kitovi Rookeries. Counts made during 5 years are compared in table 42.

Counts of live pups on these areas were begun originally to provide a means of measuring population changes expected to occur as a result of herd reduction. The data obtained to date, however, cannot be used to measure population changes because they are inconsistent. In the same year, the number of pups on one area has decreased, while on another the count has increased. This approach can be used to measure population

Table 42.--Live-pup counts, St. Paul Island, 1959-63

Year	Rookery areas		
	Tolstoi	Kitovi	
	White Cross to No. 16	Amphi-theater	Blind to No. 13
1959....	702	1,218	979
1960....	405	1,211	1,072
1961....	558	1,048	942
1962....	465	1,067	764
1963....	535	1,106	956

changes only if several thousand pups are involved and all the pups on the areas or rookeries being used can be counted.

The counts on the Tolstoi Rookery area and on that part of Kitovi Rookery defined as Blind to No. 13 will be discontinued because these areas are not isolated from their respective rookeries. Counts of pups in Kitovi amphitheater will be continued because this area is separated from Kitovi Rookery by natural barriers. Beginning in 1964, counts of live pups will also be made on Little Polovina and Zapadni Reef where a reasonably accurate count can be made.

Zapadni Reef and Little Polovina Rookeries and Kitovi amphitheater contained 6.4 percent of the total harem bulls counted on St. Paul Island in 1963. An attempt will also be made in 1964 to count the live pups on Zapadni and Polovina Cliffs. These rookeries included an additional 17.6 percent of the total harem bulls counted on St. Paul Island in 1963. Complete and accurate counts of live pups, in addition to their value as a measure of population changes, will be useful as a check on the reliability of estimates of the pup population made from marked to unmarked ratios.

EXPERIMENTAL SKINS

Several hundred skins have been collected from fur seals for experimental use in relating economic value to biological factors. Table 43 summarizes the skins taken for this purpose in recent years.

Age, sex, reproductive condition, vibrissal color, and body weight and length are the biological attributes that have been compared to the finished grade and size of the corresponding skins.

Experimental skins taken in 1958 and in 1961-62 have been routinely processed, graded, and offered for sale as "blacks." Skins taken in 1963 are still in process. Seals of smaller and larger sizes not usually taken for commercial use were included in the experimental kill. So far, the study has shown that the skins of females ages 2-5 years have good market value. The skins of females ages 6-15 years include about 90 percent "scarred" or "rejected." Those good enough to process have a market value equivalent to about 75 percent of that of the average male skin.

Table 43.--Skins collected for experimental use, St. Paul Island, 1958 and 1961-63

Year	Males		Females	
	Number	Age in years	Number	Age in years
1958.....	-	-	248	2-10
1961.....	-	-	117	2-5
1962.....	9	2-4	171	2-15
1963.....	142	3-6	120	3-6

Processors now state that the reasons why female skins are of lower value than male skins from seals of the same age are:

1. Smaller size.
2. Narrower distance between flipper holes, giving a reduced area of fur.
3. Thinner and silkier fur.
4. More loss of fur by the manufacturer when trimming the sides, because of mammae.

Male and female seals have approximately the same number of fur bundles per unit area and the same number of fibers per bundle. The thinner fur of females must, therefore, result from fibers of smaller diameter. Data to demonstrate this difference have not been collected.

A full analysis of the experimental skins taken in 1961-63 will be made in 1964. Meanwhile, a system of evaluating a skin by assigning it an "index number" has been devised. The index number is approximately the mean sale value for each grade of black-dyed bachelor skin over the past 10 years. Use of the index number allows a quick evaluation of a graded black-dyed skin without knowledge of its ultimate sale value. The actual sale value fluctuates with fashion and may be difficult to extract from complex auction data. The history of sales of female skins is brief. More time will be needed to develop an index value for them.

DENTITION STUDIES

A report describing the origin and growth of the deciduous and permanent teeth of the fur seal was completed. Co-authors were V. B. Scheffer, Bureau of Commercial Fisheries, and Bertram S. Kraus, Cleft Palate Research Center, University of Pittsburgh. The report will be published as a Fishery Bulletin by the Bureau of Commercial Fisheries.

PLASTIC IMPRESSION TECHNIQUE FOR STUDYING SEALSKINS

A technique was developed for studying the distribution and diameter of hairs on the surface of the skin of fur seals and other pinnipeds. Without resorting to the conventional method of embedding, sectioning, and staining, a thermoplastic impression on transparent film is made directly from the sheared skin. The technique can be used to identify fragments of sealskin found in stomachs of killer whales and sharks, and may also furnish information on the evolution and adaptations of the 20 known genera of pinnipeds. A description of the technique is to be published in the Proceedings of the Zoological Society of London.

EYE LENS WEIGHT AS AN INDICATOR OF AGE

The dry weight of the eye lens in mammals tends to increase through life. Biologists have used lens weight as an indicator of age of rabbits, antelopes, and opossums. Eye lenses of 147 fur seals of known age were weighed in 1963. Bauer, Johnson, and Scheffer (1964) showed that lens weight increases geometrically in both sexes and is still increasing in the oldest specimens studied, a 14-year-old male and a 21-year-old female. When only the lens weight and sex are known, the age of a seal can be identified to the nearest year through age 2 only.

AGE OF THE FUR SEAL PUP AT COMPLETION OF ITS FIRST MOLT

From a series of newborn pups marked in June 1962, six were killed at ages ranging from 73 to 103 days. A pelage specimen was saved from each. Histological examination of the pelage indicates that the transition from the black coat (late fetal and neonatal) to the silver coat (adult) may be completed as early as 11 weeks after birth and as late as 15 weeks, with a mean of about 13 weeks. The mean completion date is about 7 October (Bauer, Peterson, and Scheffer, 1964).

OTHER WILDLIFE SPECIES

SEA LIONS

The number of sea lion pups tagged on Walrus Island in 1963 is given in table 44 with those tagged in previous years.

No tags have been recovered from sea lions tagged as pups in 1959 and 1960 even though a reward of $5 is offered. One fur seal pup was seen on Walrus Island in 1963; adult fur seals were not observed.

Table 44.--Sea lion pup tagging, Walrus Island, 1959-60 and 1963

Year	Date	Number tagged	Tag series and numbers[1]
1959....	21 Jul	100	XA 1 to 100
1960....	15 July	530	XA 201 to 800
1963....	11 July	81	XA1201 to 1300

[1] Tags within the range of numbers given were used.

WHALES

Two dead whales drifted ashore on St. Paul Island in 1963, an adult sei whale (Balaenoptera borealis) and a newborn pilot whale (Globicephala scammoni). One unidentified whale drifted ashore on St. George Island.

WALRUS

One adult female walrus drifted ashore dead on Staraya Artil Rookery, St. George Island, April 1963.

SEA OTTERS

Through the courtesy of the Commanding Officer of the Coast Guard Cutter Northwind, the ship's helicopter was used 6 July to search for survivors of a 1959 transplant of sea otters. Two biologists were aboard as observers. The island was circled completely at a distance of from 100 yards to perhaps a mile off shore. Kelp beds in particular were examined but no sea otters were observed.

REINDEER

The helicopter was also used on 6 July to locate and photograph the reindeer herd. The herd was in two groups, one containing cows and calves and the other containing mostly bulls. The total count of reindeer on the photographs was 537. This figure agreed closely with a count of 550 obtained from the ground a month earlier.

Parts of the island are showing effects from overgrazing by the reindeer herd. The productivity of the island and the reindeer herd will both be maintained best by regular, severe cropping. Management officials will make a separate report on the reindeer.

SUMMARY

Males

1. Of 42,386 male seals killed on the Pribilof Islands in 1963, 39,685 were taken during the male kill from 2 July to 5 August and 2,701 during the kill of females 13 August to 12 September. St. Paul Island accounted for 31,881 and St. George Island, 10,505. Age classification of the kill in percent was: St. Paul Island, 4, 46, 45, and 5, ages 2-5; St. George Island, 9, 41, 45, and 5, ages 2-5.

2. At least 3,150 male seals were taken as a result of early season removal of the maximum length limit of 48-3/4 inches. Absence of the mane, a secondary sex characteristic evident at age 6 and older, was suggested as a substitute for the maximum length limit.

3. The peak of the kill occurred during round 6 (22-26 July) when 5,809 males were taken on St. Paul Island. The total kill of 18,481 4-year-old males by 5 August agreed closely with the forecast of 18,750 for a kill ending between 31 July and 15 August. A kill of 37,500 3-year-olds by 31 July or 50,000 by 15 August was predicted; 17,986 were taken by 5 August.

4. The number of bulls counted on land 10-17 July decreased from 12,674 harem and 11,759 idle in 1962 to 11,283 harem and 9,540 idle in 1963.

5. From 3- and 4-year-old male data, estimates of number of pups born on the Pribilof Islands in 1958 and 1959 were 729,000 and 778,000.

6. The St. Paul Island pup population in 1963 was estimated at 229,900 from a marked to unmarked ratio obtained from shearing and sampling pups in August and adjusted to 255,700 on the basis of a live-pup count on one rookery. Exclusive of pups that died before shearing, the pup population of both islands was estimated at 316,000.

Females

1. A total of 43,952 female seals were taken on the Pribilof Islands in 1963. The female kill began 13 August, ending 12 September on St. Paul Island with a kill of 35,093 and 30 August on St. George Island with a kill of 8,859.

2. Reproductive studies of 310 known-age 3- and 4-year-old females taken on St. Paul Island in 1963 were made. Two of 170 4-year-olds were primiparous and had given birth to their first pup in 1963; all (140) of the 3-year-old females examined were nulliparous. Graafian follicles in both ovaries of 307 of the females indicated approaching maturity. Based on the presence in one ovary of a developing corpus luteum or one or more follicles 5 mm. or larger in diameter, 33 (24 percent) of the 3-year-olds and 118 (70 percent) of the 4-year-olds would have been bred in 1963.

3. Total pup populations estimated from female data were 872,376 for the 1958 year class and 859,371 for 1959.

Tag Recoveries and Tagging

1. A total of 3,703 tagged seals and 2,077 with checkmarks only were recovered in 1963; 37 Soviet-tagged fur seals were taken. Eighty-four seals selected and tagged as yearlings in 1961 and 1962 were recovered in 1963. Only 13 of 34 recoveries from the 1961 tagging were actually yearlings when tagged; 45 of 50 recoveries from 1962 were yearlings when tagged. Body weight was used as an indicator of age in 1961, whereas length was used in 1962.

2. Twenty-five thousand seal pups were tagged; the tip of the same flipper was sliced off as a checkmark. A total of 701 seals was selected and tagged as yearlings in 1963; 98 that had been tagged as pups in 1962 were each given an additional tag.

3. Five weekly counts of yearlings tagged as pups in 1962 were made from 27 September through 11 October 1963 on 11 sampling areas on St. Paul Island. These counts may provide an index to survival from birth to age 1 and a rough prediction of the return of 3-year-old male seals 2 years later.

Mortality

1. The 1963 pup mortality on land decreased to 39,239 from 53,748 in 1962. The lowest count since the beginning of complete dead-pup counts in 1953 was recorded in 1958.

Seal-Pup Weights

1. The data from year classes 1957-59 suggest a correlation between mean weight as pups and return at age 3.

2. Tagged pups weighed an average of 0.57 kg. less than untagged pups from 1957 through 1963.

Related Studies

1. Counts of live pups made each year since 1959 on two of three small rookery areas on St. Paul Island will be discontinued because of unreliability. Live-pup counts will be continued on one area as a check on the reliability of estimates of the pup population made from marked to unmarked ratios. For the same purpose, total counts will be made of pups on four rookeries.

2. Studies of 536 skins from females showed that those in ages 2-5 years have good market

value. Some in ages 6-15 years have a market value equivalent to about 75 percent of that of the average male skin.

3. Eye lens weight can be used to identify the ages of fur seals through age 2 only.

4. The black birth coat of fur seal pups is replaced by the silvery pelage of the adult about 13 weeks after birth.

Other Wildlife Species

1. Eighty-one sea lion pups were tagged on Walrus Island in 1963.

2. Three dead whales and one walrus drifted ashore on the Pribilof Islands in 1963.

3. A Coast Guard helicopter was used to search offshore areas of St. Paul Island, 6 July 1963, for survivors of a 1959 transplant of sea otters and to make aerial photographs of the reindeer herd. No sea otters were seen. The total count of reindeer on the photographs was 537 compared to 550 counted from the ground a month earlier.

