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ALASKA FUR SEAL INVESTIGATIONS,
PRIBILOF ISLANDS, SUMMER OF 1951

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COOPERATION

Collaborators and visiting scientists.--Nineteen fifty-one was a record year for collaborators and visiting scientists. These men make invaluable contributions to fur seal research and it is our opinion that such visits should be encouraged. However, it should be realized that visitors in 1951 far outstripped the work facilities.

There were never less than four people using a workroom that was possibly adequate for two. The workroom (laboratory) currently used had no water supply and no connected drain. The mass of material handled this summer made it imperative for us to have a temporary cold water line installed, connect two drains, and install a sink. We assigned our summer assistant, Clarence Jordan, to help with this work and it also took some of one biologist's time. We had and have no source of hot water. Water leaks into the room during rains; it therefore is too damp for proper storage of most materials.

It is our feeling that acquisition of reasonable laboratory facilities should precede the assignment of workers to the Pribilofs provided, of course, that they will require laboratory space.

The Chevrolet pickup purchased for Wildlife Research arrived in Seattle two days before departure of the Penguin. This was the first season the biologists have had adequate transportation. The present arrangement is a great improvement. There is now no cause for the minor irritation to both management and research of constantly requesting a truck. We were able to be of much more help to the visiting workers who needed transportation.

Collaborators and visiting scientists who came to St. Paul this summer included:

1. Dr. George A. Bartholomew of the Department of Zoology, University of California at Los Angeles. His systematic observations of harem activities and the interval between arrival, parturition, coitus, trips to sea, etc., gave us an understanding of rookery life much needed for intelligent research.

2. Dr. O. Wilford Olsen, head of the Department of Zoology, Colorado Agriculture and Mechanics College, was a temporary employee of the Fish and Wildlife Service. He worked intensively on the problem of finding the reservoir host of the hookworm of fur seal pups and made a beginning in other phases of the hookworm investigations.

3. Dr. Raymond Aretas represented the Museum National d'Histoire Naturelle, in Paris. Dr. Aretas, a medical doctor, was primarily interested in the endocrine glands of seals although he collected some bird, mammal, and fish specimens for the Museum. He is on active duty with the French Colonial troops with a temporary assignment to the Museum.

4. Dr. Karre Rodahl is doing Arctic adaptation research at the Arctic Aeromedical Laboratory at Ladd Air Force Base near Fairbanks, Alaska. His research interest on the Pribilof Islands was the occurrence of so-called "seal finger", a peculiar type of infection found among sealers. It is characterized by a hard, persistent swelling without pus that may affect the joints in chronic cases. So far as is known it is very uncommon on the Pribilofs. Clarence Jordan had an infection at the time of Dr. Rodahl's visit that had many of the symptoms of "seal finger" and Kenyon and Wilke had previously had similar infections. Dr.

Rodahl obtained a blood and a tissue sample from Jordan and a pus sample from the scars on a bull fur seal.

5. Dr. William J. Jellison of the Microbiological Institute, Rocky Mountain Laboratory, U. S. Public Health Service, came in mid-August. He was interested in ectoparasites of Pribilof fauna but carried on additional phases of hookworm research, took blood samples of the dairy cows for 'Bang' disease tests, took blood samples of Jordan, Kenyon, and Wilke to detect changes, if any, due to earlier seal finger infections, etc.

FOOD HABITS

Fur seals from the Pribilofa. --Jordan* observed what he called the spewings of seals on the Pribilof rookeries and noted that they were composed of pollack, Theragra chalcogramma. Disgorged material consisting largely of bones but including some flesh was seen frequently in the summer of 1951. On 30 June at Reef rookery a bull disgorged the remains of three pollack each over 15 inches long. Bones ejected by a sub-adult bull on the same rookery on 20 July represented the remains of about 25 pollack. In August pollack were common in the spewings but there were also the remains of other small Gadidae. Otoliths of Gadidae may be found scattered about on the rookery sands. A collection of about 50 otoliths made by Kenyon on St. George in 1950 were almost all from Theragra. Another group of over 500 he collected on St. Paul contained

* Jordan, David S. and George A. Clark. 1889. Fur seals and fur seal islands of the north Pacific Ocean.

about 20 Theragra. The remainder were other small Gadidae of the genera Gadus, Microgadus, Boreogadus, and Eleginus, ranging from four or five inches to a foot in length.

Evidence from the food remains on the Pribilof rookeries is that fur seals depend to a large degree on small Gadid fishes for food during their stay in the Bering Sea.

