Alaska Fur Seal Investigations
Pribilof Islands, Alaska

Summer of 1954

Karl W. Kenyon

ALASKA FUR SEAL INVESTIGATIONS

PRIBILOF ISLANDS SUMMER OF 1954

Karl W. Kenyon

November 1954

CONTENTS

Rookery maps are not available in quantity and are included only in copies to be used on the Pribilof Islands and in the Seattle Laboratory.

I. INTRODUCTION

Biological studies were conducted on the Pribilof Islands in 1954 between 28 May and 25 September. All five islands of the group were visited during the summer but the biological studies were carried out primarily on St. Paul.

Biologists participating in the summer work were: Karl W. Kenyon, Wildlife Research Biologist, who arrived on 28 May and departed 25 September; Carl F. Dixon, Parasitologist (Veterinary), who arrived 3 June and departed 9 September; Richard E. Phillips, Biological Aid, who arrived 19 June and departed 24 September.

A brief statement of the summer's work is included in this report. Although some preliminary conclusions are reported these may be somewhat modified by studies now in progress. Considerable data requires more extensive analysis which will be the subjects of future reports.

The biologists wish to express their appreciation for the willing cooperation extended to their program by the Pribilof Island management through Mr. Clarence L. Olson. Mr. Daniel Benson and Mr. Roy Herd, on St. George and St. Paul, respectively, took every opportunity to facilitate field research by furnishing native crews, trucks, and materials whenever these were necessary to our work. Their interest and their spirit of cooperation contributed immeasurably to the success and prompt accomplishment of our 1954 field program.

II. Hookworm investigation.

A. Experimental hookworm spray operation.

In accordance with the recommendations of Dr. O. Wilford Olsen, contained in his "Report on Third Summer of Investigations on Hookworms--1953", large experimental sample plots were sprayed with two vermicides between 1 and 15 June. The total area sprayed was 6.24 acres. The areas sprayed and chemicals used were:

Rookery	Approximate area covered	Chemical used	Amount of recommended solution per sq.ft.
Polovina	3 acres	coal tar creosol	322.5 ml.
Northeast Point	2.5 acres	cresylic acid	200 ml.
Little Polovina	0.3 acres	cresylic acid	258 ml.
Little Polovina	0.44 acres	coal tar creosol	161 ml.

1. Equipment and crew.

A gasoline powered Hudson sprayer having a 100-gallon tank and delivering approximately 3.3 gallons per minute was placed on the bed of a one-half ton Chevrolet Pickup truck. The hose and nozzle furnished with the sprayer were unsatisfactory for our purposes. Instead, 100 feet of plastic garden hose with an adjustable nozzle were found to be more efficient. The sprayer tank was kept full by hand pumping fresh solution from 12, 50-gallon drums carried on a 3-ton Diamond-T truck. Two Diamond-T trucks were used, one in service in the field, the other in the village loading and mixing the spray solution.

A crew of three men worked in the field and another in the village to mix solution and deliver each new load to the field crew. In addition to the solution sprayed on the rookeries by the power sprayer, considerable areas were covered by hand pumping the solution directly from the 50-gallon drums to the ground. The hand pump delivered approximately 10 gallons per minute.

2. General remarks on spraying operations.

a. Sprayer.--The Hudson Peerless power sprayer No. 43105 performed satisfactorily to the limit of its capacity. However, future spraying on a scale similar to that of the 1954 work will require a pump of greater capacity. No pump should be considered for an operation of this size that delivers less than 10 gallons per minute. A pumping capacity of 20 gallons per minute would be ideal.

A power driven pump, carried on the bed of the pickup and drawing disinfectant solution directly from 50-gallon drums on a larger truck would probably be best for this work.

b. Time of spraying.--The date to commence spraying operations should be determined by observing field conditions. If no snow is on the ground spraying should begin by mid-May and be completed in early June. In any event spraying should begin as soon after mid-May as the snow has melted.

c. Bull seals in relation to spraying.--When spraying was begun on 1 June 1954, 40 bulls had taken stations on Polovina rookery. On 8 June when operations here were completed 85 bulls and 2 cows were on the area. Many of the bulls strongly resisted our invasion of their territories and could be driven off only with difficulty. On Northeast Point between

8 and 15 June spraying was greatly hampered by the bulls. On 10 June, Dixon suffered a dangerous and painful bite and the loss of his pants and coat when surprised from behind by a bull.

3. Results.--Larval counts in soil samples and mortality of pups.

A study of the numbers of hookworm larvae found in the soil before and after spraying operations revealed that the sprays considerably reduced the population of hookworm larvae. However, the numbers of pups which later died on the sprayed areas indicated that a sufficient number of larvae survived the spray to cause high mortality. It is recommended, in view of the constantly increasing mortality among seal pups on the Pribilofs due to hookworm infestation, that a similar large scale experimental spraying program, using more concentrated sprays be planned for late May and early June of 1955. A detailed account of the results and conclusions of the 1954 hookworm experiments will be included in Mr. Dixon's report.

B. Additional hookworm studies.

1. Larvicide tests, laboratory and field.

During the summer, Mr. Dixon continued experimental studies of the effect of various disinfectants on hookworm larvae. These experiments were conducted both in the laboratory and in the field on infected rookery areas. Various emulsifying agents which could be used with hookworm disinfectants as spreading or wetting agents were sent to the Pribilofs and limited experiments with them carried out.

An overwinter study of hookworm larvicides was started in the fall of 1954. In the spring of 1954, Mr. L. M. Stahler, Director, Agricultural

Research and Development of the Pacific Coast Borax Company of Los Angeles, volunteered to contribute chemicals for experimental hookworm eradication studies. The chemicals contributed were (1) Polybor-2, 500 pounds; (2) Anhydrous Rasorite, 500 pounds; (3) Colemanite, 500 pounds. In accordance with suggestions by Mr. Stahler and instructions from Dr. Olsen, these chemicals were applied to infected rookery plots on Polovina and Northeast Point on 1 and 2 September. Studies of overwinter hookworm survival on these study areas will be continued in the spring of 1955.

2. Pup shelter.

The parasitologists have noted during their studies that when pups are exposed to inclement weather, mortality increases sharply. In order to test the possible value of offering shelter to pups during storms, Mr. Dixon erected a platform on Polovina rookery measuring 8 feet square and about a foot above the ground. The pups appeared to be attracted to this structure, sleeping both under it and on top of it. Undoubtedly, it afforded some degree of protection from puddles of rain water and driving rain and wind. The practical adaptation of such a structure to the large fur seal rookeries, however, seems questionable.

III. Mortality studies.

A. Dead pup counts.

Dead pups were counted as in recent, previous years. On St. George two counters worked. On St. Paul Island, two-, four-, and five-man crews were used. Each pup carcass was marked with white plaster shaken from a can at the end of a stick and simultaneously recorded on a hand tally.