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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.

age class Age group. Seals of the same age (usually used when referring to seals older than pups). See year class.

at time of sampling A phrase used to qualify estimates of the pup population based on sampling for a marked to unmarked ratio in the summer of birth. A pup population estimate "at time of sampling" does not include pups of the year class that died earlier in the summer or before the pups were marked. See "at time of tagging."

at time of tagging A phrase used to qualify estimates of the pup population based on (1) sampling for a tagged to untagged ratio in the summer of birth, or on (2) tag returns at various ages. Pups that died before tagging are not included in the estimates. See "at time of sampling."

checkmark A notch, slit, hole, or other mark made on a seal flipper when a tag is applied, to insure later recognition of an animal which has lost its tag.

clinch or clinching The device or action by which metal tags applied to seal flippers are fastened. A metal point is bent over a narrow band in order to form a closed ring.

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 not the proper size or were not available.

extra mortality Above normal mortality. For example, tag wounds and other injuries associated with tagging may cause tagged pups to die at a greater rate than untagged pups.

hauling grounds An area, usually near a rookery, on which nonbreeding animals congregate.

haul out The act of seals moving from the sea to a rookery or hauling grounds on shore.

homing tendency The inclination of seals to return to the rookery where they were born, that is, home rookery or rookery of birth. Homing tendency is expressed as a percentage by comparing the number of tagged seals in a specific group that were found on their natal rookery with the number that were found on some other rookery or island.

known-age Applied to seals for which age is definitely known because they bear an inscribed tag or have a certain combination of tag scar and checkmark.

marked Seals that have been tagged, sheared, or otherwise artificially marked so they can be identified.

marked to unmarked ratio See tagged to untagged ratio.

mortality rate Percent of a year class dying over a specific period.

pregnancy rate Percent females that were carrying or had borne pups in the year examined. For example, the pregnancy rate of 5-year-old females was 60 percent.

return The return or survival of seals from a year class. For example, 10,000 3-year-old seals from the 1960 year class returned in 1963.

round The sequence in which hauling grounds on the Pribilof Islands are visited in order to collect seals for harvest. Current practice is to make a complete circuit or round of the hauling grounds in 5 days.

roundup The act of surrounding and collecting seals to be driven for harvest, tagging, or other purposes.

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

tag-lost A term applied to a seal that is known to have been tagged because of a checkmark and, in some cases, a tag scar but no longer has a tag.

tag scar A hole or torn area near the usual tag site on a seal's flipper. Tags fall out because of poor clinching or wear and are torn out by catching in rock crevices or driftwood. Possibly some are torn out by the tagged seal.

tagged to untagged ratio The number of tagged seals compared to the number of untagged seals, usually expressed as a decimal fraction. Example, 5:20, ratio = .25. See "marked to unmarked ratio."

tag lost to tag ratio The number of seals that have lost tags as compared with the number retaining tags. Usually expressed as a decimal fraction.

unmarked Not marked.

untagged Not tagged.

year class Group of seals born in the same year. See age class.

APPENDIX A

PREDICTION OF 1964 MALE RETURNS AND KILL

Douglas G. Chapman
2 January 1964

Four-year-old Males

Method 1.--The postseason escapement of 3-year-old males in 1963 was calculated by fitting a normal curve to the kill, by round, of this age class. This method indicates that 74.2 percent of the 3-year-old males of the proper body length were taken by 5 August 1963. Because the round system was not used on St. George Island, the estimate of 74.2 percent was based on data collected on St. Paul Island.

The method of estimating then proceeds as follows:

Total return of 3-year-old males of the proper body length = $\frac{13,954}{.742}$ = 18,806 (13,954 3-year-old males taken on St. Paul Island by 5 August 1963)

Total kill of 3-year-old males on St. Paul Island in 1963 (to 26 August) = 14,310

Escapement (postseason is 18,806 - 14,310 = 4,496)

Percentage escapement is $100 \times \frac{4,496}{18,806} = 24$

Using 5 as an average percentage escapement due to body length, the total escapement percentage is 1 - (.95)(.76) = .28 x 100.

The total escapement is $\frac{14,310}{.72}$ - 14,310 = 5,565, which is then adjusted by the 17 percent correction worked out emperically after the extended 1956 and 1957 seasons. Hence, the escapement is (5,565) (1.17) = 6,511.

The kill of 4-year-old males is forecasted as 85 percent of this escapement, or 5,500.

Method 2.--Data on the kill of 3- and 4-year-old male seals and the mean date of the kill of 3-year-olds are given in appendix table 1 for year classes 1952-59.

Because killing was terminated on various dates over the years, the data were standardized by considering the kill to 31 July only. In years in which killing continued after 31 July, 80 percent of the 3-year-old males taken

Appendix table 1.--Forecast of the 4-year-old male kill from the mean date and kill of 3-year-old males, St. Paul Island, year classes 1952-59

Year class	3-year-male kill to 31 July	4-year-male kill adjusted[1]	Mean date of 3-year-male kill[2] (After 20 July)
	Number	Number	Days
1952....	31,000	29,000	5
1953....	27,000	17,000	4
1954....	17,000	11,000	3
1955....	27,000	11,000	2
1956....	10,000	3,000	3
1957....	15,000	20,000	4
1958....	30,000	27,000	4
1959....	20,000	17,000	3

[1] Kill of 4-year-old males to 31 July, plus 80 percent of the number of 3-year-old males taken after 31 July.

[2] Adjusted to the base of a common starting round on 27 June.

in August were added to the kill of 4-year-old males. This has been done on the assumption that if seals had not been killed in August, 80 percent of the 3-year-olds alive after 31 July would have been taken as 4-year-olds the following year. Also, the starting round of killing before 1960 was 27 June to 1 July; the beginning round in 1960 and thereafter was 2-6 July. Therefore the data in 1960 and subsequent years were adjusted by allotting 45 percent of the kill in the 2-6 July round to the 27 June to 1 July round. The 45 percent factor was based on kills in 1955 through 1959.

The regression determined from the data is:

$$Y = -14.83 + 0.56\,x_1 + 5.53\,x_2$$

where x_1 = the kill of 3-year-old males to 31 July
x_2 = mean date of the 3-year-old male kill in days past 20 July
Y = the kill of 4-year-old males to 31 July, plus 80 percent of the 3-year-old male kill after 31 July

The correlation coefficient, $R^2 = 0.82$, is highly significant and indicates that 82 percent of the variance of Y is explained by x_1 and x_2.

For the 1960 year class $x_1 = 12$, $x_2 = 4$ so that $Y = 14.01$.

Since the kill of 3-year-old males in August was 2,714 (of which 80 percent is 2,171), the kill of 4-year-old males by 31 July 1964 is estimated at 11,800. Adding 10 percent for 4-year-olds that will be taken 1-5 August, the total estimate is 13,000 of this age for St. Paul Island.

Method 3.--In previous years, dead-pup counts have been used to forecast returns of a year class. The apparent relationship of the dead-pup count to the annual mean temperature of the 12 months preceding birth of the pups make it seem worthwhile to consider both of these variables as a means of predicting the kill of 3- and 4-year-old males. The basic data and an analysis of variance to determine if both variables are necessary are shown in appendix tables 2 and 3.

The small F value (.02) given by the test to determine the effect of neglecting the dead-pup count shows that all the forecast information is essentially contained in the temperature variable. Consequently, use of temperature only in the regression is preferable, because it provides a datum point for 1952. Using the data for all 10 years, the temperature-kill relationship is:

$$Y = 17.4 + 1.01X$$

where Y = adjusted kill
X = 10 (mean temperature in $^{o}F - 32$)

The mean temperature in 1960 was 33.7, so $x = 17$ and $Y = 34.6$. The kill in 1963 prior to 31 July was 11,596 and 80 percent of the kill in August (2,714) is 2,171. There remains according to this forecast 34,600 - 11,600 - 2,200, that is, 20,800.

Appendix table 2.--Kill of 3- and 4-year-old males, dead-pup counts, and mean temperature, St. Paul Island, year classes 1950-59

Year class	Adjusted kill[1]	Dead-pup count	Temperature[2]
	Number	Number	$^{o}F.$
1950....	56,000	56,000	35
1951....	50,000	74,000	36
1952....	60,000	-	37
1953....	44,000	83,000	16
1954....	28,000	101,000	10
1955....	38,000	70,000	17
1956....	13,000	104,000	1
1957....	35,000	65,000	23
1958....	57,000	33,000	34
1959....	37,000	42,000	33

[1] Kill prior to 31 July, plus 80 percent of the number of 3-year-olds taken in August.

[2] The difference between the annual mean temperature and 32^{o}, multiplied by 10; 10(Temperature-32).

Appendix table 3.--Analysis of variance of regression of adjusted kill on dead-pup count and mean temperature, St. Paul Island

Source of variation	Degrees of freedom	Sum of squares	Mean square	F
Dead-pup count and temperature	2	1157.44	578.72	
Temperature alone	1	1156.30	1156.30	
Difference due to neglecting dead-pup count	1	1.14	1.14	.02
Dead-pup count alone	1	900.43	900.43	
Difference due to neglecting temperature	1	257.01	257.01	3.72
Error (residual)	6	414.12	69.02	

Three-year-old Males

Method 1.--The temperature-kill relationship given above can be applied. The mean temperature from July 1960 to June 1961 was 33.8, therefore, X = 18 and $\hat{Y}$ = 35.6. During the past 5 years, 73 percent of the number killed at ages 3 and 4 have been taken at age 3. On this basis, the predicted kill of 3-year-olds is:

$$(.73)(35,600) = 26,000$$

Method 2.--An alternative method of prediction is based on average returns from the 1953-59 year classes against the average number of females. By the accumulative estimate[1] the average number of females age 3 and older was 801,100. The average kill of 3-year-old males from these year classes was 28,500. This represents 3.56 percent of the number of females. The accumulative estimate of the number of females in 1961 is 610,000. Thus, an average kill would produce 21,700 or 22,000 animals.

Confidence Intervals, Other Methods

Confidence interval estimates for some of the predictions can be obtained. For example, the 95 percent confidence intervals for the estimated adjusted kill from the 1960 and 1961 year classes, based on the temperature-kill relationship are:

1960: Y lies between 34,600 ± 22,000, i.e., 12,600 to 56,600

1961: Y lies between 35,600 ± 22,000, i.e., 13,600 to 57,600

These imply a confidence interval for the kill of 4-year-old males in 1963 of from 0 to 42,800. At present, the variability inherent in these predictions is high.

In other years, attempts were made to forecast the kill of 3-year-old males on some index from the kill of 2-year-old males the previous season. Clearly, this is the best approach. At present, however, the small number of 2-year-old males killed and the selection involved in their killing are factors which prevent a satisfactory prediction.

Prediction of Total Kill

Three widely separated predictions for the kill of 4-year-old males are available. Because information suggesting preference of one prediction over another is not available, the median value is used. Assuming that the male kill will be terminated 5 August, the resulting predictions for St. Paul Island in 1964 are:

Age			Total
2 and 5	3	4	
Number	Number	Number	
3,000	24,000	13,000	40,000

An implied total male kill of 50,000 is based on the usual kill ratio of 80:20 between St. Paul and St. George Islands, though the ratio in 1963 was 76:24 for 3- and 4-year-old males.

[1] An estimate based on the kill of males and on a survival rate for females 1.25 times that of males.

APPENDIX B

Appendix table 4. --Age classification of male seals killed on St. Paul Island, 2 July to 5 August and 13-26 August 1963

Date	Rookery	Number		Percent in each age class of sample					Estimated number killed from each age class				
		Males killed	Tooth sample	2	3	4	5	6	2	3	4	5	6
2 July	NEP	1,717	171	1	33	63	3	-	17	567	1,081	52	-
3	TZR	471	47	-	28	66	6	-	-	132	311	28	-
4	ZAP	1,078	102	2	32	57	9	-	22	345	614	97	-
5	REEF-LK	552	53	2	30	57	11	-	10	166	315	61	-
6	POL	551	54	-	31	63	6	-	-	171	347	33	-
Round total		4,369	427						49	1,381	2,668	271	-
7 July	NEP	1,151	114	-	38	53	9	-	-	437	610	104	-
8	TZR	626	62	-	37	58	5	-	-	232	363	31	-
9	ZAP	687	66	-	50	42	8	-	-	343	289	55	-
10	REEF-LK	201	19	-	37	58	5	-	-	74	117	10	-
11	POL	346	33	-	9	82	9	-	-	31	284	31	-
Round total		3,011	294						-	1,117	1,663	231	-
12 July	NEP	848	83	-	36	57	7	-	-	305	484	59	-
13	TZR	306	29	-	31	59	7	3	-	94	181	22	9
14	ZAP	333	66	-	36	56	8	-	-	121	186	26	-
15	REEF-LK	280	54	-	22	72	6	-	-	62	201	17	-
16	POL	279	54	-	27	53	18	2	-	75	148	50	6
Round total		2,046	286							657	1,200	174	15
17 July	NEP	1,911	187	3	53	41	3	-	57	1,013	784	57	-
18	TZR	444	85	1	51	42	4	2	4	227	186	18	9
19	ZAP	1,552	153	2	55	39	4	-	31	854	605	62	-
20	REEF-LK	1,099	110	1	46	46	6	1	11	506	506	65	11
21	POL	586	58	2	50	46	2	-	12	292	270	12	-
Round total		5,592	593						115	2,892	2,351	214	20
22 July	NEP	2,056	204	4	50	41	5	-	82	1,028	843	103	-
23	TZR	306	59	-	41	54	5	-	-	126	165	15	-
24	ZAP	1,609	160	2	64	30	4	-	32	1,030	483	64	-
25	REEF-LK	1,243	122	-	43	47	10	-	-	535	584	124	-
26	POL	595	59	-	25	70	5	-	-	149	416	30	-
Round total		5,809	604						114	2,868	2,491	336	-
27 July	NEP	1,854	185	3	58	34	5	-	56	1,075	630	93	-
28	TZR	490	96	1	59	38	2	-	5	289	186	10	-
29	ZAP	1,091	110	5	55	37	3	-	55	600	404	32	-
30	REEF-LK	1,165	121	2	50	44	4	-	23	582	513	47	-
31	POL	329	66	2	41	54	3	-	7	135	177	10	-
Round total		4,929	578						146	2,681	1,910	192	-
1 August	NEP	846	88	3	65	30	2	-	25	550	254	17	-
2	TZR	688	69	10	51	36	3	-	69	351	247	21	-
3	ZAP	907	99	7	49	37	5	2	64	444	336	45	18
4	REEF-LK	1,299	149	5	57	36	1	1	65	740	468	13	13
5	POL	506	54	4	54	40	2	-	20	273	203	10	-
Round total		4,246	459						243	2,358	1,508	106	31
August 13-26	[1]	1,245	548	36	28	31	5	-	431	356	393	63	2
Season total	[2]	31,247	3,789						1,098	14,310	14,184	1,587	68