* Fur seals from Sitka,--Thirty-six of the 107 stomachs of female fur seals collected at Sitka in January 1951 have been examined in a cursory fashion. When the stomachs contain only herring (Clupea pallasii), the herring are counted and the volume estimated by multiplying by the average volume of a herring. If other forms are present the stomach is held for more careful examination. Of the 36 examined, 8 were empty. All of the others contained herring, ranging in amounts from 50 to 3,000 cc. One stomach contained, in addition to 7 herring, 2 pollack (Theragra) and 2 squids (Decapoda).

It is planned to complete examinations of the remaining stomachs in October.

Sea-lions,--An adult female Steller's sea-lion taken 23 July for hook-worm studies had 9,000 cc. of fish in its stomach in addition to four large stones.

Included in the stomach contents were:

1 halibut, <u>Hippoglossus stenolepis</u> , original size 25-30 lbs.	70%
10 flounders, <u>Pleuronectidae</u>	5%
4 cod, <u>Gadus macrocephalus</u>	15%
3 pollack, <u>Theragra chalcogramma</u>	10%

The only other sea-lion stomach, in the 20 examined, containing food had nothing more than a large Cephalopod beak in it.

GROWTH AND MEASUREMENTS

Tagged 3- and 4-year old males.--Ninety tagged 3-year old seals and 26 tagged 4-year old seals were weighed. In addition, the total length, hind flipper length, and field length measurement made by the native calipermen are recorded.

A summary of the weights and lengths follows:

<u>No.</u>	<u>Age,</u> <u>years</u>	<u>Tag</u> <u>code</u>	<u>Weight,</u>		<u>Total length,</u>	
			<u>Average,</u> <u>lbs.</u>	<u>Range,</u> <u>lbs.</u>	<u>Average,</u> <u>inches</u>	<u>Range,</u> <u>inches</u>
90	3	B	62.0	(⁴⁷ 49 -79)	45.2	(40-49)
26	4	A	78.2	(60-106)	49.5	(46.5-54.7)

Date,
21 and
23 July
1951

These weights and measurements will be used in studying possible changes in the size of the seals as the herd has expanded.

At present, the field measurements taken on the killing field are not indicative of the age of the seals. The size range of animals now killed includes about two-thirds 3-year olds and one-third 4-year olds. Although the field measurements do not sort the seals into age classes, they do serve to standardize the kill by constantly furnishing size references for the clubbers and they enable the manager to note immediately any increase in irregularly sized seals.

Tagged 10-year old seals.--Seals tagged and branded in 1941 are still easily found, the bulls being most conspicuous because of their relative isolation. In 1951, their tenth year, the bulls are not yet in

their prime. Most of them hold territories in the upper (landward) edges of the rookeries. They usually do not have cows until late in the season when the harems drift away from the sea and many older bulls desert the rookery area. Large prime bulls are apparently 12 or more years old.

Ten-year old cows are definitely mature but not old or grizzled in appearance.

<u>BDM No.</u>	<u>Rookery</u>	<u>Tag no.</u>	<u>Sex</u>	<u>Wt., lbs.</u>	<u>T.L., mm.</u>	<u>Girth, mm.</u>
419	Reaf	3670	male	432	1940	1510
420	Reaf	3842	male	360	1850	1410
421	Reaf	Brand only	male	593	2085	1675
438	Reaf	4127	female	90	1308	750
439	Zapadni	6437	female	76	1222	775

The two tagged males and two tagged females listed above all were recovered on the same rookery and same general area on the rookery on which they were tagged and branded in 1941, ten years earlier. The persistence of the seals in returning to nearly the same spot in which they were born partly accounts for the crowded condition of some rookery areas and the increased loss of pups from disease as the herd grew larger. It is also a warning that the recovery of an exterminated rookery would be very slow, for the strong homing instinct would prevent rapid recruitment from other rookeries.

Mr. Dan Benson, Manager at St. George, found a 10-year old branded and tagged male on the hauling ground at Zapadni in July.

MARKING

Tagging pups.--The purpose of tagging in 1951 was to establish a small reservoir of known age animals for use in future studies.

Since only 1,000 tags were applied, this year's operation is too small to be considered of value as an addition to our population study taggings of 1947-1949.

One hundred of the tagged pups were also ear clipped. About half of the left ear was removed with a sharp knife. We believe that by leaving half of the ear intact the danger of water entering the auditory canal is reduced. If the experimental clipping proves harmless to the animals so marked it would furnish a useful field mark for picking out tagged seals. Seals were ear clipped as pups by the Russians in the 1860's, by Bryant in 1870, and by Bower in 1924. However, insufficient details are available on the methods and results.