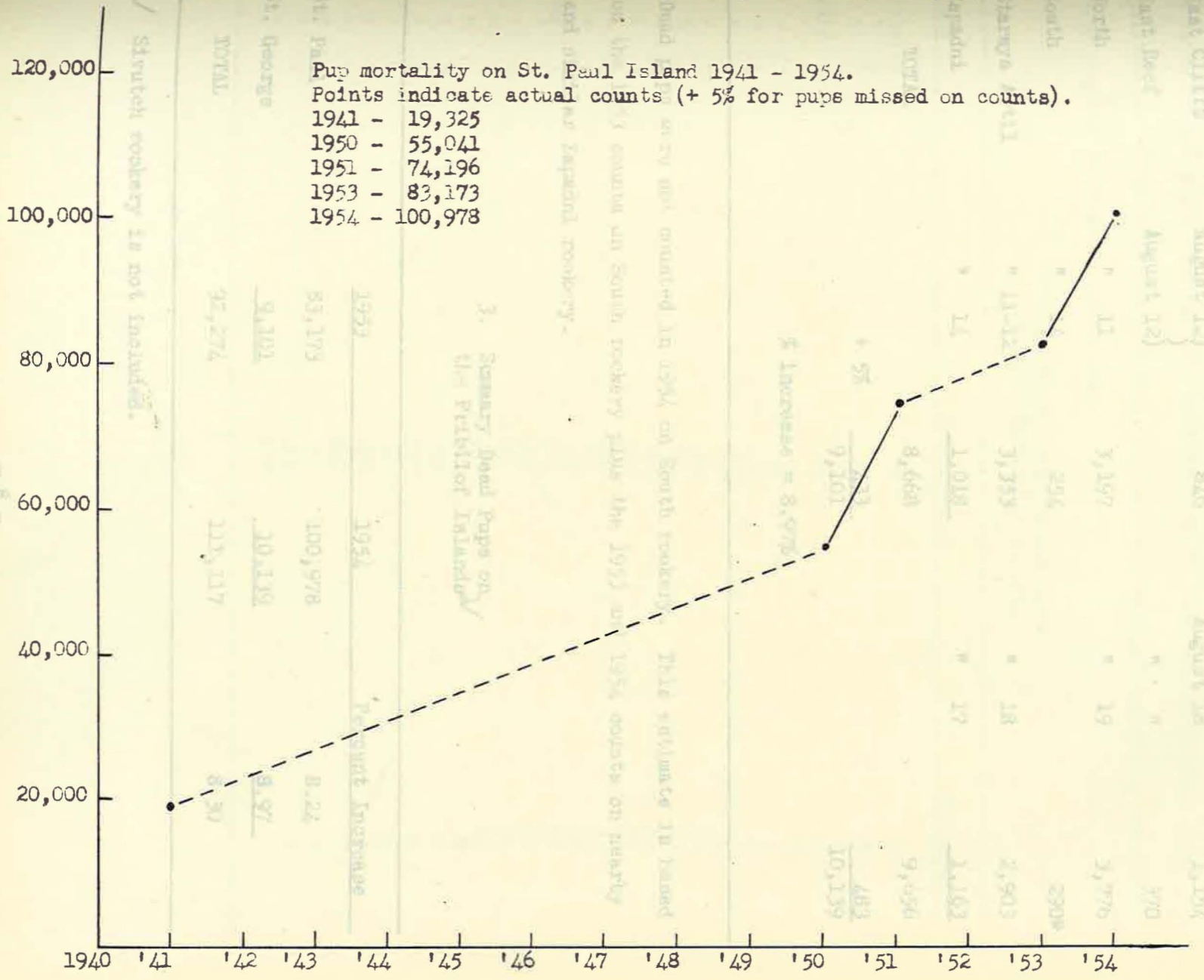
1. St. Paul Island
Dead Pup Counts

Rookery	Year - 1953	Year - 1954
Ardiguen	189	282
Gorbatch	3,679	4,900
Kitovi	1,695	1,669
Little Polovina	2,211	3,852
Little Zapadni	2,446	4,979
Lukanin	1,086	1,129
Morjovi	3,764	8,049
Polovina	5,036	6,459
Polovina Cliffs	5,451	6,413
Reef	13,661	12,959
Sivutch	---- 1/	---- 1/
Tolstoi	6,154	7,552
Vostochni	19,503	25,233
Zapadni	12,221	10,424
Zapadni Reef	1,116	2,278
ACTUAL TOTAL	79,212	96,178
Add 5%	3,961	4,809
Estimated Total	83,173	100,978

Increase in mortality - 17,805 or 8.24%

1/ Dead pups were not counted on Sivutch rookery. Since no count has been made there in recent years no estimate is included.

a. Fur seal pup mortality trend 1941 - 1954.



2. St. George Island
Dead Pup Counts

Rookery	Date - 1953	Dead Pups	Date - 1954	Dead Pups
East Cliffs	August 12)	846	August 18	1,154
East Reef	August 12)		" "	370
North	" 11	3,197	" 19	3,776
South	" 14	254		290*
Staraya Artil	" 11-12	3,353	" 18	2,903
Zapadni	" 14	1,018	" 17	1,163
TOTAL		8,668		9,656
	+ 5%	433		483
		9,101		10,139

% increase = 8.97%

*Dead pups were not counted in 1954 on South rookery. This estimate is based on the 1953 counts on South rookery plus the 1953 and 1954 counts on nearby and similar Zapadni rookery.

3. Summary Dead Pups on the Pribilof Islands 1/

	1953	1954	Percent Increase
St. Paul	83,173	100,978	8.24
St. George	9,101	10,139	8.97
TOTAL	92,274	111,117	8.30

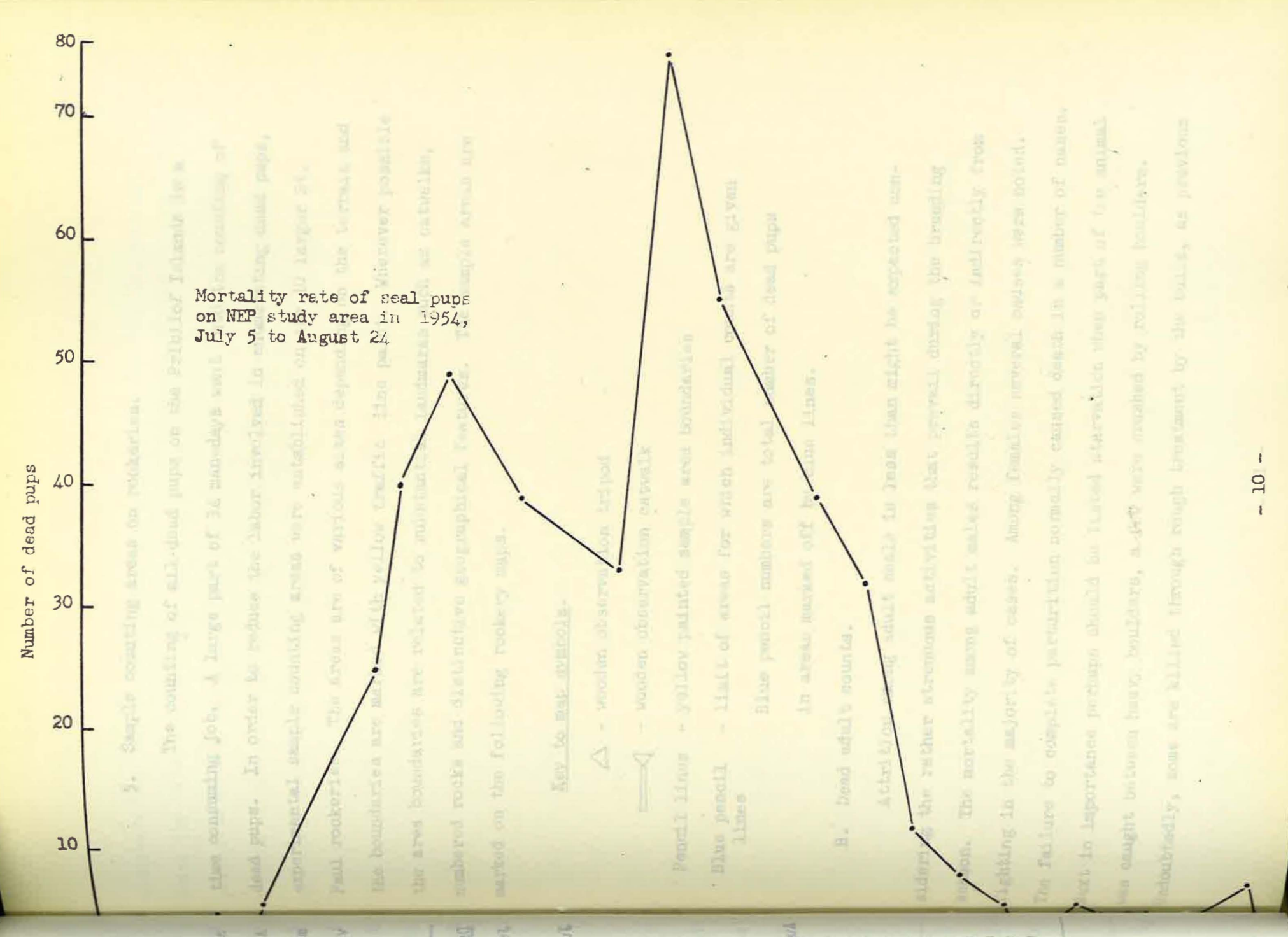
1/ Sivutch rookery is not included.

4. Mortality rate study.

The increment of pups dying on the Northeast Point study area (established in 1951) was counted every day or two throughout the summer. A total of 420 pups died on this area between 29 June and 24 August. The maximum mortality took place during the last few days of August, a condition very similar to that found in 1951.

Northeast Point Study Area
Rate of Mortality in 1954

Date	Total Count	Increment
June 25	0	0
" 29	1	1
" 30	1	0
July 5	2	1
" 7	4	2
" 10	8	4
" 11	8	0
" 12	13	5
" 17	38	25
" 18	66	40
" 20	89	49
" 23	128	39
" 27	171	33
" 29	246	75
Aug. 1	301	55
" 5	340	39
" 7	372	32
" 9	384	12
" 11	392	8
" 13	397	5
" 14	397	0
" 16	402	5
" 17	406	4
" 19	410	4
" 20	412	2
" 23	419	7
" 24	420	1

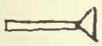

Mortality rate of seal pups
on NEP study area in 1954,
July 5 to August 24
Number of dead pups
80
70
60
50
40
30
20
10

5. Sample counting areas on rookeries.

The counting of all dead pups on the Pribilof Islands is a time consuming job. A large part of 34 man-days went into the counting of dead pups. In order to reduce the labor involved in enumerating dead pups, experimental sample counting areas were established on the 10 larger St. Paul rookeries. The areas are of various sizes depending on the terrain and the boundaries are marked with yellow traffic line paint. Wherever possible the area boundaries are related to substantial landmarks such as catwalks, numbered rocks and distinctive geographical features. The sample areas are marked on the following rookery maps.

Key to map symbols.

△ - wooden observation tripod

 - wooden observation catwalk

Pencil lines - yellow painted sample area boundaries

Blue pencil lines - limit of areas for which individual counts are given

Blue pencil numbers are total number of dead pups in areas marked off by blue lines.