1 Age classification of these males calculated on a daily basis, then combined.

2 Plus 634 unclassified male seals taken during the 27 August to 12 September portion of the female kill.

Appendix table 5. --Cumulative age classification of male seals killed on St. Paul Island, 2 July to 5 August and 13-26 August 1963

Date	Rookery	Estimated number killed from each age class					Total kill	Percent killed from each age class				
		2	3	4	5	6		2	3	4	5	6
2 July	NEP	17	567	1,081	52	-	1,717	1	33	63	3	-
3	TZR	17	699	1,392	80	-	2,188	1	32	63	4	-
4	ZAP	39	1,044	2,006	177	-	3,266	1	33	61	5	-
5	REEF-LK	49	1,210	2,321	238	-	3,818	1	32	61	6	-
6	POL	49	1,381	2,668	271	-	4,369	1	32	61	6	-
7	NEP	49	1,818	3,278	375	-	5,520	1	33	59	7	-
8	TZR	49	2,050	3,641	406	-	6,146	1	33	59	7	-
9	ZAP	49	2,393	3,930	461	-	6,833	1	34	58	7	-
10	REEF-LK	49	2,467	4,047	471	-	7,034	1	35	58	6	-
11	POL	49	2,498	4,331	502	-	7,380	1	34	58	7	-
12	NEP	49	2,803	4,815	561	-	8,228	-	34	59	7	-
13	TZR	49	2,897	4,996	583	9	8,534	-	34	59	7	-
14	ZAP	49	3,018	5,182	609	9	8,867	-	34	58	8	-
15	REEF-LK	49	3,080	5,383	626	9	9,147	-	34	59	7	-
16	POL	49	3,155	5,531	676	15	9,426	-	33	59	7	1
17	NEP	106	4,168	6,315	733	15	11,337	1	37	56	6	-
18	TZR	110	4,395	6,501	751	24	11,781	1	37	55	6	1
19	ZAP	141	5,249	7,106	813	24	13,333	1	39	54	6	-
20	REEF-LK	152	5,755	7,612	878	35	14,432	1	40	53	6	-
21	POL	164	6,047	7,882	890	35	15,018	1	40	53	6	-
22	NEP	246	7,075	8,725	993	35	17,074	1	42	51	6	-
23	TZR	246	7,201	8,890	1,008	35	17,380	1	42	51	6	-
24	ZAP	278	8,231	9,373	1,072	35	18,989	2	43	49	6	-
25	REEF-LK	278	8,766	9,957	1,196	35	20,232	1	43	50	6	-
26	POL	278	8,915	10,373	1,226	35	20,827	1	43	50	6	-
27	NEP	334	9,990	11,003	1,319	35	22,681	1	44	49	6	-
28	TZR	339	10,279	11,189	1,329	35	23,171	1	45	48	6	-
29	ZAP	394	10,879	11,593	1,361	35	24,262	1	45	48	6	-
30	REEF-LK	417	11,461	12,106	1,408	35	25,427	1	45	48	6	-
31	POL	424	11,596	12,283	1,418	35	25,756	1	45	48	6	-
1 August	NEP	449	12,146	12,537	1,435	35	26,602	2	46	47	5	-
2	TZR	518	12,497	12,784	1,456	35	27,290	2	46	47	5	-
3	ZAP	582	12,941	13,120	1,501	53	28,197	2	46	47	5	-
4	REEF-LK	647	13,681	13,588	1,514	66	29,496	2	47	46	5	-
5	POL	667	13,954	13,791	1,524	66	30,002	2	47	46	5	-
13-26 August		1,098	14,310	14,184	1,587	68	[1] 31,247	4	46	45	5	-

1 Plus 634 unclassified male seals taken during the 27 August to 12 September portion of the female kill.

Appendix table 6.--Age classification of male seals killed on St. George Island, 2 July to 5 August and 13-30 August 1963

Date	Rookery	Number		Percent in each age class of sample					Estimated number killed from each age class				
		Males killed	Tooth sample	2	3	4	5	6	2	3	4	5	6
July													
2	ZAP	457	47	2	15	68	13	2	10	68	311	58	10
2	STAR	68	22	-	9	55	36	-	-	6	37	25	-
5	EAST	482	49	2	28	59	10	-	10	137	286	49	-
5	NOR	391	40	-	30	60	10	-	-	117	235	39	-
8	ZAP	356	36	3	42	44	11	-	10	148	158	40	-
8	NOR	115	36	-	14	75	11	-	-	16	86	13	-
10	EAST	281	29	-	24	69	7	-	-	68	194	19	-
10	NOR	248	48	-	25	67	8	-	-	62	165	21	-
12	ZAP	166	33	-	21	67	12	-	-	35	111	20	-
15	EAST	411	41	-	49	49	2	-	-	200	201	10	-
15	NOR	454	46	-	20	69	11	-	-	89	315	50	-
17	ZAP	159	48	-	25	62	13	-	-	40	99	20	-
19	EAST	502	51	2	47	51	-	-	10	236	256	-	-
19	STAR	88	26	4	12	73	11	-	3	10	65	10	-
22	ZAP	202	44	-	36	52	10	2	-	73	105	20	4
22	NOR	698	70	-	47	50	3	-	-	329	349	20	-
24	EAST	893	92	2	59	38	1	-	18	527	339	9	-
24	STAR	81	23	-	31	52	13	4	-	25	42	11	3
26	NOR	601	67	2	44	49	5	-	12	264	295	30	-
26	ZAP	182	33	-	37	48	15	-	-	67	88	27	-
29	EAST	212	36	8	64	28	-	-	17	136	59	-	-
29	NOR	102	30	7	60	33	-	-	7	61	34	-	-
31	NOR	653	67	11	48	37	4	-	72	313	242	26	-
31	ZAP	242	24	17	54	29	-	-	41	131	70	-	-
August													
2	EAST	529	53	10	62	28	-	-	53	328	148	-	-
2	STAR	249	52	15	54	29	2	-	37	135	72	5	-
5	NOR	705	72	24	49	26	1	-	169	346	183	7	-
5	ZAP	156	38	13	42	37	5	3	20	65	58	8	5
Total		9,683	1,253						489	4,032	4,603	537	22
August													
13	STAR	155	41	37	41	20	2	-	57	64	31	3	-
14	NOR	83	23	26	52	22	-	-	22	43	18	-	-
16	EAST	6	6	50	33	17	-	-	3	2	1	-	-
16	NOR	27	27	56	33	11	-	-	15	9	3	-	-
19	STAR	75	30	67	30	3	-	-	50	23	2	-	-
21	ZAP	121	37	32	54	14	-	-	39	65	17	-	-
23	EAST	46	19	79	16	5	-	-	36	8	2	-	-
23	NOR	31	26	66	19	15	-	-	20	6	5	-	-
26	ZAP	133	48	61	33	6	-	-	81	44	8	-	-
28	STAR	104	48	71	29	-	-	-	74	30	-	-	-
30	NOR	41	34	85	15	-	-	-	35	6	-	-	-
Total		822	339						432	300	87	3	-
Season total		10,505	1,592						921	4,332	4,690	540	22

Appendix table 7.--Cumulative age classification of male seals killed on St. George Island, 2 July to 5 August and 13-30 August 1963

Date	Rookery	Estimated number killed from each age class					Total kill	Percent killed from each age class				
		2	3	4	5	6		2	3	4	5	6
2 July	ZAP	10	68	311	58	10	457	2	15	68	13	2
2	STAR	10	74	348	83	10	525	2	14	66	16	2
5	EAST	20	211	634	132	10	1,007	2	21	63	13	1
5	NOR	20	328	869	171	10	1,398	2	23	62	12	1
8	ZAP	30	476	1,027	211	10	1,754	2	27	58	12	1
8	NOR	30	492	1,113	224	10	1,869	2	26	60	12	-
10	EAST	30	560	1,307	243	10	2,150	1	26	62	11	-
10	NOR	30	622	1,472	264	10	2,398	1	26	62	11	-
12	ZAP	30	657	1,583	284	10	2,564	1	26	62	11	-
15	EAST	30	857	1,784	294	10	2,975	1	29	60	10	-
15	NOR	30	946	2,099	344	10	3,429	1	28	61	10	-
17	ZAP	30	986	2,198	364	10	3,588	1	28	61	10	-
19	EAST	40	1,222	2,454	364	10	4,090	1	30	60	9	-
19	STAR	43	1,232	2,519	374	10	4,178	1	30	60	9	-
22	ZAP	43	1,305	2,624	394	14	4,380	1	30	60	9	-
22	NOR	43	1,634	2,973	414	14	5,078	1	32	59	8	-
24	EAST	61	2,161	3,312	423	14	5,971	1	36	56	7	-
24	STAR	61	2,186	3,354	434	17	6,052	1	36	56	7	-
26	NOR	73	2,450	3,649	464	17	6,653	1	37	55	7	-
26	ZAP	73	2,517	3,737	491	17	6,835	1	37	55	7	-
29	EAST	90	2,653	3,796	491	17	7,047	1	38	54	7	-
29	NOR	97	2,714	3,830	491	17	7,149	1	38	54	7	-
31	NOR	169	3,027	4,072	517	17	7,802	2	39	52	7	-
31	ZAP	210	3,158	4,142	517	17	8,044	3	39	52	6	-
2 August	EAST	263	3,486	4,290	517	17	8,573	3	41	50	6	-
2	STAR	300	3,621	4,362	522	17	8,822	3	41	50	6	-
5	NOR	469	3,967	4,545	529	17	9,527	5	42	48	5	-
5	ZAP	489	4,032	4,603	537	22	9,683	5	42	48	5	-
13	STAR	546	4,096	4,634	540	22	9,838	5	42	47	6	-
14	NOR	568	4,139	4,652	540	22	9,921	6	42	47	5	-
16	EAST	571	4,141	4,653	540	22	9,927	6	42	47	5	-
16	NOR	586	4,150	4,656	540	22	9,954	6	42	47	5	-
19	STAR	636	4,173	4,658	540	22	10,029	6	42	47	5	-
21	ZAP	675	4,238	4,675	540	22	10,150	7	42	46	5	-
23	EAST	711	4,246	4,677	540	22	10,196	7	42	46	5	-
23	NOR	731	4,252	4,682	540	22	10,227	7	42	46	5	-
26	ZAP	812	4,296	4,690	540	22	10,360	8	42	45	5	-
28	STAR	886	4,326	4,690	540	22	10,464	9	41	45	5	-
30	NOR	921	4,332	4,690	540	22	10,505	9	41	45	5	-

Appendix table 8. -- Age classification of female seals killed on St. Paul Island, 2 July to 5 August and 13 August to 12 September 1963