Tagging operations were completed between 8:30 and 10:45 on the morning of 17 August by Biologists Wilke, Kenyon, and Jordan plus the same crew of Aleuts that helped in previous years. (See "Report on the Tagging of Fur Seal Pups, St. Paul Island, Alaska, Season of 1949", by K. W. Kenyon, for methods used.) The pups were tagged this year near the central area of Polovina Cliffs rookery.

The tags used were of monel metal, large cattle ear size, and were furnished by the National Band and Tag Company of Newport, Kentucky. On one side is printed "NOTIFY F & W SERVICE WASHINGTON D C", and on the other the letter D followed by numbers from 1 to 1,000.

Summary:--

1. 1,000 pups tagged (100 of them also ear clipped).
2. Tagging on August 17, 1951
3. Place: Central area, Polovina Cliffs rookery, St. Paul Is.
4. Location of tag: Leading edge of right rear flipper, over first two digits at about hair line.
5. Tag marking: "D" series numbered 1 to 1,000, plus "NOTIFY F & W SERVICE WASHINGTON D C".

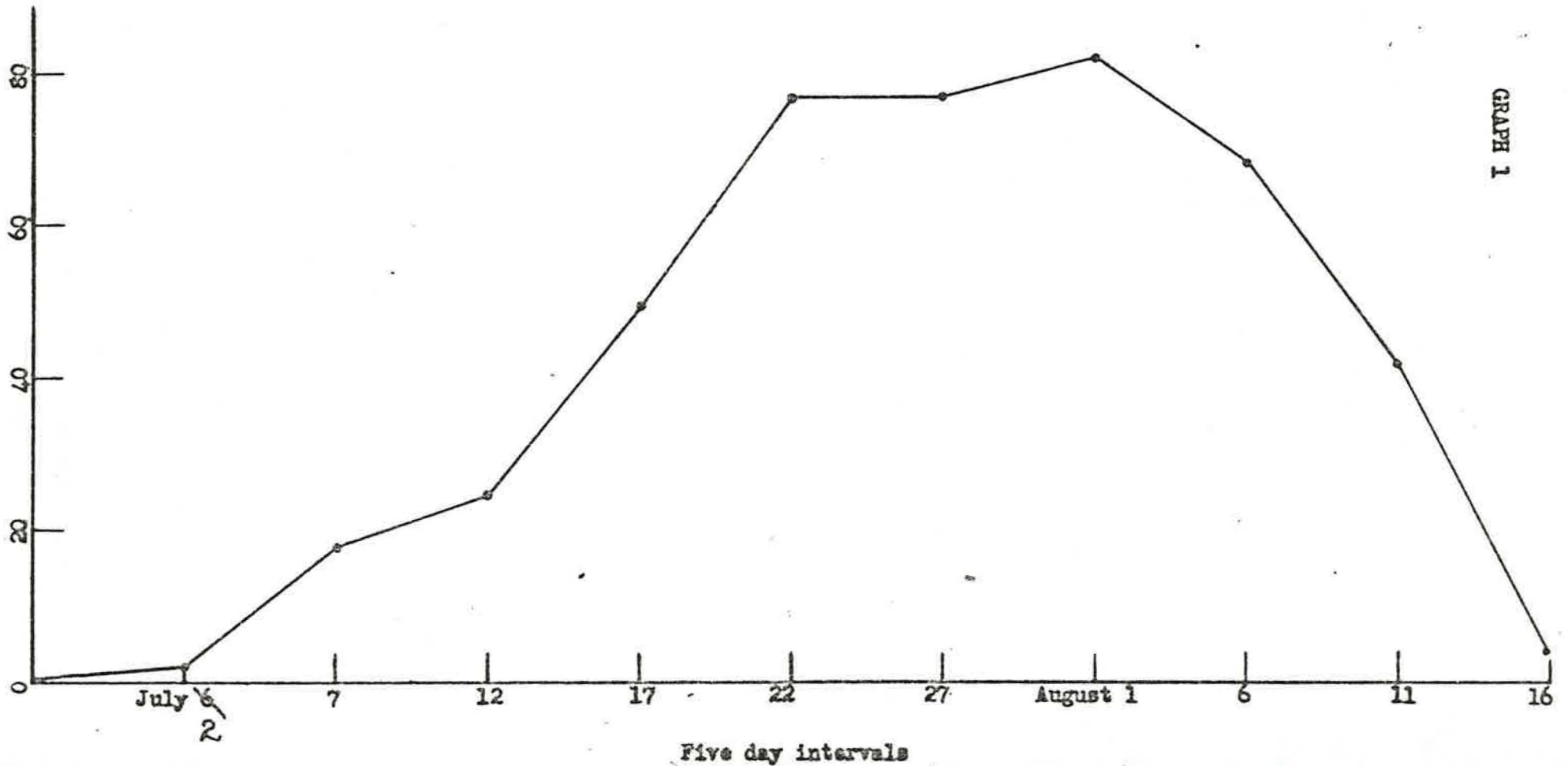
Excess wear in 1948 tags.--Many of the numbers on the monel metal tags applied in 1948 were worn entirely away. Wear was most severe at the end of the tag nearest the bend and in some instances the tag was worn completely through this point so that it was hanging in two pieces. Fortunately the magnitude of the number could be established by its location on the tag. In 1948 the tags were applied with the number facing down but the placement does not account for the wear, for in other years the monel tags showed so little wear that lettering on both sides was legible, even after 10 years of use. The monel used in 1948 was apparently of especially soft composition, an irregularity that will make it useless for long term observations. The use of stainless steel would be advisable in the future in order to avoid difficulty with soft lots of monel. See Temporary marking under MISCELLANEOUS (field techniques).