B. Dead adult counts.

Attrition among adult seals is less than might be expected considering the rather strenuous activities that prevail during the breeding season. The mortality among adult males results directly or indirectly from fighting in the majority of cases. Among females several causes were noted. The failure to complete parturition normally caused death in a number of cases. Next in importance perhaps should be listed starvation when part of the animal was caught between heavy boulders, a few were crushed by rolling boulders. Undoubtedly, some are killed through rough treatment by the bulls, as previous

observers have noted. Dead adults were counted on St. Paul Island only. Using the harem and idle bull counts of 1954, or 16,713, the approximate percent mortality among adult males on St. Paul Island was 1.38%. Using 530,000 as the approximate number of breeding cows the approximate percent mortality among females was .084.

Counts of Dead Adults on St. Paul Island

Rookery	Date 1954	Dead Adults Male	Female
Ardiguen	September 1	1	8
Gorbatch	September 1	14	28
Kitovi	August 27, 28	7	10
Little Polovina	August 31	0	4
Little Zapadni	August 24, 25	15	39
Lukanin	August 27	1	10
Morjovi	August 30	14	25
Polovina	August 27	2	13
Polovina Cliffs	August 27, 28	6	17
Reef	September 1 and 2	66	11
Tolstoi	September 1	22	42
Vostochni	August 30, 31	18	47
Zapadni	August 25, 26, 27	46	62
Zapadni Reef	August 26	9	7
TOTAL		221	423
Add 5% for those missed		11	21
		232	444

Harem bulls = 9,906
Idle " = 6,807
16,713

% mortality among bulls = $\frac{232 \times 100}{16,713} = 1.38\%$

Approximately 530,000 females: % mortality among females $\frac{444 \times 100}{530,000} = .0837$

IV. Population studies.

A. Tag recoveries.

In 1954 the majority of seals were killed for size according to the commercial standards; selection to kill for tags was made only in the case of E tagged (two-year-old) seals. A total of 81 tagged two-year-olds was taken, 15 on St. George and 65 on St. Paul. A canine tooth, weight and measurements were taken from 49 of the St. Paul specimens.

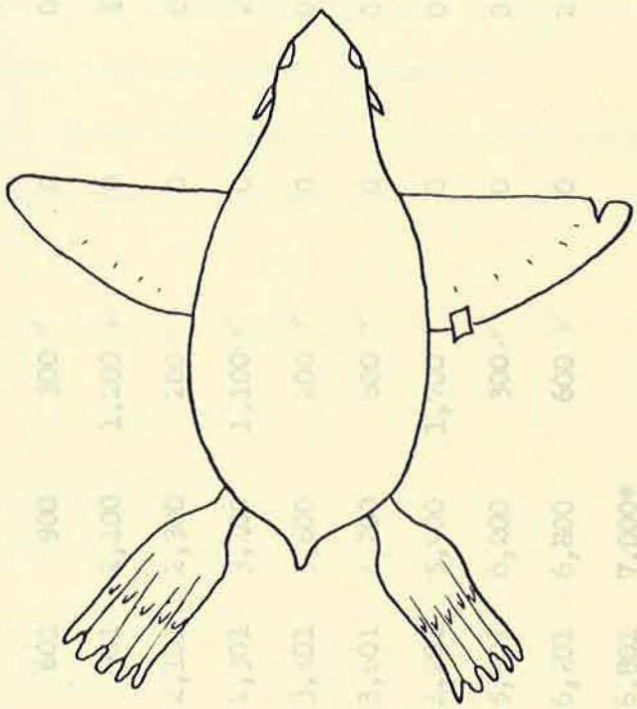
Tag recoveries are summarized in the following table. This data will be used in population and homing studies.

Tags recovered on St. Paul and St. George in 1954.

Series	Age	St. Paul		St. George		Totals
		Male	Female	Male	Female	
B	6	0	5	1	0	6
CS	5	13	6	4	0	23
D	3	65	0	4	0	69
E	2	65	0	16	0	81
TOTALS		143	11	25	0	179

B. Pup tagging.

Tagging of 10,000 pups was begun on 7 September and finished on 10 September. The tags were placed on the right front flipper and an additional identification mark, a v-shaped section was clipped from the same flipper as shown: (Dorsal view of tagged and clipped seal pup.)



The tags used are monel, cattle ear size as specified in 1953 and are of the G series. Because of the accidental application of 400 G series tags in 1953 (Numbers 7,000 - 7,401) these numbers are missing from the series applied in 1954. However, the discrepancy in total number was made up by 400 tags numbered G-10,001 to G-10,400.

Record of tagging operations:

Daily field record of fur seal pup tagging operations.

Series G---------Year 1954

Date	Rookery	Tag Numbers Begin	Tag Numbers End	Number Tagged	No. Tags Spoiled	Pups Killed	Adults Killed	Days Total
September 7, 1954	Polovina Cliffs	1	600	600	0	2	0	900
" 7 "	Polovina	601	900	300	0	0	0	
" 8 "	Tolstoi	901	2,100	1,200	0	1	0	
" 8 "	Lukanin	2,101	2,300	200	0	0	0	2,700
" 8 "	Zapadni	2,301	3,400	1,100	0	2	0	
" 8 "	Zapadni Reef	3,401	3,600	200	0	0	0	
" 9 "	Morjovi	3,601	4,200	600	0	0	0	
" 9 "	Vostochni	4,201	5,900	1,700	0	0	0	3,500
" 9 "	Little Polovina	5,901	6,200	300	0	0	0	
" 9 "	Kitovi	6,201	6,800	600	0	2	0	
" 9 "	Gorbatch	6,801	7,000*					
		7,401	7,500	300	0	0	0	
" 10 "	Gorbatch	7,501	8,200	700	0	0	0	
" 10 "	Reef	8,201	9,800	1,600	0	1	0	2,900
" 10 "	Little Zapadni	9,801	10,400	600	0	0	0	
TOTALS						8		10,000

*7,001 - 7,400 were accidentally applied in 1953.

C. Living pup counts and estimates.

Estimates of living pups were made on several rookeries on both St. Paul and St. George. Their value is questionable because of their highly subjective nature. Attempts to evaluate them, by comparison with other population studies will be continued.

Since incomplete counts only were made on St. Paul Island, no attempt to compute the number of pups born in 1954 is attempted. The raw data is summarized only for future reference.

However, since more complete counts were attempted on St. George, a brief preliminary computation is presented.

1. Rapid Field Estimates
St. Paul Island
Living Pups Only

Date 1954	Rookery	Estimates REP	Estimates KWK	Most Probable Figure
August 13	NEP - Morjovi	20,900	24,400	23,000
" 13	NEP - Vostochni #24 - #47	10,500	11,300	11,000
" 13	" " Station #47, L. Catwalk	6,600	7,350	7,000
" 14	" " L. Catwalk to end	18,700	18,050	18,000
" 14	" " Sta. #88 - #89	750	675	700
" 14	" " " #97 - #99	300	330	300
TOTAL	Morjovi-Vostochni (NEP)	57,750	62,105	60,000
August 16	NEP - spray area only	4,000	3,900	4,000
" 16	Kitovi 1st Point	800	850	850
	Kitovi-Amphitheater	650	650	650
	" remainder	8,000	10,550	9,000
TOTAL	Kitovi	9,450	12,050	10,500
August 12	Little Polovina (Total)	7,700	8,000	8,000
" 16	Polovina Cliffs (Total)	24,700	20,300	22,000
" 14	Zapadni Reef - Est. #1	4,600	7,500	7,500
" 14	Zapadni Reef - Est. #2	7,410	8,800	
" 16	Lukanin (Total)	4,300	5,300	4,500
" 12	Polovina (Not Sand Beach)	5,500	6,050	6,000
" 16 1/	Polovina (Not Sand Beach)	4,000	4,100	4,000

1/ This second count is lower, probably because pups in the water had moved to other areas and could not be seen near their home rookery.

2. Estimate of Pups Born on St. George Island Using Rapid Field Estimates, Dead Pup Counts, and Harem Bull Count.

Rookery	Date 1954 (Live & dead pup estimates)	Living pup estimates by KWK and REP Max.	Min.		Dead pup counts	Total pups Live est. + dead count each rookery Max.	Min.	Harem bull counts	Pups per harem bull Max.	Min.
Zapadni	August 17	10,500	9,400		1,163	11,721	10,621	293	40.0	36.2
				+5%	58					
					1,221					
East Reef	" 18	3,400	2,500		370	3,788	2,888	135	28.0	21.4
				+5%	18					
					388					
East Cliffs	" 18	7,600	5,300		1,154	8,812	6,512	331	26.6	19.7
				+5%	58					
					1,212					
Staraya Artil	" 18	8,600	6,300		2,903	11,648	9,348	396	29.4	23.6
				+5%	145					
					3,048					
North	" 19	19,400	15,200		3,776	23,365	19,165	821	28.5	23.3
				+5%	189					
					3,965					
South[1/]	------	9,200	8,000		290	9,504	8,304	252	37.7	32.9
				+5%	14					
					304					
TOTALS		58,700	46,700		9,656			2,228		
				+5%	483					
					10,139					
Add dead pups -		10,139	10,139							
		69,839	56,839							
Overall average pups per harem bull		69,839 ÷ 2,228 = 31.34				56,839 ÷ 2,228 = 25.51				

Introducing 25% correction factor for pups overlooked in live pup estimates. 2/

Max. - 58,700 + 25% or (14,675) = 73,375 + 10,139 (deads) =
83,514 (Max. number pups born)

$\frac{83,514}{2,228}$ = 37.5 average number pups per harem bull. (round to 84,000)

Min.- 46,700 + 25% or (11,675) = 58,375 + 10,139 (deads) =
68,514 (Min. number pups born)

$\frac{68,514}{2,228}$ = 30.7 average number pups per harem bull (round to 69,000)

1/ Only harem bulls counted this rookery; all other figures are extrapolated from Zapadni - (nearby and similar).