Date	Rookery	Source of females	Number Females killed	Number Tooth sample	Number in each age class of sample 2	3	4	5	6	7	8+	Percent in each age class of sample 2	3	4	5	6	7	8+	Estimated number killed from each age class 2	3	4	5	6	7	8+
July																									
2-31			218	Unclassified																					
August																									
1	NEP	HG[1]	41	21	-	-	-	3	4	2	12	-	-	-	15	19	10	56	-	-	-	6	8	4	23
2	TZR	"	21	14	-	-	1	-	3	-	10	-	-	7	-	21	-	72	-	-	2	-	4	-	15
3	ZAP	"	114	65	-	-	7	12	10	6	30	-	-	11	19	15	9	46	-	-	13	22	17	10	52
4	REEF	"	220	121	-	-	8	11	10	7	85	-	-	7	9	8	6	70	-	-	15	20	18	13	154
5	POL	"	51	21	-	1	-	4	4	2	10	-	5	-	19	19	10	47	-	2	-	10	10	5	24
Round total			447	242	-	1	16	30	31	17	147								-	2	30	58	57	32	268
August																									
13	NEP	HG	435	108	-	-	15	22	9	4	58	-	-	14	20	8	4	54	-	-	61	87	35	17	235
13	POL	"	768	167	-	-	23	42	26	5	71	-	-	14	25	16	3	42	-	-	107	192	123	23	323
14	ZAP	"	1,611	343	-	7	49	73	32	16	166	-	2	14	21	9	5	49	-	32	225	338	146	80	790
15	REEF	"	311	71	-	4	15	19	8	1	24	-	6	21	27	11	1	34	-	19	65	84	34	3	106
15	ZAP-REEF	"	265	63	-	2	16	16	6	2	21	-	3	25	25	10	3	34	-	8	66	66	27	8	90
15	POL	"	311	70	-	1	6	16	11	5	31	-	1	9	23	16	7	44	-	3	28	71	50	22	137
16	ZAP	R[1]	965	189	1	4	22	38	14	9	101	-	2	12	20	8	5	53	-	19	116	193	77	48	512
16	LZ	"	1,130	217	-	9	35	28	18	10	117	-	4	16	13	8	5	54	-	45	181	147	91	56	610
19	NEP	M[1]	2,062	419	4	33	81	90	35	17	159	1	8	19	21	9	4	38	20	165	392	433	186	82	784
20	NEP	"	2,072	431	3	30	109	105	45	16	123	1	7	25	24	10	4	29	21	145	518	498	207	83	600
21	REEF	R	1,290	256	1	3	29	38	32	9	144	-	1	11	15	13	4	56	-	13	142	193	168	52	722
21	GOR	M	510	108	-	5	21	30	9	4	39	-	5	19	28	8	4	36	-	25	97	143	41	20	184
22	LZ	R	1,082	211	-	15	44	32	20	6	94	-	7	21	15	9	3	45	-	76	227	162	98	32	487
22	ZAP-REEF	HG	274	55	-	5	14	13	6	-	17	-	9	25	24	11	-	31	-	25	68	66	30	-	85
22	ZAP	R	445	84	-	1	8	22	12	4	37	-	1	10	26	14	5	44	-	4	45	116	62	22	196
23	POL-CLIFF	M	475	96	-	4	13	21	10	5	43	-	4	14	22	10	5	45	-	19	66	105	47	24	214
23	POL	HG	1,399	285	3	25	76	63	34	9	75	1	9	27	22	11	3	27	14	126	377	308	154	42	378
26	NEP	M	2,103	405	5	33	90	103	36	9	129	1	8	22	26	9	2	32	21	168	463	547	189	42	673
27	NEP	HG	320	68	-	-	1	10	3	4	50	-	-	1	15	4	6	74	-	-	3	48	13	19	237
27	NEP	M	1,792	358	1	20	86	97	42	7	105	-	6	24	27	12	2	29	-	107	430	484	215	36	520
28	REEF	R	2,198	438	4	27	77	84	33	8	205	1	6	18	19	7	2	47	22	131	396	418	154	44	1,033
30	REEF	M	1,310	261	9	25	41	60	12	12	102	3	9	16	23	5	5	39	39	118	210	301	65	66	511
30	REEF	R	1,113	224	11	21	38	37	16	6	95	5	9	17	17	7	3	42	56	101	189	189	78	33	467
Total			24,241	4,927	42	274	909	1,059	469	168	2,006								193	1,349	4,472	5,189	2,290	854	9,894
September																									
3	TZR	HG	1,139	227	3	13	21	38	15	16	121	1	6	9	17	7	7	53	11	68	103	194	79	80	604
4	LZ	R	824	149	6	10	27	23	12	7	64	4	7	18	15	8	5	43	33	58	148	124	66	41	354
5	POL	HG	516	106	2	6	29	26	11	6	26	2	6	27	25	10	5	25	10	31	139	129	52	26	129
5	POL	M	883	173	5	17	31	43	20	4	53	3	9	18	25	12	2	31	26	79	159	221	106	18	274
5	LZ	R	612	120	4	10	9	13	9	6	69	3	8	8	11	8	5	57	18	49	49	67	49	31	349
6	LZ	R	986	197	1	17	13	19	18	14	115	-	9	7	10	9	7	58	-	89	69	98	89	69	572
7	REEF	M	1,081	214	14	14	38	39	17	9	83	7	7	18	18	8	4	38	76	76	195	195	86	43	410
9	REEF	R	1,395	286	14	24	27	35	21	13	152	5	9	10	12	7	4	53	70	126	139	167	98	56	739
9	TOL	HG	130	28	-	-	1	3	1	1	22	-	-	4	10	4	4	78	-	-	5	13	5	5	102
10	NEP	HG	689	129	3	5	25	27	4	12	53	2	4	20	21	3	9	41	14	27	138	145	21	62	282
10	NEP	R	930	203	6	20	46	60	21	5	45	3	10	23	29	11	2	22	28	93	214	270	102	19	204
12	REEF	R	1,002	202	3	7	11	16	11	13	141	2	3	5	8	5	7	70	20	30	50	80	50	70	702
Total			10,187	2,034	61	143	278	342	160	106	944								306	726	1,408	1,703	803	520	4,721
Season total			35,093	7,203	103	418	1,203	1,431	660	291	3,097								499	2,077	5,910	6,950	3,150	1,406	14,883

1 HG = hauling ground; R = rookery; M = mixed.

Appendix table 9. --Cumulative age classification of female seals killed on St. Paul Island, 2 July to 5 August and 13 August to 12 September 1963

Date	Rookery	Estimated number killed from each age class							Total kill	Percent killed from each age class						
		2	3	4	5	6	7	8+		2	3	4	5	6	7	8+
August																
1	NEP	-	-	-	6	8	4	23	41	-	-	-	15	19	10	56
2	TZR	-	-	2	6	12	4	38	62	-	-	3	10	19	7	61
3	ZAP	-	-	15	28	29	14	90	176	-	-	9	16	16	8	51
4	REEF	-	-	30	48	47	27	244	396	-	-	7	12	12	7	62
5	POL	-	2	30	58	57	32	268	447	-	-	7	13	13	7	60
13	NEP	-	2	91	145	92	49	503	882	-	-	10	17	10	6	57
13	POL	-	2	198	337	215	72	826	1,650	-	-	12	21	13	4	50
14	ZAP	-	34	423	675	361	152	1,616	3,261	-	1	13	21	11	4	50
15	REEF	-	53	488	759	395	155	1,722	3,572	-	2	14	21	11	4	48
15	ZR	-	61	554	825	422	163	1,812	3,837	-	2	14	22	11	4	47
15	POL	-	64	582	896	472	185	1,949	4,148	-	2	14	22	11	4	47
16	ZAP	-	83	698	1,089	549	233	2,461	5,113	-	2	14	21	11	4	48
16	LZ	-	128	879	1,236	640	289	3,071	6,243	-	2	14	20	10	5	49
19	NEP	20	293	1,271	1,669	826	371	3,855	8,305	-	4	15	20	10	5	46
20	NEP	41	438	1,789	2,167	1,033	454	4,455	10,377	-	4	17	21	10	5	43
21	REEF	41	451	1,931	2,360	1,201	506	5,177	11,677	-	4	17	20	10	5	44
21	GOR	41	476	2,028	2,503	1,242	526	5,361	12,177	-	4	17	20	10	5	44
22	LZ	41	552	2,255	2,665	1,340	558	5,848	13,259	-	4	17	20	10	5	44
22	ZR	41	577	2,323	2,731	1,370	558	5,933	13,533	-	5	17	20	10	4	44
22	ZAP	41	581	2,368	2,847	1,432	580	6,129	13,978	-	4	17	21	10	4	44
23	POL-CLIFF	41	600	2,434	2,952	1,479	604	6,343	14,453	-	4	17	21	10	4	44
23	POL	55	726	2,811	3,260	1,633	646	6,721	15,852	-	5	18	21	10	4	42
26	NEP	76	894	3,274	3,807	1,822	688	7,394	17,955	1	5	18	21	10	4	41
27	NEP	76	894	3,277	3,855	1,835	707	7,631	18,275	-	5	18	21	10	4	42
27	NEP	76	1,001	3,707	4,339	2,050	743	8,151	20,067	-	5	18	22	10	4	41
28	REEF	98	1,132	4,103	4,757	2,204	787	9,184	22,265	1	5	18	21	10	4	41
30	REEF	137	1,250	4,313	5,058	2,269	853	9,695	23,575	1	5	18	21	10	4	41
30	REEF	193	1,351	4,502	5,247	2,347	886	10,162	24,688	1	5	18	21	10	4	41
September																
3	TZR	204	1,419	4,605	5,441	2,426	966	10,766	25,827	1	5	18	21	9	4	42
4	LZ	237	1,477	4,753	5,565	2,492	1,007	11,120	26,651	1	5	18	21	9	4	42
5	POL	247	1,508	4,892	5,694	2,544	1,033	11,249	27,167	1	6	18	21	9	4	41
5	POL	273	1,587	5,051	5,915	2,650	1,051	11,523	28,050	1	6	18	21	9	4	41
5	LZ	291	1,636	5,100	5,982	2,699	1,082	11,872	28,662	1	6	18	21	9	4	41
6	LZ	291	1,725	5,169	6,080	2,788	1,151	12,444	29,648	1	6	18	20	9	4	42
7	REEF	367	1,801	5,364	6,275	2,874	1,194	12,854	30,729	1	6	18	20	9	4	42
9	REEF	437	1,927	5,503	6,442	2,972	1,250	13,593	32,124	1	6	18	20	9	4	42
9	TOL	437	1,927	5,508	6,455	2,977	1,255	13,695	32,254	1	6	17	20	9	4	43
10	NEP	451	1,954	5,646	6,600	2,998	1,317	13,977	32,943	1	6	17	20	9	4	43
10	NEP	479	2,047	5,860	6,870	3,100	1,336	14,181	33,873	1	6	17	20	9	4	43
12	REEF	499	2,077	5,910	6,950	3,150	1,406	14,883	[1] 34,875	1	6	17	20	9	4	43

1 Plus 218 females taken during the 2-31 July portion of the male kill.

Appendix table 10. -Age classification of female seals killed on St. George Island, 2 July to 30 August 1963

Date	Rookery	Number		Number in each age class of sample							Percent in each age class of sample							Estimated number killed from each age class						
		Females killed	Tooth sample	2	3	4	5	6	7	8+	2	3	4	5	6	7	8+	2	3	4	5	6	7	8+
2 July-1 August		59	Unclassified																					
August																								
2	EAST	22	19	-	-	4	2	3	2	8	-	-	21	11	16	10	42	-	-	5	2	4	2	9
2	STAR	21	20	-	-	3	2	1	-	14	-	-	15	10	5	-	70	-	-	3	2	1	-	15
5	NOR	58	27	-	1	6	5	5	-	10	-	4	22	19	18	-	37	-	2	13	11	10	-	22
5	ZAP	47	20	-	1	4	2	2	1	10	-	5	20	10	10	5	50	-	2	9	5	5	2	24
13	STAR	415	135	-	2	11	20	13	8	81	-	2	12	19	9	5	53	-	10	49	79	37	22	218
14	NOR	1,069	174	-	8	39	35	25	8	59	-	5	22	20	14	5	34	-	54	235	214	150	53	363
16	EAST	90	26	1	1	5	7	2	2	8	4	4	19	27	8	7	31	4	4	17	24	7	6	28
16	NOR	1,010	144	-	13	26	27	12	6	60	-	9	18	19	8	4	42	-	91	182	192	81	40	424
19	STAR	530	75	-	5	17	14	5	4	30	-	7	23	19	6	5	40	-	37	122	101	32	26	212
21	ZAP	897	110	1	4	29	12	11	4	49	1	4	26	11	10	4	44	9	36	233	99	90	36	394
23	EAST	460	60	4	9	15	8	6	5	13	7	15	25	13	10	8	22	32	69	115	60	46	37	101
23	NOR	609	69	4	7	21	13	4	3	17	6	10	30	19	6	4	25	37	61	183	116	36	24	152
26	ZAP	1,003	124	2	18	41	16	13	3	31	2	14	33	13	11	2	25	20	141	331	130	110	20	251
28	STAR	1,243	159	1	17	29	38	13	9	52	1	11	18	24	8	5	33	12	137	224	298	100	62	410
30	NOR	1,234	116	8	18	27	22	11	3	27	7	16	23	19	9	3	23	86	197	284	235	111	37	284
Season total		[1] 8,767	1,278	21	104	277	223	126	58	469								200	841	2,005	1,568	820	367	2,907

[1] Plus 92 rejected on the killing field as unfit for processing.