MORTALITY

Dead pup study area.--In order to show graphically the mortality of pups on St. Paul Island we marked off an area, before the seals arrived, by means of painted rocks and counted the dead pups in this area every five days throughout the breeding season.

Rate of death of seal pups, on an area
of approximately 15,000 square feet,
Northeast Point, St. Paul Island

Total number of pups that died in this
area previous to August 16 -- 430



GRAPH 1

The results of our study show that mortality begins about the first of July. From the first to the twelfth it rises with moderate rapidity then shoots up until the 22nd. Between the 22nd of July and 1 August the mortality nearly levels off, retaining its peak during this late July period. Between 1 and 16 August it drops off steadily and rapidly.

NORTHEAST POINT--JUNE 25-AUGUST 16, 1951

		<u>Count of total dead pups</u>	<u>Increment at 5 day intervals*</u>
June	25	0	
July	2	2	2
	7	20	18
	12	45	25
	17	95	50
	22	160	75
	27	235	75
August	1	317	82
	6	385	68
	11	427	42
	16	430	3

Hookworm investigation.--Part time of one or more biologists was devoted almost everyday from 12 July to 10 August assisting Dr. O. Wilford Olsen with hookworm investigations. The assistance given included

1. Collecting seal and sea-lion intestines for examination.
2. Trapping or shooting blue foxes.

* See Graph 1

3. Stripping intestines.
4. Collecting cows and pups from heavily infested rookery areas.
5. Indicating the areas of heavy mortality.
6. Collecting soil samples.
7. General service work: furnishing transportation, making or locating equipment, etc.

After examining several hundred seals, 2-years old or older, Dr. Olsen had still found no hookworms. The examinations included over 125 cows and several adult bulls, some taken directly from rookery areas where a severe die-off of pups was taking place. Most sea-lion pups were infected and one sub-adult (4-year) male sea-lion carried an infection. Adult blue foxes generally have hookworm but Dr. Olsen concluded that previous investigators were correct in describing this parasite as a separate species.

Sea-lions appeared to be the only possible reservoir host discovered this far in the investigation.

Other approaches to be explored are:

1. Testing the temperature resistance of hookworm eggs and larvae to determine possible over winter survival.
2. Determining the possibility of cross infection between blue foxes and fur seals and sea-lions and fur seals.

PHYSIOLOGY

Temperature.--The biologists collaborated with Dr. George A. Bartholomew in taking the temperatures of 283 bachelor seals including

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those that died of exhaustion in the drive, 27 pups, 4 cows, and 8 bulls killed for specimens. On 25 June, a dry, almost windless day (air temperature 8.6° to 10.4° C.), the chest cavity temperatures of freshly killed bachelors ranged from 38° to 41.4° C. The average temperature was 39.7 C. Temperatures of roadskin seals were between 42.3° and 43.9° C.

On the following day, 26 June, there was a 10-12 mile wind and mist (air temperature 6.6° C.). No severe prostrations or deaths occurred in the drive. Chest cavity temperatures ranged from 37.2° to 39.6° C. The average temperature was 38.4° C., a drop of 1.3° C. from the average of those observed the previous morning.

Seals with temperatures above 42° C. (107.6° F.) are invariably prostrated or dead. The heart beat of prostrate seals is rapid and erratic. Counts ranged from 180 to 248 beats per minute.

The average of 27 pup temperatures (rectal) taken 24 July was 38.2° C. The lowest recorded was 37.2° C. and the highest 38.8° C.