2/ Correction factor established in 1951 - See Wilke & Kenyon, Summer Report, 1951 - 30 September 1951.

V. Age study of seals taken in commercial sealing operations using daily tooth samples.

Each day of sealing operations random samples of canine teeth for age analysis were taken from the killing fields.

On St. Paul a minimum of 25 teeth was collected. If the kill was more than 1,250 seals an additional number of teeth amounting to 2% of the total kill was collected.

On St. George a fixed number of 10 teeth per day of sealing were collected. Since no biologists were on St. George during sealing operations, the manager, Mr. Dan Benson, cooperated in this work.

Digest of total kill of male seals by age classes.

	Total teeth in samples	Age 2		Age 3		Age 4		Age 5		Total
		No.	%	No.	%	No.	%	No.	%	
St. Paul	1,244	1,735	3.49	32,349.9	65.09	15,365.1	30.92	249	.50	49,69
St. George	303	544.9	4.03	7,907.3	58.46	4,792.9	35.44	279.9	2.07	13,52
Both Islands	1,547	2,279.9	3.6	40,257.2	63.7	20,158.0	31.9	528.9	.8	63,27
Rounded %			4.		64.		32.		1.	

The tables that follow show the daily breakdown of the kill according to the ages of seals taken; both on St. Paul and St. George. The graphs show by rounds the ages of seals taken in the kill.

/ The total commercial kill of 63,882 included 658 cows or 1.03%.

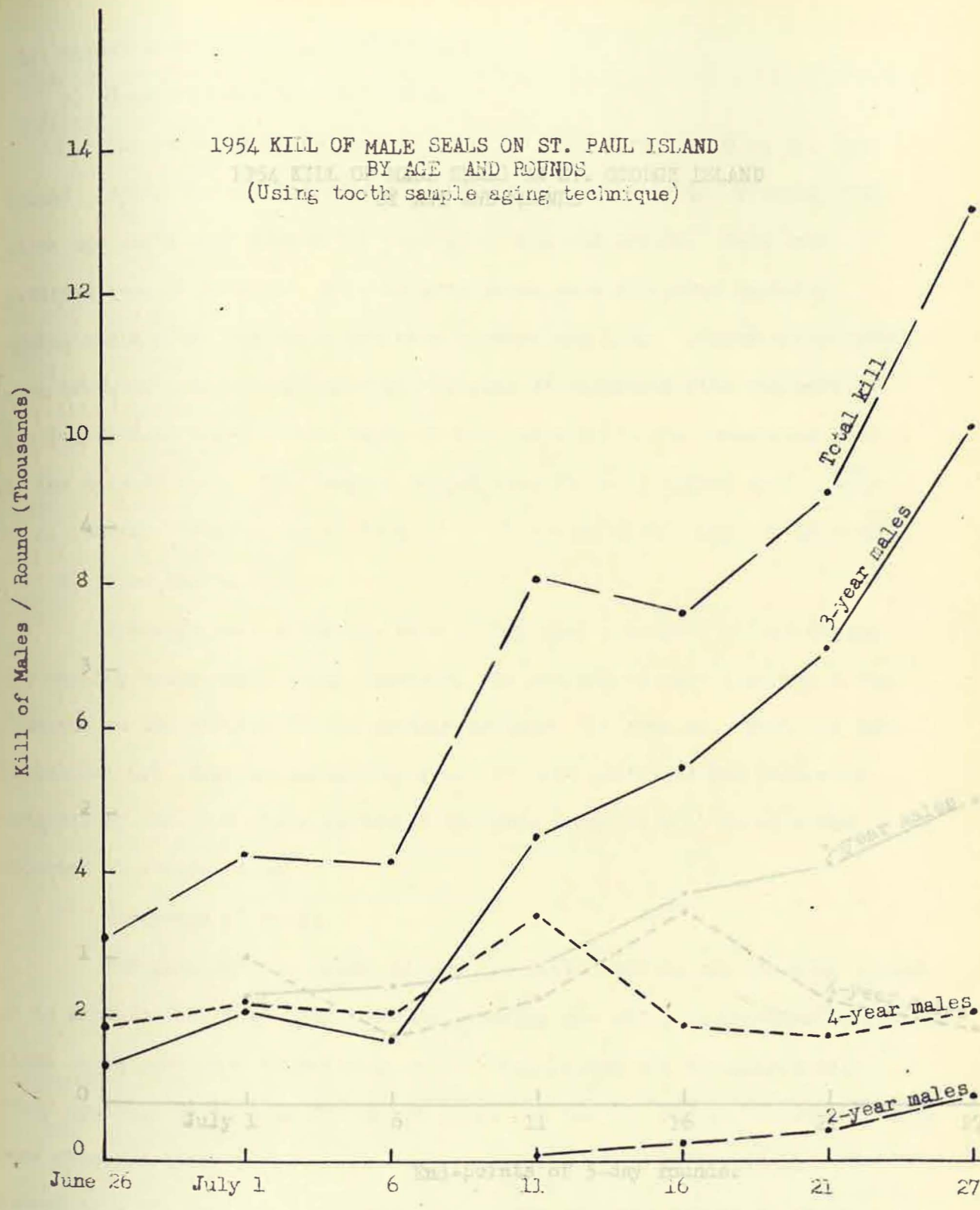
Date	Kill No.	Rookery	Total males killed	Percent of tooth sample Age 2	Age 3	Age 4	Age 5	Estimated number killed Age 2	Age 3	Age 4	Age 5	
6-22	1	NEP	693	----	44.0	56.0	----	----	304.9	388.1	----	
6-23	2	TLK	321	----	20.0	60.0	20.0	----	64.2	192.6	64.2	
6-24	3	Zap.	1061	----	52.0	48.0	----	----	551.7	509.3	----	
6-25	4	Reef	382	----	36.0	64.0	----	----	137.5	244.5	----	
6-26	5	Pol.	683	----	28.0	72.0	----	----	191.2	491.8	----	
			3140						1249.5	1826.3	64.2	3140
6-27	6	NEP	803	----	44.0	52.0	4.0	----	353.3	417.6	32.1	
6-28	7	TLK	344	----	36.0	64.0	----	----	123.8	220.2	----	
6-29	8	Zap.	1815	----	55.6	44.4	----	----	1009.1	805.9	----	
6-30	9	Reef	442	----	48.0	52.0	----	----	212.2	229.8	----	
7-1	10	Pol.	872	----	48.0	52.0	----	----	418.6	453.4	----	
			4276						2117.0	2126.9	32.1	4276
7-2	11	NEP	1245	----	36.0	56.0	8.0	----	448.2	697.2	99.6	
7-3	12	TLK	486	----	36.0	64.0	----	----	175.0	311.0	----	
7-4	13	Zap.	1108	----	44.0	56.0	----	----	487.5	620.5	----	
7-5	14	Reef	203	----	28.0	68.0	4.0	----	56.9	138.0	8.1	
7-6	15	Pol.	1124	----	48.0	48.0	4.0	----	539.5	539.5	45.0	
			4166						1707.1	2306.2	152.7	4166
7-7	16	NEP	2067	2.4	47.6	50.0	----	49.6	983.9	1033.5	----	
7-8	17	TLK	541	----	48.0	52.0	----	----	259.7	281.3	----	
7-9	18	Zap.	3484	1.4	67.2	31.4	----	48.8	2341.2	1094.0	----	
7-10	19	Reef	447	----	48.0	52.0	----	----	214.6	232.4	----	
7-11	20	Pol.	1535	----	50.0	50.0	----	----	767.5	767.5	----	
			8074					98.4	4566.9	3408.7		8074.0
7-12	21	NEP	1639	3.2	71.0	25.8	----	52.4	1163.7	422.9	----	
7-13	22	TLK	767	----	72.0	28.0	----	----	552.2	214.8	----	
7-14	23	Zap.	2980	3.3	73.3	23.4	----	98.3	2184.4	697.3	----	
7-15	24	Reef	552	----	52.0	48.0	----	----	287.0	265.0	----	
7-16	25	Pol.	1668	5.9	76.5	17.6	----	98.4	1276.0	293.6	----	
			7606					249.1	5463.3	1893.6		7606