Appendix table 11. -- Cumulative age classification of female seals killed on St. George Island 2 July to 30 August 1963

Date	Rookery	Estimated number killed from each age class							Total kill	Percent killed from each age class						
		2	3	4	5	6	7	8+		2	3	4	5	6	7	8+
August																
2	EAST	-	-	5	2	4	2	9	22	-	-	15	10	5	-	70
2	STAR	-	-	8	4	5	2	24	43	-	-	18	9	12	5	56
5	NOR	-	2	21	15	15	2	46	101	-	2	21	15	15	2	45
5	ZAP	-	4	30	20	20	4	70	148	-	3	20	14	13	3	47
13	STAR	-	14	79	99	57	26	288	563	-	2	14	18	10	5	51
14	NOR	-	68	314	313	207	79	651	1,632	-	4	19	19	13	5	40
16	EAST	4	72	331	337	214	85	679	1,722	-	4	19	20	12	5	40
16	NOR	4	163	513	529	295	125	1,103	2,732	-	6	19	19	11	5	40
19	STAR	4	200	635	630	327	151	1,315	3,262	-	6	20	19	10	5	40
21	ZAP	13	236	868	729	417	187	1,709	4,159	-	6	21	18	10	4	41
23	EAST	45	305	983	789	463	224	1,810	4,619	1	7	21	17	10	5	39
23	NOR	82	366	1,166	905	499	248	1,962	5,228	2	7	22	17	10	5	37
26	ZAP	102	507	1,497	1,035	609	268	2,213	6,231	2	8	24	17	10	4	35
28	STAR	114	644	1,721	1,333	709	330	2,623	[1] 7,474	2	9	23	18	9	4	35
30	NOR	200	841	2,005	1,568	820	367	2,907	[1] 8,708	2	10	23	18	10	4	33

[1] Plus 59 unclassified females taken during the 2 July to 1 August portion of the male kill, and 92 rejected on the killing field as unfit for processing.

Appendix table 12. --Recovery location of tagged male seals killed, by age and rookery, Pribilof Islands, Alaska, 1963

Rookery of tagging	Rookery of recovery: St. Paul Island							St. George Island					Grand total
	ZAP-1	TOL	L-K	REEF	POL	NEP	Total	ZAP-2	NOR	EAST	STAR	Total	
N-series - 2-year-old seals													
ZAP-1	3	1	-	-	3	-	7	3	1	-	-	4	11
TOL	2	3	-	1	1	5	12	1	1	-	1	3	15
L-K	2	-	1	-	-	2	5	-	1	-	-	1	6
REEF	-	-	-	11	1	3	15	4	6	3	2	15	30
POL	-	-	-	-	1	3	4	-	-	2	-	2	6
NEP	1	-	-	1	1	10	13	-	5	2	4	11	24
NOR	-	-	-	-	-	3	3	4	10	1	2	17	20
EAST	-	-	-	-	-	-	-	-	-	2	1	3	3
STAR	-	-	-	-	-	-	-	-	3	-	6	9	9
ZAP-2	-	-	-	-	-	-	-	6	1	-	3	10	10
Tags lost	48	6	7	6	14	33	114	3	12	6	3	24	138
Total	56	10	8	19	21	59	173	21	40	16	22	99	272
M-series - 3-year-old seals													
ZAP-1	188	8	17	4	15	32	264	9	11	7	1	28	292
TOL	63	26	5	5	4	37	140	-	7	4	2	13	153
L-K	12	2	50	1	6	23	94	-	5	6	2	13	107
REEF	47	11	21	93	9	33	214	8	11	12	-	31	245
POL	8	3	7	7	59	52	136	-	3	6	1	10	146
NEP	16	3	14	3	6	195	237	5	11	10	1	27	264
NOR	2	3	1	1	1	4	12	7	56	17	-	80	92
EAST	2	-	2	-	2	6	12	3	4	23	-	30	42
STAR	-	1	-	1	2	1	5	1	12	5	8	26	31
ZAP-2	11	1	2	2	1	5	22	4	8	11	-	23	45
Tags lost	115	30	40	41	45	218	489	27	95	42	9	173	662
Total	464	88	159	158	150	606	1,625	64	223	143	24	454	2,079
L-series - 4-year-old seals													
ZAP-1	118	9	1	4	3	18	153	6	2	1	-	9	162
TOL	30	20	1	-	3	10	64	-	2	1	-	3	67
L-K	6	-	23	3	2	4	38	-	1	1	-	2	40
REEF	33	8	5	58	2	18	124	6	4	6	1	17	141
POL	2	3	4	1	44	34	88	-	2	4	-	6	94
NEP	8	-	1	4	12	105	130	1	4	4	-	9	139
ZAP-2	-	1	2	-	2	8	13	1	35	5	1	42	55
NOR	2	-	-	1	-	3	6	-	4	23	-	27	33
EAST	2	-	-	-	-	3	5	-	8	5	6	19	24
STAR	3	-	-	1	1	1	6	30	2	2	2	36	42
Tags lost	117	36	40	54	52	171	470	33	54	51	9	147	617
Total	321	77	77	126	121	375	1,097	77	118	103	19	317	1,414
K-series - 5 year-old seals													
ZAP-1	21	1	1	-	1	-	24	-	-	-	-	-	24
TOL	1	7	-	-	-	2	10	-	-	-	-	-	10
L-K	1	-	7	-	2	1	11	-	-	-	-	-	11
REEF	3	-	1	8	2	1	15	-	-	-	-	-	15
POL	1	-	-	-	9	2	12	-	-	-	-	-	12
NEP	-	-	-	-	1	27	28	-	1	-	-	1	29
ZAP-2	-	-	-	1	-	-	1	-	8	-	-	8	9
NOR	-	-	-	-	-	-	-	-	-	6	-	6	6
EAST	-	1	-	-	-	-	1	-	-	-	1	1	2
STAR	-	1	-	-	-	-	1	-	-	-	-	-	1
Tags lost	40	8	12	9	12	42	123	11	14	6	1	32	155
Total	67	18	21	18	27	75	226	11	23	12	2	48	274
J-series - 6-year-old seals													
ZAP-1	1	-	-	-	-	2	3	-	-	-	-	-	3
TOL	-	4	-	-	-	-	4	-	-	-	-	-	4
L-K	-	-	1	-	1	2	4	-	-	-	-	-	4
REEF	2	-	-	7	-	1	10	-	-	-	-	-	10
POL	-	-	-	-	3	2	5	-	-	-	-	-	5
NEP	-	-	-	-	-	6	6	-	-	-	-	-	6
ZAP-2	-	-	1	-	-	-	1	-	-	-	-	-	1
Tags lost	-	-	-	-	-	-	-	1	-	-	-	1	1
Total	3	4	2	7	4	13	33	1	-	-	-	1	34

Appendix table 13. --Seals selected and tagged as yearlings in 1961 (M-series) and 1962 (N-series) and recovered from the kill, Pribilof Islands, Alaska, 1963

Tag number	Sex	Age		Rookery	
		Tagged	Recovered	Tagged	Recovered
			St. Paul Island		
M-21	♂	1	3	ZAP	ZAP
M-89	♂	1	3	ZAP	ZAP
M-173	♂	1	3	ZAP	ZAP
M-200	♂	1	3	NEP	NEP
M-311	♂	2	4	NEP	NEP
M-319	♂	2	4	NEP	NEP
M-432	♂	1	3	REEF	REEF
M-462	♂	1	3	POL	POL
M-471	♂	1	3	POL	L. POL
M-605	♂	1	3	L. ZAP	ZAP
M-782	♂	1	3	POL	POL
M-809	♂	1	3	L. ZAP	ZAP
M-834	♂	1	3	L. ZAP	NEP
M-1109	♂	2	4	NEP	POL
Tags lost	♂	-	3	-	ZAP
" "	♂	-	3	-	ZAP
" "	♂	-	4	-	L-K
M-53	♀	1	3	ZAP	ZAP
M-287	♀	2	4	REEF	REEF
M-288	♀	3	5	REEF	ZAP-REEF
M-320	♀	1	3	NEP	NEP
M-336	♀	2	4	NEP	NEP
M-362	♀	2	4	NEP	NEP
M-381	♀	2	4	NEP	ZAP
M-407	♀	2	4	POL	POL
M-415	♀	2	4	POL	POL
M-418	♀	2	4	POL	POL
M-421	♀	3	5	POL	POL
M-459	♀	2	4	POL	POL
M-478	♀	2	4	POL	REEF
M-545	♀	2	4	POL	POL
M-554	♀	2	4	REEF	REEF
M-593	♀	2	4	REEF	REEF
M-704	♀	2	4	NEP	NEP

Appendix table 13. --Seals selected and tagged as yearlings in 1961 (M-series) and 1962 (N-series) and recovered from the kill, Pribilof Islands, Alaska, 1963--Continued

Tag number	Sex	Age		Rookery	
		Tagged	Recovered	Tagged	Recovered
		St. Paul Island			
M-714	♀	2	4	NEP	NEP
M-778	♀	2	4	POL	L. ZAP
M-1114	♀	2	4	POL	POL
N-50088	♂	1	2	REEF	ZAP-REEF
N-50130	♂	1	2	L. ZAP	L-K
N-50207	♂	1	2	NEP	NEP
N-50258	♂	1	2	NEP	NEP
N-50267	♂	1	2	NEP	TOL
N-50273	♂	1	2	NEP	NEP
N-50281	♂	1	2	ZAP	ZAP
N-50334	♂	1	2	TOL	ZAP-REEF
N-50337	♂	1	2	TOL	TZR
N-50358	♂	1	2	TOL	NEP
N-50376	♂	1	2	REEF	REEF
N-50472	♂	1	2	ZAP	NEP
N-50485	♂	1	2	ZAP	NEP
N-50569	♂	1	2	TOL	ZAP
N-50583	♂	1	2	ZAP-REEF	NEP
N-50605	♂	1	2	ZAP	ZAP
N-50606	♂	1	2	ZAP	NEP
N-50615	♂	1	2	ZAP	ZAP
N-50654	♂	1	2	REEF	NEP
N-50673	♂	1	2	REEF	REEF
N-50676	♂	1	2	REEF	ZAP
N-50695	♂	1	2	POL	ZAP
N-50708	♂	1	2	NEP	NEP
N-50712	♂	1	2	NEP	NEP
N-50715	♂	1	2	NEP	L. ZAP
N-50740	♂	1	2	NEP	NEP
N-50756	♂	1	2	NEP	REEF
N-50760	♂	1	2	NEP	NEP
N-50775	♂	1	2	TOL	ZAP

Appendix table 13. --Seals selected and tagged as yearlings in 1961 (M-series) and 1962 (N-series) and recovered from the kill, Pribilof Islands, Alaska, 1963--Continued

Tag number	Sex	Age		Rookery	
		Tagged	Recovered	Tagged	Recovered
		St. Paul Island			
N-50829	♂	1	2	ZAP	ZAP
N-50881	♂	1	2	NEP	REEF
N-50894	♂	1	2	NEP	NEP
N-50895	♂	1	2	NEP	ZAP
N-50897	♂	1	2	NEP	NEP
N-50924	♂	1	2	L-K	ZAP-REEF
N-50978	♂	1	2	REEF	REEF
N-50103	♀	2	3	POL	ZAP
N-50272	♀	1	2	NEP	NEP
N-50960	♀	1	2	REEF	REEF
		St. George Island			
N-50068	♂	1	2	REEF	EAST
N-50162	♂	2	3	POL	STAR
N-50245	♂	1	2	NEP	STAR
N-50283	♂	1	2	ZAP	EAST
N-50406	♂	1	2	L-K	NORTH
N-50622	♂	2	3	ZAP	NORTH
N-50647	♂	1	2	ZAP	NORTH
N-50758	♂	1	2	NEP	NORTH
N-50814	♂	1	2	TOL	NORTH
N-50932	♂	1	2	L-K	NORTH
N-50140	♀	1	2	REEF	NORTH

Appendix table 14. -- Soviet tags recovered from the kill, Pribilof Islands, Alaska, 1963