Chest cavity temperatures of seven bulls averaged 37.6° C., 7.4° more than the average scrotal temperature. Four cows averaged 37.8° C. ($37.6 - 38.0^{\circ}$ C.) in the chest cavity.

Fat content of seal milk.--Milk drained from the slashed mammary glands of a female seal in estrus was analyzed for fat content by Mr. William Clegg of the Technological Laboratory, Branch of Commercial Fisheries, Fish and Wildlife Service. The fat content, using the acid hydrolysis method, averaged 45.97% for two samples

POPULATION

Tag recoveries.--In 1951 all seals tagged on a fore flipper were killed irrespective of size. The tagged 2-year olds were allowed to escape, although 20 were killed by mistake. The taking of 2-year olds would not aid greatly to the population data and their large, distinct hind flipper tags could be by-passed without causing confusion in taking the other tagged classes. The carcass of every seal was examined for a tag. Beginning with our arrival on 25 June every seal was also examined for a tag scar and hind flipper perforation. Lost tags for 20, 22, and 24 June were estimated from the proportion of tagged and tag lost animals taken during the remainder of the season.

Tagged and tag scarred seals examined in 1951 were as follows:

1947 tags recovered	462	} 35.55%
<u>A</u> tag scarred and perforated hind flipper	259	
1948 tags recovered	1265	} 64.45%
<u>B</u> tag scarred	42	
1949 (C) tags accidentally taken	20	

*465 - June 1953
account
VBS, 7/20/54*

Two conditions will effect the use of these data in estimating the 1948 pup crop. One is the fact that in 1950, 117 tagged 2-year olds were killed. That year all tagged seals were taken because there was no way of distinguishing 2- and 3-year old seals on the killing field. Both were tagged on the left fore flipper. Only one percent or less of the kill is normally made up of 2-year olds. As a result, the kill of tagged 2-year olds was not accompanied by a proportional kill of untagged seals. The 1951 recovery of B tags was thereby reduced. The second

condition requiring adjustment is that pointed out by Kenyon, Scheffer, and Chapman in their 1950 report. Seals at the upper and lower size limits are killed because they are tagged, not because they fall within the commercial kill limits. It is necessary to calculate the number of tagged seals that would have been recovered if tags had been ignored and the kills based entirely on size.

These calculations will be made when the 1951 tag recoveries are used to revise present population estimates.

It is sufficient in this preliminary report to say that the tag recoveries appear to substantiate the estimates made in 1950.