Date	Kill No.	Rookery	Total males killed	Percent of tooth sample Age 2	Age 3	Age 4	Age 5	Estimated number killed Age 2	Age 3	Age 4	Age 5	
7-17	26	NEP	1981	7.5	75.0	17.5	----	148.6	1485.8	346.6	----	
7-18	27	TLK	1117	4.0	40.0	56.0	----	44.7	446.8	625.5	----	
7-19	28	Zap.	3632	5.5	87.7	6.8	----	199.8	3185.2	247.0	----	
7-20	29	Reef	706	4.0	64.0	32.0	----	28.2	451.9	225.9	----	
7-21	30	Pol.	1817	----	83.8	16.2	----	----	1522.6	294.4	----	
			9253					421.3	7092.3	1739.4		9253.0
7-22	31	NEP	2692	9.1	72.7	18.2	----	245.0	1957.1	489.9	----	
7-23	32	TLK	823	----	73.1	26.9	----	----	601.6	221.4	----	
7-24	33	Zap.	4461	9.9	78.0	12.1	----	441.6	3479.6	539.8	----	
7-25	34	Reef	729	----	80.0	20.0	----	----	583.2	145.8	----	
7-26	35	Pol.	2124	2.3	83.7	14.0	----	48.8	1777.8	297.4	----	
7-27	36	NLP	2355	9.8	74.5	15.7	----	230.8	1754.5	369.7	----	
			13184					966.2	10153.8	2064.0	----	13184.0
			49699					1735.0	32349.9	15365.1	249.0	49699

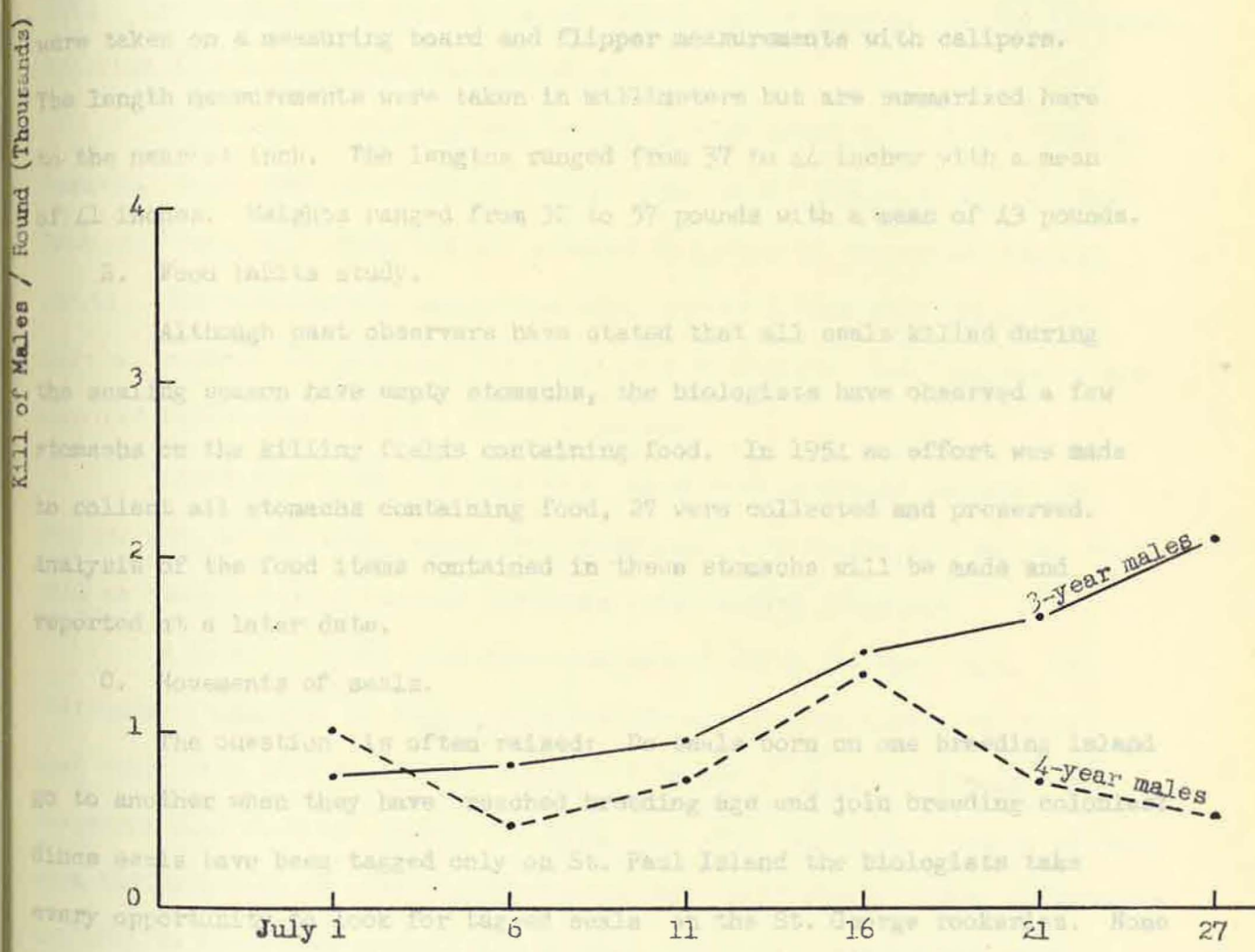
Date	Kill No.	Rookery	Total males killed	Percent of tooth sample				Estimated number killed				
				Age 2	Age 3	Age 4	Age 5	Age 2	Age 3	Age 4	Age 5	
6-27	1	Zap.	488	10.0	40.0	50.0	----	48.8	195.2	244.0	----	
6-28	2	N.	510	----	60.0	40.0	----	----	306.0	204.0	----	
6-29	3	E.	405	----	11.1	88.9	----	----	45.0	360.0	----	
6-30	4	Star. A.	188	----	11.1	88.9	----	----	20.9	167.1	----	
7-1	5	N.	266	----	80.0	20.0	----	----	212.8	53.2	----	
			1857					48.8	779.9	1028.3	----	1857
7-2	6	Zap.	353	----	80.0	20.0	----	----	282.4	70.6	----	
7-3	7	N.	206	----	60.0	40.0	----	----	123.6	82.4	----	
7-4	8	E.	385	----	60.0	40.0	----	----	231.0	154.0	----	
7-5	9	Star. A.	113	----	33.3	55.6	11.1	----	37.6	62.8	12.6	
7-6	10	N.	286	----	55.6	44.4	----	----	159.0	127.0	----	
			1343						833.6	496.8	12.6	1343
7-7	11	Zap.	482	----	50.0	50.0	----	----	241.0	241.0	----	
7-8	12	N.	239	10.0	60.0	30.0	----	23.9	143.4	71.7	----	
7-9	13	E.	388	----	50.0	40.0	10.0	----	194.0	155.2	38.8	
7-10	14	Star. A.	192	----	60.0	30.0	10.0	----	115.2	57.6	19.2	
7-11	15	N.	533	----	50.0	40.0	10.0	----	266.5	213.2	53.3	
			1834					23.9	960.1	738.7	111.3	1834
7-12	16	Zap.	705	----	80.0	20.0	----	----	564.0	141.0	----	
7-13	17	N.	438	----	30.0	70.0	----	----	131.4	306.6	----	
7-14	18	E.	670	10.0	30.0	60.0	----	67.0	201.0	402.0	----	
7-15	19	Star. A.	367	----	20.0	70.0	10.0	----	73.4	256.9	36.7	
7-16	20	N.	709	----	70.0	30.0	----	----	496.3	212.7	----	
			2889					67.0	1466.1	1319.2	36.7	2889
7-17	21	Zap.	577	11.1	66.7	22.2	----	64.0	384.9	128.1	----	
7-18	22	N.	257	----	50.0	50.0	----	----	128.5	128.5	----	
7-19	23	E.	704	----	66.7	33.3	----	----	469.6	234.4	----	
7-20	24	Star. A.	396	----	77.8	22.2	----	----	308.1	87.9	----	
7-21	25	N.	610	10.0	60.0	20.0	10.0	61.0	366.0	122.0	61.0	
			2544					125.0	1657.1	700.9	61.0	2544

Date	Kill No.	Rookery	Total males killed	Percent of tooth sample Age 2	Age 3	Age 4	Age 5	Estimated number killed Age 2	Age 3	Age 4	Age 5	
7-22	26	Zap.	419	----	60.0	40.0	----	-----	251.4	167.6	-----	
7-23	27	N.	272	----	80.0	10.0	10.0	-----	217.6	27.2	27.2	
7-24	28	E.	1262	22.2	66.7	11.1	----	280.2	841.7	140.1	-----	
7-25	29	Star. A.	311	----	70.0	20.0	10.0	-----	217.7	62.2	31.1	
7-26	30	N.	469	----	90.0	10.0	----	-----	422.1	46.9	----	
7-27	31	Zap.	325	----	80.0	20.0	----	----	260.0	65.0	----	
			3058					280.2	2210.5	509.0	58.3	3058

	Number males killed	Number 2-year	Number 3-year	Number 4-year	Number 5-year	
	13,525	544.9	7,907.3	4,792.9	279.9	13,525


1954 KILL OF MALE SEALS ON ST. PAUL ISLAND
BY AGE AND ROUNDS
(Using tooth sample aging technique)
Kill of Males / Round (Thousands)
14
12
10
8
6
4
2
0
Total Kill
3-year males
4-year males
2-year males
June 26
July 1
6
11
16
21
27
End-points of 5-day rounds.