Date	Tag number	Age	Sex	Island of tagging	Rookery of recovery	Length	Weight
		Years				Cm.	Kg.
				St. Paul Island			
27 July	C-47020	2	♂	Commander	NEP	-	-
19 "	C-48620	2	♂	"	ZAP	113.5	27.8
6 "	C-56000	2	♂	"	POL	106.0	21.3
1 Aug.	C-66540	2	♂	"	NEP	122.0	33.6
27 July	C-73850	2	♂	"	NEP	-	-
15 Aug.	C-77290	2	♂	"	ZAP-REEF	114.5	28.3
29 July	C-80150	2	♂	"	ZAP	112.0	24.7
24 "	C-81330	2	♂	"	ZAP	110.0	22.0
21 "	C-87630	2	♂	"	POL	119.0	27.4
19 Aug.	C-89466	2	♂	"	NEP	-	-
4 "	C-98000	2	♂	"	REEF	109.5	28.0
27 July	C-28170	3	♂	Medny	NEP	102.0	20.8
22 "	E- 7064	3	♂	Bering	NEP	116.0	29.0
7 "	E-11346	3	♂	"	NEP	118.0	26.8
18 "	C-13006	4	♂	Commander	TZR	115.5	31.7
7 "	C-14179	4	♂	"	NEP	107.5	21.7
2 "	C-16498	4	♂	"	NEP	118.0	27.8
7 "	C-18164	4	♂	"	NEP	123.5	33.4
4 "	C-18387	4	♂	"	ZAP	121.0	27.2
5 Sept.	C-49130	2	♀	"	POL	104.0	-
10 "	K-14811	2	♀	Bering	NEP	96.5	-
3 "	C-27580	3	♀	Medny	TZR	103.5	-
30 Aug.	C-27950	3	♀	"	REEF	96.5	-
23 "	C- 7711	4	♀	Robben	POL	115.0	26.8
10 Sept.	C-13366	4	♀	Commander	NEP	106.5	-
23 Aug.	B- 2761	5	♀	"	POL	116.0	24.8
15 "	A- 1730	6	♀	Robben	REEF	110.0	25.4
				St. George Island			
31 July	C-31400	2	♂	Commander	ZAP	-	-
29 "	C-44620	2	♂	"	NOR	-	-
19 "	C-72390	2	♂	"	STAR	-	-
31 "	C-82920	2	♂	"	NOR	-	-
2 Aug.	C-88290	2	♂	"	EAST	-	-
2 July	C-96040	2	♂	"	ZAP	-	-
19 "	E-17030	2	♂	"	EAST	-	-
5 Aug.	C-18817	4	♂	"	ZAP	-	-
2 "	C-19974	4	♂	"	EAST	-	-
30 "	B- 2567	5	♀	"	NOR	-	-

Appendix table 15.--Length classes of tagged 3-year-old male seals sampled from the kill, by date, St. Paul Island, 1963

Date	Length in inches												Total
	39	40	41	42	43	44	45	46	47	48	49	>49	
July													
2	1	3	3	3	8	6	9	5	2	2	1	1	44
3	-	-	-	-	1	-	2	2	1	-	-	-	6
4	-	-	2	1	7	7	2	3	2	-	-	-	24
5	-	-	-	3	2	-	1	2	1	-	-	-	9
6	-	-	-	2	3	2	3	1	2	-	-	-	13
Total	1	3	5	9	21	15	17	13	8	2	1	1	96
7	2	1	-	-	9	7	5	1	2	2	1	-	30
8	-	-	-	-	-	-	-	-	-	-	-	-	-
9	1	-	-	1	2	2	-	3	-	1	1	-	11
10	-	-	-	-	-	-	1	1	-	-	-	-	2
11	-	-	-	-	1	1	1	1	-	-	-	-	4
Total	3	1	-	1	12	10	7	6	2	3	2	-	47
12	-	-	2	2	3	5	1	1	-	2	-	-	16
13	-	-	-	1	1	2	1	1	-	-	-	-	6
14	-	-	-	1	2	2	-	4	-	1	-	1	11
15	-	1	-	-	2	1	1	-	1	-	-	-	6
16	-	-	-	-	-	-	4	-	1	2	-	-	7
Total	-	1	2	4	8	10	7	6	2	5	-	1	46
17	-	-	3	3	8	16	7	5	3	2	-	1	48
18	-	-	2	1	4	5	2	1	-	-	-	-	15
19	-	1	1	5	8	13	10	10	4	4	1	-	57
20	-	1	2	3	2	10	6	7	5	2	-	-	38
21	-	-	1	4	2	3	1	3	3	-	-	-	17
Total	-	2	9	16	24	47	26	26	15	8	1	1	175
22	1	2	8	10	11	15	13	11	8	5	2	-	86
23	-	-	-	-	1	6	-	1	1	-	-	-	9
24	1	1	5	6	9	17	14	7	9	2	2	-	73
25	-	1	1	3	8	14	4	7	6	2	-	-	46
26	-	1	1	2	1	7	2	3	1	1	1	-	20
Total	2	5	15	21	30	59	33	29	25	10	5	-	234
27	-	-	1	5	16	24	11	15	5	2	1	-	80
28	-	-	2	1	5	4	1	6	2	1	1	1	24
29	-	1	1	2	8	18	7	5	5	4	-	-	51
30	1	1	4	4	17	11	8	5	4	1	1	-	57
31	-	-	-	2	1	4	4	1	-	-	-	1	13
Total	1	2	8	14	47	61	31	32	16	8	3	2	225
August													
1	-	-	1	5	14	8	7	5	1	2	-	-	43
2	-	-	-	1	6	11	7	1	4	3	-	-	33
3	-	1	1	3	7	6	7	8	7	1	-	-	41
4	-	-	4	2	8	14	4	5	2	1	-	-	40
5	-	-	2	4	4	6	2	2	4	1	-	-	25
Total	-	1	8	15	39	45	27	21	18	8	-	-	182
Grand total	7	15	47	80	181	247	148	133	86	44	12	5	1,005

Appendix table 16.--Tag numbers (P-series) and weights of live male and female fur seal pups, by rookery, St. Paul Island, 31 August and 1 September 1963

Tag number	Weight	Tag number	Weight	Tag number	Weight	Tag number	Weight	Tag number	Weight
	Kg.		Kg.		Kg.		Kg.		Kg.
				REEF - males					
8942	7.2	10063	8.0	10413	5.9	10639	7.7	11046	9.5
8949	7.0	10214	6.7	10437	6.8	10659	8.8	11082	9.0
9012	6.6	10219	11.7	10446	5.0	10676	7.0	11090	9.8
9065	10.8	10220	9.3	10449	8.0	10689	7.4	11114	5.1
9167	9.0	10231	7.6	10450	10.5	10701	8.8	11132	8.4
9335	9.4	10259	11.0	10457	12.0	10723	7.2	11153	6.5
9476	7.1	10285	12.2	10458	6.0	10832	9.0	11156	8.8
9683	9.8	10291	8.2	10467	8.1	10870	5.6	11165	7.0
9860	7.2	10293	5.6	10470	7.2	10880	8.2	11168	8.8
9883	11.5	10339	10.0	10471	7.8	10891	9.6	11171	6.6
9937	9.5	10343	7.0	10560	9.1	10896	7.1	11186	8.8
9952	7.4	10358	6.8	10580	9.3	10898	7.7	11199	7.8
10002	6.8	10362	7.1	10598	11.7	10974	13.4	11222	8.2
10024	7.0	10389	9.5	10610	4.7	10985	9.6	11224	7.0
10039	8.1	10412	7.6	10634	8.5	11008	8.8	11298	9.0
				REEF - females					
8904	7.0	9914	8.9	10341	7.9	10698	6.7	10990	6.3
8939	6.8	9945	7.9	10395	9.9	10699	7.3	11047	4.9
8977	6.0	9967	4.0	10434	7.8	10708	7.7	11080	8.7
9013	9.6	9971	7.0	10438	8.7	10736	5.6	11109	6.6
9016	5.5	9997	7.3	10453	11.9	10740	10.3	11162	6.0
9121	6.7	10037	6.0	10499	6.8	10741	6.6	11198	6.6
9153	6.0	10045	8.0	10528	8.4	10755	6.6	11267	7.2
9243	8.3	10092	5.5	10537	9.9	10764	11.0	11276	7.9
9254	9.9	10093	7.6	10539	7.2	10768	7.3	11277	7.4
9358	7.4	10159	7.1	10552	8.5	10769	7.5	11281	9.0
9447	4.5	10195	5.9	10571	8.0	10784	3.9	11287	6.7
9648	8.1	10246	9.0	10576	7.2	10791	7.0	11295	7.6
9700	9.6	10299	9.2	10609	9.3	10835	5.3		
9862	5.0	10309	6.2	10643	7.9	10844	6.0		
9873	10.2	10322	7.3	10670	8.4	10954	7.9		
				ZAPADNI - males					
7123	5.6	7326	5.1	7432	7.1	7637	11.5	7793	8.8
7129	7.9	7332	7.7	7462	9.3	7644	9.0	7819	7.9
7135	8.6	7364	10.2	7473	8.0	7649	8.1	7847	8.0
7153	8.7	7368	8.1	7487	9.1	7652	8.8	7850	6.2
7156	5.9	7375	10.2	7490	8.1	7654	8.5	7880	9.7
7167	8.1	7378	9.7	7498	8.0	7667	7.8	7885	10.4
7174	8.3	7382	7.1	7503	8.2	7668	7.2	7913	8.5
7183	8.1	7384	8.6	7533	5.9	7700	6.5	7923	10.1
7212	11.0	7394	6.5	7535	9.2	7726	7.6	7930	8.3
7217	6.7	7395	8.6	7548	6.5	7735	8.3	7942	8.4
7261	6.2	7409	9.2	7552	10.2	7752	8.1	7951	8.9
7273	10.4	7412	8.3	7570	5.3	7756	8.8	7980	7.6
7286	10.1	7414	6.7	7579	8.3	7759	8.9	7992	9.5
7297	9.3	7419	6.4	7580	7.8	7760	7.1	7993	8.9
7306	11.2	7427	7.0	7624	8.8	7761	5.3		
				ZAPADNI - females					
5070	7.9	7268	7.4	7457	6.6	7646	7.1	7789	11.0
7121	7.4	7289	4.8	7501	6.3	7647	6.6	7794	5.6
7122	9.3	7292	5.5	7510	6.9	7653	4.3	7798	6.6
7132	6.5	7317	10.8	7519	9.5	7660	8.2	7807	7.3
7134	9.6	7319	8.7	7521	7.2	7661	6.8	7833	6.9
7138	8.8	7336	7.0	7537	3.9	7662	7.0	7843	7.2
7140	6.8	7344	7.8	7546	8.1	7670	5.4	7849	9.6
7164	9.3	7346	6.4	7554	6.2	7672	5.8	7852	6.5
7169	8.5	7358	6.4	7564	8.5	7688	5.7	7863	9.5
7185	7.8	7373	7.8	7571	5.7	7697	8.3	7869	7.3
7188	7.0	7377	5.4	7589	7.3	7702	7.6	7877	5.4
7199	6.9	7381	6.0	7591	7.5	7704	7.1	7912	7.4
7213	6.3	7405	9.0	7596	5.9	7722	7.8	7968	6.7
7244	7.4	7418	6.0	7611	6.4	7742	7.2	7997	6.2
7263	9.7	7438	9.5	7635	6.9	7747	8.6	8000	9.8

Appendix table 16.--Tag numbers (P-series) and weights of live male and female fur seal pups, by rookery, St. Paul Island, 31 August and 1 September 1963--Continued