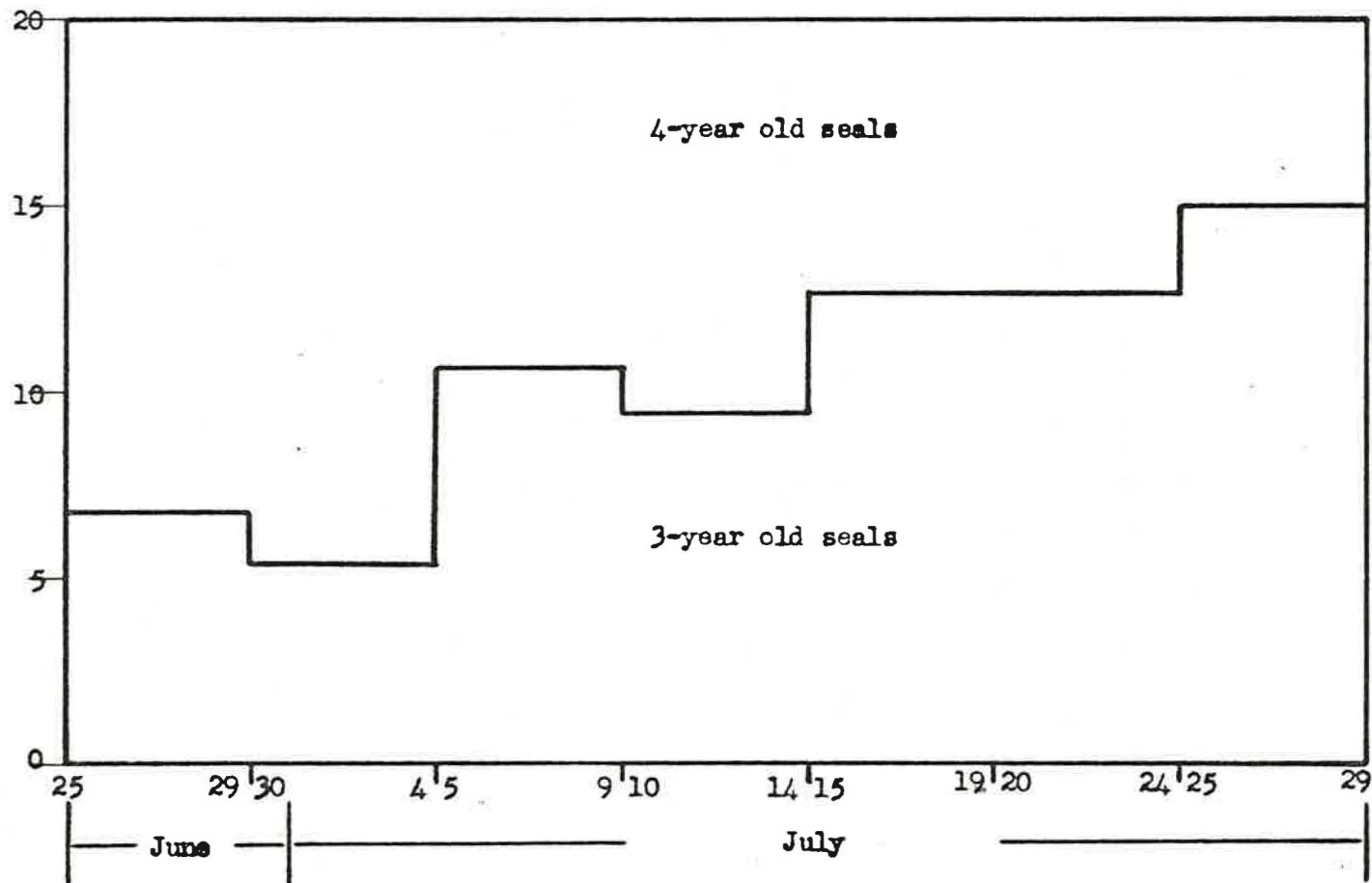
Tooth ridge counts.--A random tooth sample of 20 upper right canines for each day of the kill on St. Paul and 5 for each day on St. George was preserved. The number and percent of seals of each age, according to tooth ridge counts, represented in the sample is:

<u>Age, years</u>	<u>Number</u>			<u>Percent</u>		
	<u>St. Paul</u>	<u>St. George</u>	<u>Average</u>	<u>St. Paul</u>	<u>St. George</u>	<u>Average</u>
2	2.0	5.0	7.0	0.0	3.0	1.0
3	391.0	103.0	493.0	51.0	55.0	52.0
4	354.0	69.0	423.0	47.0	37.0	45.0
5	<u>13.0</u>	<u>8.0</u>	<u>22.0</u>	2.0	5.0	2.0
	760.0	185.0	945.0			

The kill of males on both islands in 1951 was 60,504, therefore the approximate number of each age killed was:

<u>Age, years</u>	<u>Number</u>
2	480
3	31,560
4	27,080
5	1,380

Seasonal change in proportion of 3- and 4-year old seals in 1951 St. Paul Island commercial kill*



GRAPH 2

*Based on tooth samples of 20 per day

The surprisingly high proportion of 4-year old seals can be at least partly explained by the expansion of the killable size limits in 1951 to include the 46-inch animals. Possibly the change caused a general tendency to take larger seals. Our tooth samples illustrate a shift from a kill that is predominantly 4-year old seals in early season to one that is predominantly 3-year olds near the end of the season (Graph 2). This might indicate either that 3-year olds are unavailable in the early part of the season or that they are too small to come within acceptable size limits. Inasmuch as they compose from two-thirds to three-quarters of the kill in the later rounds it can be assumed they were unavailable earlier.

Evaluation of the 1951 pup crop.--Between 2 and 19 August we attempted to count the dead and estimate the living pups on St. Paul Island. Our departure on 22 August prevented us from completing the count of dead pups: Little Zapadni was left undone.

Methods. The same field methods were used in 1951 as in 1950 (see "Census of Pups, 1950", by K. W. Kenyon) with one exception noted later. Briefly, the methods used were: Living pups--the estimators visited each rookery and by scanning and counting--using a mechanical hand tally--attempted to record the approximate number of pups present. Dead pups--the counters carefully covered all rookeries (except Little Zapadni) and marked each carcass with a dab of powdered lime, simultaneously recording it on a mechanical hand tally.

This year one notable addition was made to our field methods. We attempted to evaluate the accuracy of our estimates of living pups. To do this we chose a small rookery, Zapadni Reef, where we estimated the

pups by our usual method. We then completely reworked the area, herding the pups and allowing them to escape slowly, thus making as accurate a count as possible.