1954 KILL OF MALE SEALS ON ST. GEORGE ISLAND
BY AGE AND ROUNDS



VI. Miscellaneous studies of fur seals.

A. Growth study, two-year males.

Two-year-old males bearing E series tags were killed on St. Paul Island during the sealing season. Additional measurements, weights, and known age teeth were needed for studies of age and growth. Data were gathered from 49 animals. Weights were taken on a 200-pound capacity spring scale after the seals had been clubbed and bled. Length measurements were taken on a measuring board and flipper measurements with calipers. The length measurements were taken in millimeters but are summarized here to the nearest inch. The lengths ranged from 37 to 44 inches with a mean of 41 inches. Weights ranged from 32 to 57 pounds with a mean of 43 pounds.

B. Food habits study.

Although past observers have stated that all seals killed during the sealing season have empty stomachs, the biologists have observed a few stomachs on the killing fields containing food. In 1954 an effort was made to collect all stomachs containing food, 27 were collected and preserved. Analysis of the food items contained in these stomachs will be made and reported at a later date.

C. Movements of seals.

The question is often raised: Do seals born on one breeding island go to another when they have reached breeding age and join breeding colonies? Since seals have been tagged only on St. Paul Island the biologists take every opportunity to look for tagged seals on the St. George rookeries. None were observed there in 1954; observation opportunities were limited. One record of a St. Paul born bull on a St. George breeding ground is known,

although tagged immature non-breeding males are regularly taken there during the sealing season.

D. Experimental recovery of tagged pups.

In order to study the movement of seal pups on the rookery where they were tagged and their possible movement from one rookery to another an experimental recovery of tagged pups was conducted on 20 and 21 September 1954. The studies were made on Zapadni Reef, Little Zapadni, Little Polovina, Polovina Cliffs, and Polovina rookeries.

Pups were "picked up" and herded to flat areas a few yards from the rookery. Here they were held in a large pod. Small groups of 50 - 70 were "cut out" from this large pod and allowed to gather in the wooden tagging corral. Two catchers then passed the pups, one at a time over the corral. Each was counted and examined for a tag by a biologist. Each tag number was recorded before the pup was allowed to escape.

Areas from which the pups were taken were carefully selected to include some of the exact areas from which pups were chosen for tagging as well as other areas at various distances from tagging locations.

A total of 5,096 pups were examined of which 236 bore tags. The overwhelming majority of tagged pups were found to be on almost the exact spot where they were found when tagged. Although a total of 14 pups were recovered away from the rookery on which they were tagged the results of this work indicate that by late September most pups still show a strong attachment not only to their home rookery but to their place of birth on that rookery.

It was hoped that if it could be found that pups show a tendency to wander about on their home rookery in the fall it might be possible to compute the size of the pup crop by obtaining the pups-per-tag ratio on each rookery.

The strong affinity shown by pups for a certain area on their home rookery, at least until late September, makes such a method of computing the number of pups born difficult.

Pups observed on rookery other than rookery where tagged.

Rookery of observation	Rookery of tagging	No. of pups
Zapadni Reef	Little Zapadni	3
" "	Zapadni	4
Little Zapadni	Zapadni Reef	3
" "	Zapadni	1
Little Polovina	Gorbatch	1
" "	Vostochni	1
Polovina Cliffs	Polovina	1
TOTAL		14

Experimental Recovery of

Tagged Pups in 1954

ry	Station number	Total pups examined	Pups bearing tags	Tags from home rookery	Tags from other rookeries	Date of recovery	Date of tagging	Location of recovery
ni Reef	1	563	32	25	7	Sept. 20	Sept. 8	Tagging loc.
	2	390	0	0	0	Sept. "	"	" (100 yards (from tagging (location
e Zapadni	1	420* (approx.)	13	9	4	Sept. 20	Sept. 10	(100 yards (from tagging (location
e Polovina	1	529	1	1	0	" "	"	9 (200 yards (from tagging (location
	2	804	36	34	2	" "	"	" Tagging loc.
	3	743	3	3	0	" "	"	" (100 yards (from tagging (location
ina Cliffs	1	545	128	127	1	Sept. 21	Sept. 7	Tagging loc.
	2	823	0	0	0	" "	"	" (200 yards (from tagging (location
ina	1	279	22	22	0	" "	"	" Tagging loc.
TOTALS	9	5,096	236	221	14			

from home rookery recovered at location of tagging 208

from home rookery recovered at location other than
ging location 13

exact count of one counter was lost. The approximation was recalled from memory.

E. Reproductive study of female seals taken in commercial kill.

The killing crews on both St. George and St. Paul were instructed to kill all cows appearing in the drives which fell within the commercially desirable length classes. Few cows were available during the first half of the killing season. During the season approximately half of the cows which appeared in the drives were killed. Those which were rejected were too large to fall within the commercially desirable length classes.

We observed that the sealing crew very often failed to identify as cows those young individuals three and four years of age which have black or partly black whiskers. Since dark whiskered, young cows are difficult to recognize as females while alive, most of those which annually occur in the sealing drives are taken.

The biologists collected the genital tracts from as many cows as possible on the killing fields of St. Paul Island. The number of cows taken during the last few days of the sealing season was so large that genital tracts were collected on a sample basis.

The uterine tubes were examined on St. Paul Island and the ovaries were preserved in 10% formalin for future study, after preliminary examinations were made.

The skins of all females killed were marked on the killing fields with a white rope through the flipper hole. These will be studied for pelage quality and skin condition by the Fouke Fur Company.

Preliminary statement of reproductive condition of commercially killed cows.

Age	Nullipara No.	Nullipara %	Primipara No.	Primipara %	Multipara No.	Multipara %	Pregnancy 1954[1] Pregnant No.	Pregnant %	Non-Pregnant No.	Non-Pregnant %	Total each age group
3	8	100	0	0	0	0	0	0	8	100	8
4	57	62.	35	38.	0	0	35	38.	57	62.	92
5	40	25.	110	68.	11	7.	120	75.	41	25.	161
6	5	5.	65	69.	24	26.	85	90.	9	10.	94
7	5	11.	20	43.	21	46.	36	78.	10	22.	46
8	0	0	2	18.	9	82.	5	45.	6	55.	11
9	0	0	0	0	11	100	10	91.	1	9.	11
10 and older	1	2.6	0	0	37[2]	97	18	47.	20	53.	38
	116		232		113		309		152		461[2]

Reported take of cow skins - 540.

Genital tracts collected by the biologists - 462.

A more detailed analysis of the reproductive condition of this collection will be presented in a later report. However, the statement can be made at the present time that if the cow skins prove to have commercial value it will be practical and not detrimental to the seal herd to continue in future sealing operations to take all cows of commercial size which appear on the killing fields.

1/ Pregnancy 1954 indicates conception during the 1953 breeding season.

2/ Specimen number 340 is excluded from these figures.

F. Territorial behavior of adult males.

1. Painted hauling ground bulls.

In order to add to our knowledge of the behavior of adult male seals on the Pribilofs, 20 bulls were marked with rapid drying white paint on Polovina sand beach hauling ground on 16 June 1954. At this time many bulls have taken territories on the rookeries. However, other mature bulls lie sleeping in groups on the hauling ground. These animals show no territorial behavior and may be driven as are the bachelors during sealing operations.

The animals to be marked were rounded up and held in a pod by a crew of three while a fourth applied paint with a swab at the end of a 12-foot bamboo pole. After the seals were released all took to the water.

Within half an hour three of the marked bulls hauled out on the rocks below Catwalk Number 3, on Polovina Cliffs rookery, about one-quarter of a mile from where they were marked. One of these animals fought with a bull already established just above the high water line and succeeded in establishing himself on part of the former territory of this bull.

Two others hauled out on the rocky reef in front of Catwalk Number 1 of Polovina. These two remained on the outer rocks without attempting to invade the territories of established beach masters.

Between 16 June and 26 July seven bulls were repeatedly observed as summarized: Five painted bulls took territories on the rookery and retained harems for periods ranging from approximately 11 to 36 days. Two bulls remained on the fringes of the rookery in an "idle bull" status each for 25 days. These latter two were easily driven from their chosen area but returned to this same area again. One of these bulls was seen holding one cow which, however, soon escaped from him. In addition, several

other white painted bulls were observed exploring the fringes of the rookery, both on the seaward and landward edges and resting on the hauling ground but these did not establish territories. One 4-year-old bachelor was splattered with paint accidentally and was killed during sealing operations at Northeast Point on 22 June.

Total days on rookery	Bull designation	Days harem duty	Date first seen on rookery (including Tidal Reef)	Position on breeding ground: Harem master Date harem first observed	Hauling ground	Idle bulls on rookery	Date last seen	
34	A	31	June 16	June 19			July	19
34	B	32	June 16	June 18			"	"
25	C	25 (days obs.)	June 18			x	"	12
36	D	36	June 21	June 21			"	26
25	E	25 (days obs.)	June 18			x	"	12
29	F	22	June 21	June 28	June 23	June 16) June 28)	"	19
34	G	11	June 16	July 8			"	19

Average days' harem duty 5 bulls = 26.4.