Tag number	Weight	Tag number	Weight	Tag number	Weight	Tag number	Weight	Tag number	Weight
	Kg.		Kg.		Kg.		Kg.		Kg.
				POLOVINA - males					
13716	7.8	13815	6.8	13936	8.1	14328	10.4	14428	9.4
13722	7.5	13817	9.8	13940	9.8	14329	11.3	14434	6.6
13724	9.0	13829	10.5	13952	10.0	14331	7.5	14435	9.0
13731	8.2	13838	10.0	13956	8.5	14344	7.1	14438	5.1
13737	8.0	13864	8.2	13963	8.2	14349	11.7	14439	5.5
13740	11.6	13869	4.5	13966	6.8	14351	7.3	14453	8.0
13746	7.1	13878	8.2	13968	7.9	14362	9.7	14466	10.2
13751	6.4	13887	7.7	13973	11.3	14364	6.8	14468	7.5
13763	9.9	13904	9.0	13979	7.4	14365	7.8	14474	8.0
13767	8.7	13905	6.9	13981	6.3	14371	8.8	14477	8.1
13771	10.3	13908	6.8	13990	6.3	14395	6.6	14479	6.0
13790	5.5	13914	5.5	13995	5.2	14403	5.8	14484	9.7
13800	6.4	13928	6.0	14000	5.4	14408	7.7	14492	6.5
13807	6.1	13930	9.7	14066	7.2	14409	8.3	14494	7.5
13809	8.8	13935	7.4	14094	7.6	14421	7.1	14580	11.2
				POLOVINA - females					
13703	8.1	13768	7.6	13875	7.1	14081	8.1	14401	8.5
13709	4.9	13775	8.3	13876	5.4	14082	5.4	14405	9.1
13717	10.0	13784	6.4	13884	6.2	14085	8.4	14410	4.6
13721	6.3	13785	6.9	13919	6.9	14088	8.9	14430	9.9
13723	7.5	13793	6.3	13937	6.8	14090	6.0	14431	9.3
13727	7.6	13795	7.6	13943	5.6	14092	4.5	14432	4.7
13732	6.7	13806	5.4	13971	5.1	14096	7.2	14441	8.1
13741	5.6	13818	5.7	13980	7.5	14098	5.9	14456	8.1
13742	6.3	13819	7.7	13981	6.3	14317	5.9	14461	10.5
13744	6.7	13830	5.5	13983	7.0	14319	5.2	14467	7.1
13747	6.4	13836	5.8	14058	5.1	14332	5.8	14470	4.2
13748	9.5	13843	6.5	14068	9.5	14336	8.7	14481	7.1
13757	7.6	13844	5.4	14071	8.4	14376	4.5	14490	7.4
13760	5.6	13852	7.0	14073	7.1	14381	5.6	14499	6.5
13761	6.3	13865	5.7	14075	10.5	14394	7.8	14651	7.6
				NORTHEAST POINT - males					
16423	9.0	16642	11.1	16855	7.9	18215	9.1	18718	9.9
16432	8.9	16672	11.0	16861	9.2	18223	7.3	18720	8.0
16452	7.9	16678	6.2	16867	8.7	18508	5.8	18783	9.0
16454	7.5	16681	9.3	16890	7.9	18536	8.8	18796	8.2
16466	9.6	16708	8.4	16892	8.1	18550	6.6	18801	7.6
16484	11.8	16726	11.8	16897	8.2	18559	8.8	18802	9.5
16488	6.9	16735	9.9	16901	11.6	18561	11.1	18815	10.8
16520	5.7	16748	5.8	16902	8.5	18566	8.5	18818	6.4
16532	7.2	16750	8.8	16924	6.0	18587	6.3	18827	9.8
16567	11.1	16761	7.4	16931	9.5	18589	7.4	18850	9.6
16599	9.7	16768	9.6	16935	9.5	18607	8.9	18853	8.5
16607	10.6	16770	12.0	16957	9.4	18614	8.5	18855	8.9
16612	7.4	16812	5.4	16982	11.8	18626	10.2	18860	10.9
16618	9.8	16818	8.0	18016	7.7	18663	7.5	18867	8.5
16640	8.9	16853	6.5	18073	9.1	18708	11.5	18899	12.7
				NORTHEAST POINT - females					
16428	9.1	16626	6.4	16797	7.5	18513	7.8	18779	7.4
16438	6.6	16645	8.7	16850	7.7	18520	7.7	18781	6.3
16452	8.9	16667	8.9	16852	10.0	18593	6.5	18784	8.8
16471	5.2	16677	10.0	16857	9.1	18602	5.3	18785	7.2
16493	5.2	16681	9.2	16877	9.6	18609	7.4	18794	7.8
16504	7.5	16687	7.7	16896	8.4	18645	7.6	18807	6.3
16505	8.3	16690	9.4	16905	7.7	18689	5.7	18808	9.8
16506	7.1	16698	8.7	16925	7.8	18700	7.1	18810	7.2
16507	6.9	16704	4.6	16956	8.3	18733	8.1	18838	8.2
16528	7.4	16713	5.1	18003	8.1	18737	7.2	18840	9.9
16537	7.5	16715	7.7	18041	10.3	18750	7.5	18859	5.5
16575	7.3	16743	8.1	18071	7.0	18755	7.6	18869	9.3
16601	11.4	16747	5.1	18076	7.2	18764	7.5	18876	5.9
16605	7.6	16764	7.4	18082	7.5	18766	6.8	18879	7.6
16620	5.5	16796	5.9	18108	7.5	18769	7.3		

Appendix table 17.--Record of fur seal pups tagged, Pribilof Islands, Alaska 1941, 1945, 1947-51, and 1952-63

Year	Series	St. Paul Island	St. George Island	Location of tag	Checkmarks
1941	USA 1-10000;	10,000		Front flipper	Branded, nape of neck
	USA 1-1000 and	1,000		♂♂ right front and	Double tagged, branded
	USA 5001-6000	1,000		hind flippers; ♀♀ left front and hind flippers	nape of neck
1945	10001-11000 (no letter prefix)	973		Left front flipper	None
1947	A 1-20000	19,183		Left front flipper	1/4" hole between 1st and 2nd digits left hind flipper
1948	B 1-19673	19,532		Left front flipper	None
1949	CS 1-20000	19,963		Left hind flipper	None
1951	D 1-1000	1,000		Right hind flipper	1/2 left ear on 100 tagged pups removed
1952	E 1-20000	19,979		Right front flipper	Tip of 1st digit on right hind flipper sliced off
1953	F 1-10000	9,990		Left front flipper	Tip of left front flipper sliced off
	G 7001-7400	398		" " "	" " " "
1954	G 1-7000	7,000		Right front flipper	"V" notch near tip right front flipper
	G 7401-10400	3,000		" " "	" " " "
1955	H 1-10000	49,870		Left front flipper	Tip of 1st digit on left hind flipper sliced off
	10001-50000 (no letter prefix)			" " "	
1956	1 1-10000		9,894	Right front flipper	Tip of right front flipper sliced off
	1 10001-50000	39,900		" " "	" " " " "
1957	J 1-10000		9,972	Left front flipper	"V" notch near tip left front flipper
	J 10001-50000	39,870		" " "	" " " " "
1958	K 1-10000		9,994	Right front flipper	"V" notch near tip right front flipper
	K 10001-50000	39,923		" " "	" " " " "
	K 10001-15000	5,000		Right and left front flippers	Double tagging plus check-mark
1959	L 1-10000		9,980	Left front flipper	Tip of left front flipper sliced off
	L 10001-50000	39,901		" " "	" " " " "
1960	M 1-12000		11,992	Right front flipper	Tip of right front flipper sliced off
	M 12001-60000	47,989		" " "	" " " " "
1961	N 1-10000		9,988	Left front flipper	"V" notch near tip left front flipper
	N 10001-50000	39,933		" " "	" " " " "
1962	O 1-10000		9,980	Right front flipper	"V" notch near tip right front flipper
	O 10001-50000	39,928		" " "	" " " " "
1963	P 1-5000		4,993	Left front flipper	Tip of left front flipper sliced off
	P 5001-25000	19,978		" " "	" " " " "

Appendix table 18. --Dead-pup counts, by rookery, Pribilof Islands, Alaska, 1941 and 1948-63

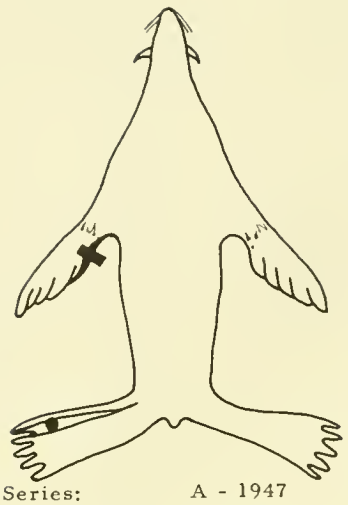
Rookery	1941	1948[1/]	1949[1/]	1950	1951	1952[1/]	1953	1954	1955	1956	1957	1958	1959	1960	1961	1962	1963
St. Paul Island																	
Morjovi	933	20600	2600	3000	3592		3764	8049	5571	10278	4253	2290	4560	6825	5259	4881	2348
Vostochni	7708		12966	13120	18450		19503	25233	14473	20498	12732	7247	7105	11333	10173	8565	5057
Little Polovina	292		1600	1740	2208		2211	3852	2782	4443	1695	975	1597	2427	2415	2121	923
Polovina Cliffs	2356			3800	5580	2954	5451	6413	5964	8637	4425	1826	2586	3462	4576	2957	2160
Polovina			1779	5660	6402	3200	5036	6459	4660	7463	5432	2184	3311	5268	2499	1880	1237
Ardiguen	42			170	242		189	282	387	364	249	102	141	331	411	225	141
Gorbatch	896			2810	3559		3679	4900	4789	6291	3801	1655	2100	3168	3550	1373	2431
Reef	2269			9520	11007		13661	12959	15145	14399	11301	5550	6052	9664	10047	7897	5688
Kitovi	404		800	1160	1517		1695	1669	2610	2892	1588	608	882	2006	2215	2081	881
Lukanin			635	770	712		1086	1129	1129	1718	870	324	631	1037	1294	660	546
Tolstoi	1623			4230	6033		6154	7552	6489	6789	5659	2823	3691	5237	4761	3004	3274
Little Zapadni	372			2120	2804		2446	4979	3555	4611	2325	1312	1691	4148	3047	2399	2580
Zapadni Reef	171		575	660	353		1116	2278	1383	1674	917	246	608	1472	1291	598	718
Zapadni	1284			4660	8204		12221	10424	6607	8650	6415	4045	5009	6450	6329	6627	4614
Counted total	18350			53420	70663		78212	96178	75544	98707	61662	31187	39964	62828	57867	45268	32598
Estimated oversight 5%	918			2671	3533		3911	4809	3777	4935	3083	1559	1998	2946	2893	2263	1630
Total	19268			56091	74196		82123	100987	79321	103642	64745	32746	41962	65774	60760	47531	34228
St. George Island																	
North							3197	3776		6357	3942	1626	2653	3489	3883	2242	2525
Zapadni							1272	1453		2742	1569	962	1633	1902	2019	1740	704
East							846	1524		2203	1064	616	664	1112	1347	504	502
Staraya Artil							3353	2903		3806	2729	1552	1987	2000	2514	1435	1041
Counted total							8668	9656		15108	9304	4756	6937	8503	9763	5921	4772
Estimated oversight 5%							433	483		755	465	238	347	425	488	296	239
Total							9101	10139		15863	9769	4994	7284	8928	10251	6217	5011

1/ Partial counts

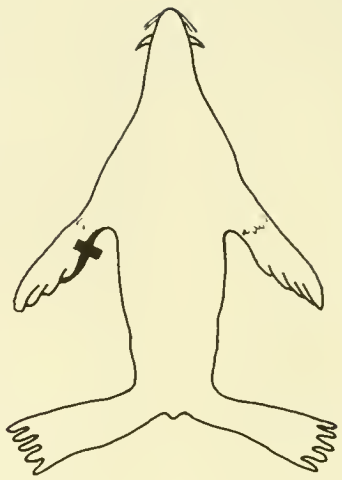
No counts made in years 1942 through 1947.

Appendix table 19.--Bull counts, Pribilof Islands, Alaska, 1911-41 and 1943-63

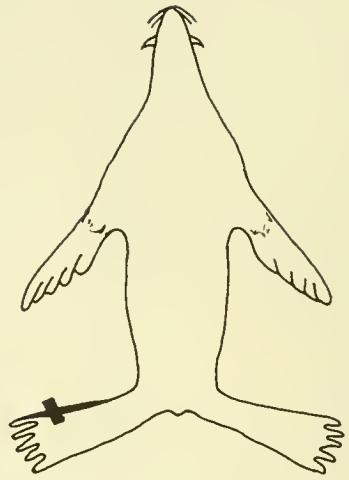
Year	St. Paul Island		St. George Island		Both islands	
	Harem	Idle	Harem	Idle	Harem	Idle
1911	1,090	258	266	71	1,356	329
1912	1,077	93	281	20	1,358	113
1913	1,142	77	261	28	1,403	105
1914	1,316	159	243	13	1,559	172
1915	1,789	546	362	127	2,151	673
1916	2,948	2,278	552	354	3,500	2,632
1917	4,166	2,341	684	365	4,850	2,706
1918	4,610	2,245	734	199	5,344	2,444
1919	4,573	2,158	585	81	5,158	2,239
1920	3,542	1,078	524	83	4,066	1,161
1921	3,443	711	466	36	3,909	747
1922	3,184	493	378	15	3,562	508
1923	3,051	303	361	9	3,412	312
1924	3,127	375	389	15	3,516	390
1925	3,103	283	423	28	3,526	311
1926	3,478	368	556	55	4,034	423
1927	3,916	846	727	126	4,643	972
1928	5,059	1,208	991	241	6,050	1,449
1929	5,998	1,339	1,189	294	7,187	1,633
1930	6,823	1,555	1,489	344	8,312	1,899
1931	7,557	1,519	1,676	369	9,233	1,888
1932	8,268	1,940	1,820	409	10,088	2,349
1933	8,334	1,933	1,879	408	10,213	2,341
1934	8,841	1,860	1,929	422	10,770	2,282
1935	9,444	2,082	2,103	453	11,547	2,535
1936	10,055	2,253	-	-	-	-
1937	10,689	2,516	2,411	515	13,100	3,031
1938	10,720	1,787	-	-	-	-
1939	9,122	2,616	1,858	357	10,980	2,973
1940	9,662	3,968	1,988	571	11,650	4,539
1941	10,089	5,059	1,942	396	12,031	5,455
1942	-	-	-	-	-	-
1943	10,948	3,523	2,107	330	13,055	3,853
1944	11,080	2,539	2,294	450	13,374	2,989
1945	10,750	4,055	2,434	750	13,184	4,805
1946	10,566	3,605	2,430	611	12,996	4,216
1947	10,160	3,331	1,808	479	11,968	3,810
1948	10,386	3,400	1,814	563	12,200	3,963
1949	9,554	2,976	1,746	552	11,300	3,528
1950	9,442	3,152	1,959	574	11,401	3,726
1951	9,434	3,581	1,825	549	11,259	4,130
1952	9,318	4,717	1,983	605	11,301	5,322
1953	9,848	5,912	2,285	826	12,133	6,738
1954	9,906	6,847	2,228	1,311	12,134	8,158
1955	9,034	8,650	2,130	1,902	11,164	10,552
1956	9,384	9,016	-	-	-	-
1957	9,562	10,060	2,423	2,693	11,985	12,753
1958	9,970	9,510	2,619	3,030	12,589	12,540
1959	10,003	11,485	2,527	2,699	12,530	14,184
1960	10,247	10,407	2,552	2,630	12,799	13,037
1961	11,163	11,791	2,843	2,489	14,006	14,280
1962	10,332	9,109	2,342	2,650	12,674	11,759
1963	9,212	7,650	2,071	1,890	11,283	9,540