Our average estimate of this rookery was 4,550, our average count was 5,950. Thus a correction factor of approximately 25% is added to our entire field estimate of living pups.

Living pups, St. Paul Island. Wilke and Kenyon covered all the rookeries and independently counted, estimated, and recorded the pups. After the field work was completed the figures obtained were averaged and the correction factor of 25% was applied.

Dead pups, St. Paul Island. Three counters required seven days to count dead pups on all but one rookery. One more day was needed but not available. The rookeries counted showed an average increase in mortality of 32% over the counts made in 1950. On the basis of this percentage the number of dead pups for Little Zapadni rookery was calculated. The number of dead pups on the St. Paul Island rookeries in mid-August was approximately 72,700. (In 1950 we counted 53,428 dead pups.) We estimate that at least 5% of the pups were either missed during the count or washed out to sea during rough weather. Thus the number of pups that actually died during the 1951 season was probably close to 76,300. The average mortality is about 21%.

Total pups, St. George Island. Since no counts of pups were made on St. George Island in 1951 an approximation is obtained by an extension

of the St. Paul counts and estimates through use of the harem bull counts. The harem bull count on St. Paul was 9,434. This gives an average of 38.09 pups born per bull from our estimates. (Bartholomew's observations for Kitovi rookery show the ~~the~~ average number of pups per bull to be 39.0.)

The average pup mortality found on St. Paul is applied to St. George. An estimate of the 1951 pup crop for the Pribilof Islands is presented below in summarized form.

Field counts and estimates

A. Harem bulls (Counter: Mr. Clarence L. Olson)

- 1. St. Paul - 9,434
- 2. St. George - 1,825

B. Pups (Counters and estimators: Wilke, Kenyon, Jordan)

1. St. Paul

a. Living--

Average of Wilke and Kenyon field estimates--226,700
 Add 25% correction factor (see explanation previously given)--56,700
 1951 corrected field estimate of living pups, St. Paul-283,400

b. Dead--

Field count (plus Little Zapadni computation)-72,700
 Add 5% for pups missed 3,635
 Approximate pup mortality 76,300

c. Total born-- 359,400

2. St. George--computed extension of St. Paul field work

a. Total pups born

Average pups per bull, St. Paul (38.09) X		
harem bull count, St. George (1,825)	.	. 69,500

b. Mortality (from St. Paul, 21%)	.	. 14,600
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c. Living pups as of mid-August	.	. 55,000
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3. Summary of pup counts, estimates, and computations for the Pribilof Islands, as of mid-August 1951.

a. Total pups dead

St. Paul	76,300	
St. George	14,600	
	<u> </u>	90,900

b. Total pups living

St. Paul	283,400	
St. George	55,000	
	<u> </u>	338,400

c. Total pups born

St. Paul	359,400	
St. George	69,500	
	<u> </u>	428,900

These figures are in reasonable agreement with others previously obtained (see "A Population Study of the Alaska Fur Seal Herd", 1951, by Kenyon, Scheffer, and Chapman). The fact that a method was developed for applying a correction factor to the field estimates brings the year's field counts and estimates much more in line with the results obtained through other means than was the case last year.

LIVING AND DEAD PUP COUNTS

1951 - ST. PAUL ISLAND

Rookery	Living pups			Dead pups	
	Date	No. (K) ^{1/}	No. (W) ^{2/} Av.	Date	No.
Ardiguen	August 13	1,200	1,500 1,350	August 18	242
Gorbatch	13	16,650	18,200 17,425	18	3,559
Kitovi	10	11,875	12,700 12,288	15	1,517
Little Polovina	2	8,500	7,900 8,200	15	2,208
Little Zapadni	10	14,800	14,000 14,400	--	2,804 ^{1/}
Lukanin	9	4,400	5,000 4,700	15	712
Morjovi	11	17,950	18,250 18,100	16	3,592
Polovina	9	6,500	9,000 7,750	15	6,402
Polovina Cliffs	9	14,050	14,500 14,275	15	5,580
Reef	13	44,250	48,000 46,125	18	11,007
Sivutch	--	5,750 ^{2/}	5,750 5,750	--	2,000 ^{1/}
Tolstoi	14	21,250	25,000 23,125	14	6,033
Vostochni	11	28,800	30,700 29,750	17	18,450
Zapadni	10	18,650	19,200 18,925	19	8,204
Zapadni Reef ^{3/}	13	4,700	4,400	13	353
Total		219,325	234,100		72,663

^{1/} Little Zapadni and Sivutch--no dead pups counted but the figure is derived by applying the average percent increase in mortality of 1951 over 1950 (average percent increase for all counted rookeries 32.27%).