Average number of days spent on rookery by 7 bulls = 31.

2. Painted breeding ground bulls.

On 2 June 1954, 10 fur-seal bulls which were observed in their breeding ground positions on May 31 were marked with rapid drying yellow paint. Observations of these bulls continued at frequent but irregular intervals until early August when the last marked animal left the rookery.

The exact time that each remained on the rookery is not known, since all were first observed on established positions on 31 May. However, minimum periods were found for nine as well as the approximate number of days spent as active harem masters.

Breeding Ground Bulls

Bull number	Date original observation	Date harem established	Date last observation on station	Number of days on station	Number of days harem duty
1	May 31	July 8	July 30	61	24
2	" "	" "	" 18	49	11
4	" "	" 18	" 16	47	29
5	" "	" 8	" 19	50	11
6	" "	" 8	" 30	61	23
7	" "	?	" 19	50	?
8	" "	" 14	" 30	61	17
9	" "	No harem	" 16	47	None
10	" "	July 14	August 2	64	19
TOTALS				54.4	

Average number of days on the rookery for 9 bulls = 54.4

Average days' harem duty for 7 (Nos. 7 and 9 excluded) = 19.1

3. Summary.

The conclusions, briefly stated, from the observations of paint marked late arriving hauling ground bulls and early arriving breeding ground bulls are:

a. The early arriving bulls choose their territories without regard to locations most likely to be chosen by the first arriving cows.

b. Many good harem locations are taken by bulls which arrive relatively late on the breeding ground.

c. Once a bull has established his territory on the breeding ground, though he may be repeatedly driven off into the sea, he will return to the exact spot from which he was driven disregarding other and better positions still available.

d. Bulls which establish themselves on the breeding ground early in the season may spend a longer period on land than late arriving bulls but may average less time on active harem duty. The average time spent on active harem duty by seven early arriving bulls was 19.1 days and by five late arriving bulls 26.4 days. The average time spent on established territories for 7 late arriving bulls was 31 days and 54.4 days for early arriving bulls.

VII. Miscellaneous research and observations (done when time permitted).

A. Steller sea lion.

1. St. Paul Island.--The sea lion colony on Northeast Point underwent a drastic reduction in size in the 1954 season. Only 16 pups were born there. Unfortunately, these pups were all killed for their skins within a few days after birth.

On 6 June the sea lion colony consisted of 31 breeding bulls, 10 adult cows, and 51 sub-adult bulls at the edge of the harem area. By 13 June the number of adult males had decreased to 24 but the number of cows had increased to approximately 25. Three newly born pups were on the rocks. On 17 June about the same number of adults and 11 pups were present. Three pups (two of them found dead, apparently still births), were taken as specimens. One adult cow (wt. 605 lbs.) was killed, weighed, and measured. Several days later the remaining pups, 13, were killed for their skins by natives. No more pups were born and, except for approximately 100 sub-adult and non-breeding bulls, St. Paul was deserted by the sea lions. Most of the remaining animals hauled out at various places on Northeast Point.

In recent, previous years 100 or more pups have been born at Northeast Point. We believe that excessive disturbance of the animals during the breeding period is responsible for their desertion of this breeding colony in 1954. Because of the ease of access of this colony to biologists, we hope that the Pribilof Island Management will give it complete protection until it becomes reestablished. This small colony uses an area which is not occupied by fur seals and in our opinion the presence of a small colony of sea lions here is in no way detrimental to the seals.

2. St. George Island.--During our visit, 17 - 20 August, about 100 sea lions, mostly sub-adults, were seen t various places along the shore, but much of the shoreline was not visited. The majority of those observed were on the rocks between Zapadni and South rookeries.

On 25 September an estimated 1,000 or more adult and sub-adult sea lions were observed from the air along the northwest shore of St. George.

3. Otter Island.--When this island was visited on 21 July approximately 100 sub-adult males were scattered along the shoreline. An area of approximately 2 acres on the north shore of the island, as far as 100 yards from the beach, had been trampled and saturated with sea lion excrement to the extent that during the summer little vegetation had grown there. The native men informed us that during the winter large numbers of sea lions haul out there.

4. Walrus Island.--A large colony of breeding sea lions occupied this island when visited on 6 July. An estimated 3,000 adult and sub-adult animals clustered mainly at the eastern and western ends of the island. Undoubtedly, many cows were at sea feeding. A count of pups, made at 42 stations where pups gathered in pods gave a total of 2,797 living pups. A complete count of dead pups was not made but it is our estimate that approximately 3,000 pups were born on Walrus Island in 1954.

In 1923 it was stated that "....this colony [Walrus Island] no longer exists, ..." (Preble and McAtee, 1923). Since that time the growth of the Walrus Island breeding colony has been such that we found the sea lions in considerable competition for space with the million or more California Murres which occupy extensive flat areas on the island.

5. Sea Lion Rock.--Between 250 and 300 sub-adult sea lion were counted on several occasions through binoculars from Reef Point.

6. Suggested sea lion control study.--It is suggested that if an experimental sea lion control and utilization program were to be contemplated, Walrus Island would be an ideal location for it. It is easily accessible to St. Paul and a large percentage of the pups could be harvested in a single day by a crew brought from St. Paul. Late June, just prior to the sealing season, would be the ideal time for such a program.

In view of the increasing complaints of fishermen relative to the expanding sea lion populations in Alaska waters, we continue to watch for possible commercial uses for sea lions. Pertinent in this matter is the text of a letter quoted below from the L. A. Rockler Fur Company of Minneapolis, Minnesota, dated November 19, 1954:

> "With reference to your letter of November 12th, we believe commercial use can be made of sea lion pelts and we feel sure this type of fur has good sales possibilities. However, the market on popular priced coats has been very poor the last few years and this, together with the high cost of fur tanning today, would allow an estimate of 'around $3.00 to $4.00 for raw pelts of the type used in Mrs. Anderson's coat. The price would be $5.00 to $6.00 dressed."

B. Blue Fox.

1. Den census, St. Paul Island.

Blue foxes on the Pribilofs gather most of their food during the pupping season from the fur seal rookeries and bird cliffs. Although they scavenge the entire beachline to some extent at all seasons, their dens are usually placed near a seal or bird breeding area. Starting in

late May and continuing through the summer all currently occupied fox dens which could be found were plotted on a chart. A total of 56 dens was located. We feel certain that the majority of the dens was found. Undoubtedly, a few escaped us. Probably the total number of dens on St. Paul in 1954 was not more than 70. It would be impossible to state how many fox pups were born and raised on the island. As many as 13 pups were seen near one den on Northeast Point. However, they may have represented two litters from nearby dens.

At any rate it was apparent that fox control measures begun in the winter of 1950 and terminating in October of 1953 have not materially reduced the fox population.

2. Den census, Otter Island.

On 21 July foxes were found extremely numerous and bold on Otter. With the exception of a small area at the east end an attempt was made to count all fox dens on the island. A total of 40 dens, which appeared to be in use, was recorded. Eighty foxes were counted; there probably were many which escaped observation, being asleep under vegetation or on sheltered ledges.

The large population of foxes on this island (only 1,400 yards long and 700 yards wide at its widest point) must suffer severe winter mortality.

3. St. George Island.

No attempt was made to enumerate the fox dens on this island during our short visit. However, foxes were very numerous in the village and were frequently seen on all parts of the island visited.

C. Reindeer observations.

During late May and early June the St. Paul reindeer herd remained on the flat area between the airstrip and Polovina Hill. By mid-June the herd moved inland to the higher central portion of the island, in the vicinity of Bogoslof Hill. Their tracks indicated that they also visited Southwest Point.

Local residents claim they have counted approximately 100 animals in the herd. The best count we were able to make, while the animals were spread out on the slopes of Bogaslof Hill, was 70.

The exclosures erected in 1953 were inspected but as yet no differential in vegetation is noticeable.

D. Visits to smaller islands of the Pribilof Group.

1. Otter Island.

Otter Island was visited by the biologists on 21 July 1954. It is seldom visited even by the residents of St. Paul Island four miles away and thus presents an area undisturbed by man and ideal for the study of wildlife. It is also the only island of the Pribilof Group where the red-legged kittiwake, which is extensively hunted for food on St. Paul and St. George, and which inhabits a very limited range, can nest undisturbed. Because of its potential value as a wildlife study and observation area and because it presents no possibilities of commercial value to the Government, it is recommended that Otter Island be set aside officially as a wildlife sanctuary.

2. Sea Lion Rock (Sivutch Rookery).

A brief visit to this islet was made on 23 July. Although a landing was accomplished it was found impossible to proceed more than a few yards from the beach and this in only one spot. Except for two small

hauling grounds, one at each extremity of the island, it is heavily populated by breeding seals. A count of harem bulls was attempted but because of wind and rough water all areas could not be seen from the water and estimates of seals on these areas were attempted. The resulting estimate of 425 harem bulls is manifestly only a rough approximation. In general appearance the seals on this rookery appeared to be more crowded than on most St. Paul areas. There appeared to be more harem bulls per unit area and the harems somewhat smaller than on most other rookeries.