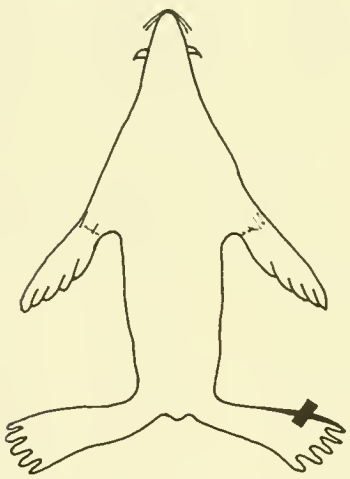
Series: A - 1947
Tag location: left front flipper
Check mark: 1/4" hole in hind left flipper
Number tagged: 19183



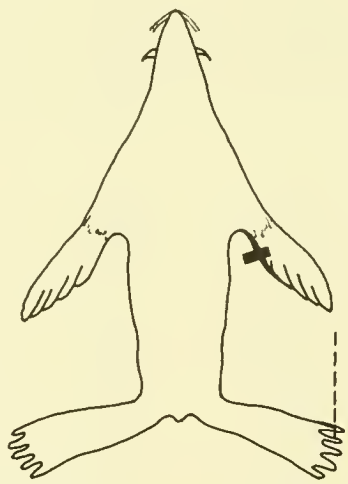
Series: B - 1948
Tag location: left front flipper
Check mark: none
Number tagged: 19532



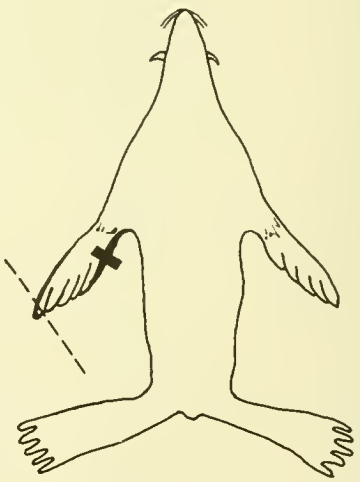
Series: CS - 1949
Tag location: left hind flipper
Check mark: none
Number tagged: 19960



Series: D - 1951
Tag location: right hind flipper
Check mark: none
Number tagged: 1000

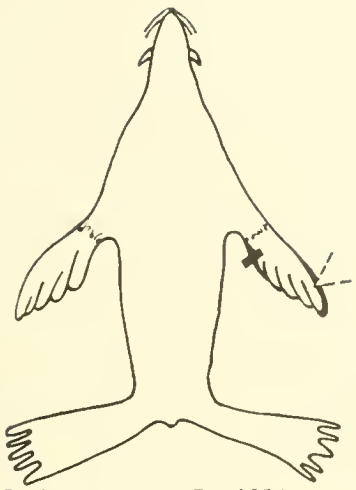


Series: E - 1952
Tag location: right front flipper
Check mark: tip of digit on right hind flipper sliced off
Number tagged: 19979

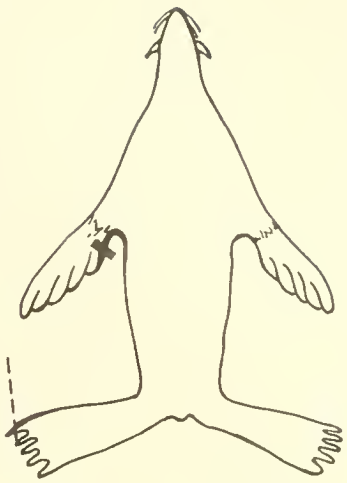


Series: F - 1953
Tag location: left front flipper
Check mark: tip of left front flipper sliced off
Number tagged: 10388
G - 1953 70001-7400

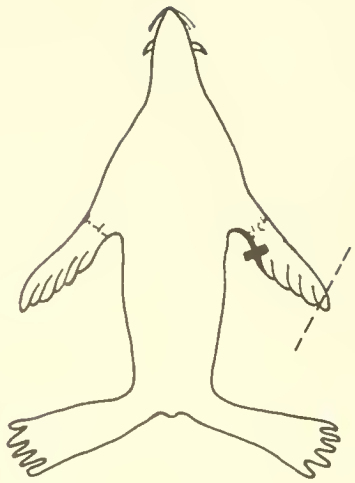
Appendix figure 1. --Tag and checkmark locations, fur seal pup tagging, Pribilof Islands, Alaska, 1947-63.



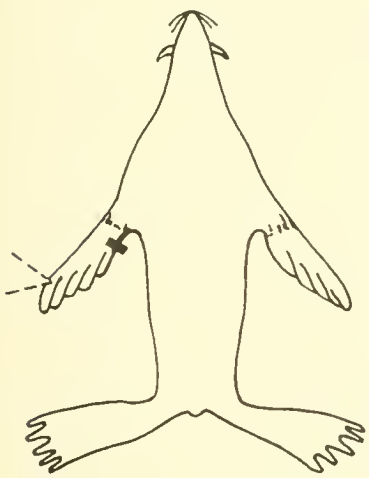
Series: G - 1954
Tag location: right front flipper
Check mark: "V" notch on right front flipper
Number tagged: 10000



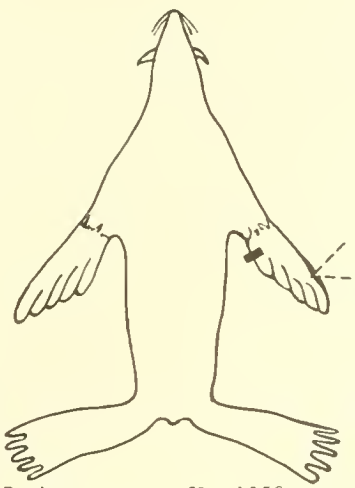
Series: H - 1955
Tag location: left front flipper
Check mark: tip of digit on left hand flipper sliced off
Number tagged: 49870 No letter
H-1955 1-10000 10001-50000



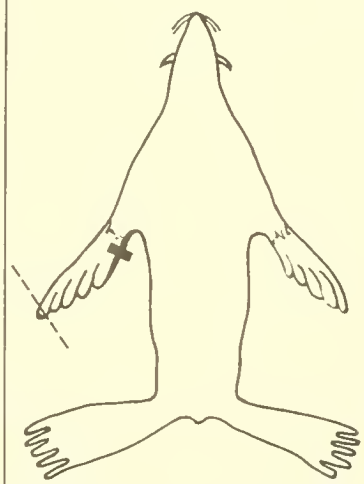
Series: I - 1956
Tag location: right front flipper
Check mark: tip of right front flipper sliced off
Number tagged: 49794



Series: J - 1957
Tag location: left front flipper
Check mark: "V" notch on left front flipper
Number tagged: 49842

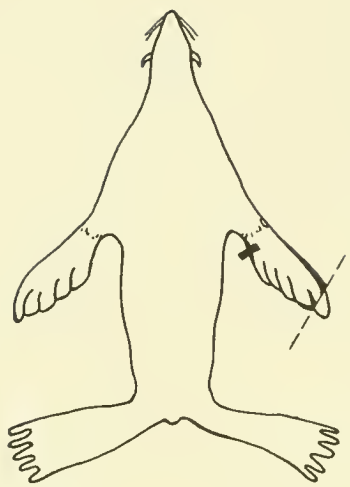


Series: K - 1958
Tag location: right front flipper
Check mark: "V" notch on right front flipper
Number tagged: 49917

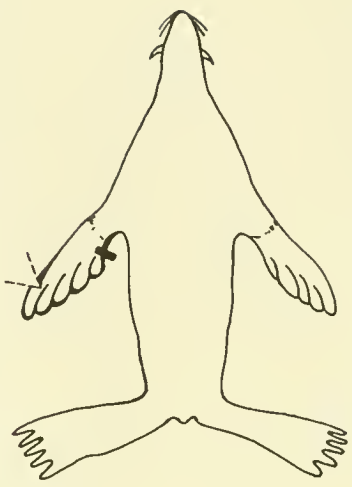


Series: L - 1959
Tag location: left front flipper
Check mark: tip of left front flipper sliced off
Number tagged: 49881

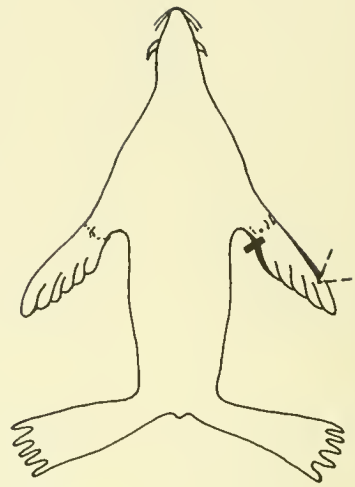
Appendix figure 1. --Tag and checkmark locations, fur seal pup tagging, Pribilof Islands, Alaska, 1947-63. --Continued



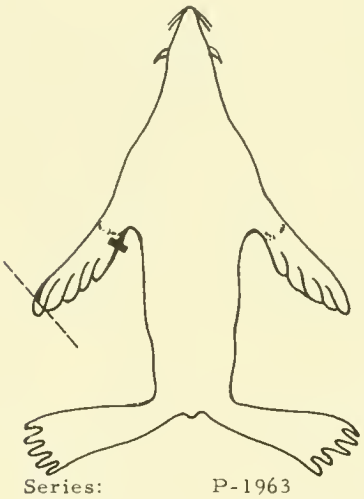
Series: M - 1960
Tag location: right front flipper
Checkmark: tip of right front flipper sliced off
Number tagged: 59981



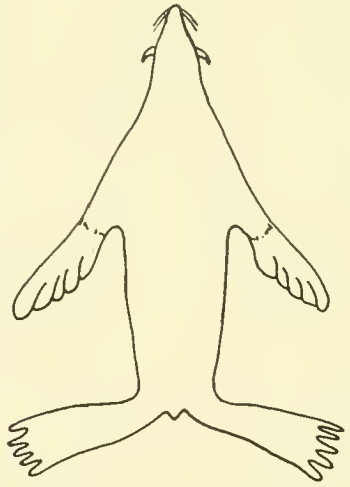
Series: N - 1961
Tag location: left front flipper
Checkmark: "V" notch on left front flipper
Number tagged: 49921

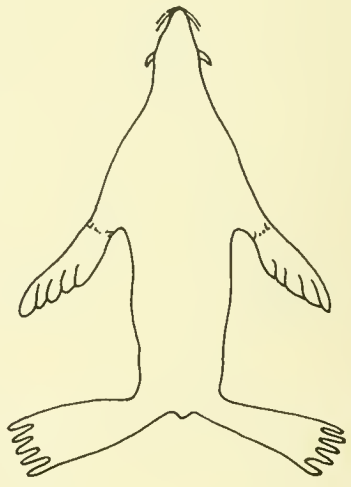


Series: O - 1962
Tag location: right front flipper
Checkmark: "V" notch on right front flipper
Number tagged: 49,908



Series: P-1963
Tag location: left front flipper
Checkmark: tip of left front flipper sliced off
Number tagged: 24,971





Appendix figure 1. --Tag and checkmark locations, fur seal pup tagging, Pribilof Islands, Alaska, 1947-63. --Continued

Created in 1849 the Department of the Interior--a department of conservation--is concerned with the management, conservation, and development of the Nation's water, fish, wildlife, mineral, forest, and park and recreational resources. It also has major responsibilities for Indian and Territorial affairs.

As the Nation's principal conservation agency, the Department works to assure that nonrenewable resources are developed and used wisely, that park and recreational resources are conserved for the future, and that renewable resources make their full contribution to the progress, prosperity, and security of the United States--now and in the future.

UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
BUREAU OF COMMERCIAL FISHERIES
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