3. Walrus Island.

The general ecological situation on Walrus Island in the summer of 1954 was one of intense competition for space between the birds and Steller sea lions. The great colonies of California murres which occupy this island are being crowded from areas which they formerly occupied. When the island was visited on 6 July it was noted that the number of eggs to be found was far less than in previous seasons. It is suggested that excessive disturbance and crowding caused by the expanding sea lion colony is reducing the production of birds. Some of the murres may renest later in July when the sea lions move off the higher parts of the island. Several new areas of nesting cliff on St. Paul were taken over by California murres, perhaps because these birds were unable to find living space on Walrus Island. A considerable number of murres had obviously been killed when trampled by the sea lions. Hundreds of others, so saturated with sea lion excrement that they were unable to fly and quickly became water logged, were grouped on rocks along the water's edge.

A glaucous-winged gull colony on the highest point of the island has been virtually obliterated by the sea lions. Three nests with eggs were found in 1954 where we observed several dozen nesting pairs in 1949. The extent of the sea lion colony appears to have increased considerably since 1949.

E. Specimens collected.

1. Fur seals.

No fur seal skins were taken for study purposes in 1954.

Four young male fur seals, age 2 and 3 years, were flown from St. Paul Island on 25 September. Two of these were deposited for study and public exhibit at the Woodland Park Zoo, Seattle, Washington. The other two are at the San Diego Zoo, San Diego, California, for study and exhibit. Pelage growth and feeding studies will be conducted.

Killing field teeth are in the Seattle office.

2. Sea lions.

Three newly born sea lion pup skins were collected on St. Paul Island for our study collection.

3. Birds.

In 1954, as in past seasons, the biologists have worked evenings and on rainy days in order to build up a small exhibit of Pribilof Island wildlife for which the management has supplied two exhibit cases.

a. St. Paul Museum, species added in 1954:

(1) Horned Puffin

(2) Crested Auklet

(3) Northern Murre

(4) Pacific Kittiwake

(5) Old Squaw Duck (downy young)

(6) Red Palarope

(7) Pribilof Sandpiper (downy young)

A collection of birds was made by Mr. Richard E. Phillips. A report of species taken will be submitted in accordance with his scientific collecting permit. Specimens were deposited at Oregon State College and at Purdue University. Others, now held in the Seattle office, will be sent to the U. S. National Museum.

VIII. Appendix.

A. Birds.

1. Land birds.

Richard E. Phillips conducted two studies in his spare time which he has summarized:

a. Post-breeding roadside counts on St. Paul Island.

During late July and the first two weeks of August, 1954, roadside counts of Alaska Longspurs and Snow Buntings were made on St. Paul Island to obtain quantitative data on the abundance of these species on the island. Theoobjectives were to get information for comparison in future years and to compare the densities of birds on different parts of the island. Roadside counts were chosen because it was felt that they were the easiest to take in conjunction with other work and so would be more likely to be repeated in future years on a scale adequate to show population trends. Counts from the Village all began where the road to the cemetery intersects the main road. The route to Lake Hill was the one past the air-strip and around the north side of the hill and up to the end of the road at the lake. The counts were made by carrying mechanical counters and tallying each bird as it flushed, using a separate counter for each species.

b. Upland breeding bird census on St. Paul Island.

Area: A rectangular plot of 50 acres (1650 by 1420 feet with the long axis running roughly north and south) of rolling upland between Kitovi rookery and the by-products plant. The west boundary is the line of old telephone poles left by the Army and it runs north 10° E, magnetic directions. The north end of the plot is just south of the sand dunes, and the south end is at the top of the ridge across the level stretch of grass

and mossy tundra. The east boundary runs above the marsh, perhaps 50 yards to the west.

Vegetation: At the time of the census, the vegetation was not over a foot high with rye-grass the dominant plant over most of the plot. In the mossy portions lupine, arctic poppy, few-flowered corydalis, spring beauties, and reindeer moss were the more conspicuous plants of the Sphagnum carpet.

Coverage: (Time spent censusing, not including time laying out.)

June 22, 1954	--	1.5 hours
June 24, 1954	---	2 hours
	--	2.5 hours
June 29, 1954	--	2.5 hours
Total		6.0 hours

Censusing was done by walking to vantage points and lying still for half to three-quarters of an hour watching and listening for singing males. Attention was directed to noting where males persistently sang, especially when more than one could be heard at a time, and both sight and auditory observations were plotted on field maps. Females were plotted when seen. Counts could not be made by cruising through the area because the moving figure attracted scolding longspurs from great distances.

Breeding birds:

Alaska Longspur	10 prs. (possibly 11)	20 prs./100 acres
Pribilof Sandpiper	1 pr.	2 prs./100 acres
Total	11 prs.	22 prs./100 acres

Visitors: Snow Bunting.--One male seemed to have territory to the north and frequently flew over the study area, often singing as he went.

Post-Breeding Roadside Counts on
St. Paul Island

	Route	Mileage	Longspur Birds	Longspur Birds/Mile	Snow Bunting Birds	Snow Bunting Birds/Mile	Rosy Finch Birds	Rosy Finch Birds/Mile
27	NEP	11.7	52	4.44	3	0.26	0	0
27	NEP	11.7	19	1.62	2	0.17	3	0.26
27	NEP	11.7	14	1.20	0	0	6	0.52
29	NEP	10.8	31	2.87	0	0	14	1.30
t 13	NEP	11.4	53	4.65	0	0	1	0.88
t 14	NEP	11.4	66	5.79	1	0.88	0	0
t 14	NEP	11.4	79	6.93	1	0.88	12	1.05
t 16	NEP	11.4	51	4.47	0	0	20	1.75
P	Total miles	91.5	Ave./Mile 3.99		Ave./Mile 0.08		Ave./Mile 0.61	
t 7	Lake Hill	6.6	28	4.24	20	3.03	8	1.21
t 7	Lake Hill	6.6	24	3.64	25	3.79	1	0.15
t 11	Lake Hill	6.6	27	4.09	49	7.42	0	0
t 11	Lake Hill	6.6	20	3.03	15	2.27	4	0.61
ke Hill	Total	26.4	Ave.	3.75	Ave.	4.13	Ave.	0.49
t 8	Sheep L.		78		0		4	
t 8	Sheep L. to Marunich	3.4	77	22.65	1	0.29	20	5.88
	Total Miles = 130.7							
	Birds/Mile =	4.74				0.90		0.71

Aleutian Rosy Finch.--Several regularly crossed the plot, flying between the Black Bluffs and the region of Icehouse Lake. They occasionally foraged on the study area.

2. Sea birds.

On holidays and when other work would not be accomplished for one reason or another, attempts were made to census some of the cliff nesting sea birds. Although this study was only partially completed the results are summarized below:

a. Cliffside nest census.

Location	Pacific Kittiwake	Red-legged Kittiwake	Red-faced Cormmant	Date
Reef Cliffs	119	0	7	5 July
Village Cliffs	0	0	0	14 July
Tolstoi Cliffs	249	0	30	5 August
Lukanin-Kitovi Cliff	24	0	0	6 August
Zapadni Cliff	463	13	7	9 August
High Cliffs, S.W. Pt.	(Not counted)	86 2/	(Not counted)	4 September
Low Cliffs, S.W. Pt. 1/	221	33	(Not counted)	6 September

1/ Cliffs between Anton Lake and abandoned U. S. Coast Guard station.

2/ Time was not available to inspect the entire cliff. Also many nests are not visible from above. We estimated that the entire population of red-legged kittiwakes on the S. W. Point High Cliffs does not greatly exceed 300 pairs.

b. Cliffside bird counts. 1/

Location	Pacific Kitti-wake	Red-legged Kitti-wake	Red-faced Cormant	Paroguet Auklet	Crested Auklet	Least Auklet	Horned Puffin	Tufted Puffin	Calif. Murre	Northern Murre	Date
Reef Cliffs	285	4	20	122	97	500+	16	44	1,000+	800+	5 July
Village Cliffs	—2/	None	—	22	28	35	4	14	—	—	14 July
S.W. Pt. High Cliffs	—	—	—	—	—	—	—	—	75,000+ (est. both sp.)		15 July
Tolstoi Cliffs	—	None	—	—	—	—	51	138	—	—	5 August
Lukanin-Kitovi Cliffs	—	None	—	—	—	—	None	20	—	—	6 August
Zapadni Cliffs	—	34	—	—	—	—	40	87	—	—	9 August

1/ Counts of birds which nest in cracks or holes are of doubtful value, since many cannot be seen. After the first week in July, many are either incubating or at sea. Murres are present in such great numbers that few attempts were made to estimate their numbers.

2/ Dash indicates birds were present but no effort made to count.

F. Plants.

Botanical notebook.--A notebook consisting of pressed botanical specimens and photographs of 71 species was assembled. This work was done in evenings and on Sundays. The notebook is deposited in the biological library on St. Paul Island.