^{2/} Not counted but same figure used as in 1949.

^{3/} By count with as much care as possible -- Kenyon 5,947; Jordan 5,838.

^{4/} The separate field estimates made by Wilke (W) and Kenyon (K) which are averaged to obtain figures shown on pages 16 and 17.

Aerial photography.--On 19 July the Naval Vessel U.S.S. Barton Island with two helicopters on board visited St. Paul Island. Through the cooperation of Commander J. R. Schwartz, one of the helicopters was put at the disposal of the biologists for an hour. Lt. R. J. Maghan as pilot cooperated in placing the biologist in position to take several rookery photographs. This method of photography will be evaluated in a future report.

REPRODUCTION

Male genital tracts.--A series of testes were collected for the purpose of determining if male impotency may be one of the causes for about 20 percent of the breeding females being non-productive.

Testes of the following males are available for examination:

A. BDM nos. 419, 420, 421, and 422--prospective harem bulls taken 30 June from Reef rookery.

Nos. 419, 420, and 421 are 10-year old bulls and probably would not have held cows until late in the season.

B. BDM nos. 427 and 428--harem bulls taken 11 July on Polovina rookery. Each was accompanied by only one cow but several pups (females at sea) at the time it was killed.

BDM nos. 429 and 430--harem bulls taken 16 July on Polovina rookery. BDM 429 was accompanied by three females and BDM 430 by 20 females.

C. BDM no. 431--an idle bull taken 16 July on Polovina rookery.
BDM nos. 432 and 433-- idle bulls taken 18 July at Northeast Point.

BDM no. 442--bull with a large harem taken 3 August at Polovina rookery; was thin from the season's breeding activity.

D. Testicle labelled "Extra, Aretas" was from bull taken 3 August at Polovina rookery in an isolated position. Breeding status unknown.

One testicle of each bull was transversely sliced in 3-4 mm. sections, preserved in Bouin's solution and later changed into alcohol. The second testicle was frozen without slicing. Right upper canines were saved for age determination.

Female genital tracts.--Ovulation. An effort was made to collect cows that would furnish the genital tracts needed to establish whether fur seals ovulate spontaneously or as a result of coitus. The following animals were collected for that purpose:

A. BDM no's. 423 and 424 were taken 3 July on Kitovi rookery. Each had a pup still dragging a fresh placenta, indicating that the pups were less than a day old (probably only a few hours) and that the cow had not been bred.

B. BDM no's. 425 and 426 were shot 5 July on Lukanin rookery immediately after the completion of coitus. These genital tracts will show the condition of follicles during estrus, that is, whether or not ovulation has occurred.

C. Our plans called for marking two females after coitus and killing them 48 hours later. We were able to mark the females but could not find them 48 hours later. From observations made by Bartholomew this summer we now know that the females go to sea within a day after coitus and remain there for about a week. If future attempts will be made to

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collect female genital tracts a few days after coitus, it will be necessary to hold the females in a pen between coitus and removal of the tract.

Regression of the uterus. For tracing regression of the uterus it was planned to collect cows 5, 10, 15, 20, and 30 days after parturition.

The same difficulty was experienced in collecting females a given number of days after parturition as in collecting them a given number of days after coitus. Inasmuch as the time spent at sea is six or seven times that spent on the rookery, the females were apt to be at sea on the day scheduled for collections. In order to increase the possibility that they can be taken at scheduled intervals several females should be marked every day for at least a week. Then, from the reservoir of marked females one can be found that fulfills or nearly fulfills the requirement.

The following three animals were marked shortly after parturition and collected to study regression of the uterus.

BDM 436--marked 25 July; collected 29 July on Reef rookery. Interval--4 days including day of collection.

BDM 437--marked 25 July; collected 7 August on Reef rookery. Interval--13 days.

Miscellaneous female 122--marked 2 July; collected 6 August on Kitovi rookery. Interval--35 days.

In addition, BDM 423 and 424 will show the condition of the uterus at parturition and BDM no's. 425 and 426 will show the amount of regression at the time of estrus, normally five to seven days after parturition.

MISCELLANEOUS (Field Methods)

A number of simple techniques have been used to facilitate field work with fur seals. Most of these are fairly obvious but may not occur to the new worker immediately.

Temporary marking.--We found that the quick-drying paint prepared for marking highways was distinguishable for at least two months if applied on dry fur. After one month the paint marks were very clear and the marked animals were readily picked out in a harem with brief scanning. To apply the paint a daub (cotton wrapped in a small piece of cloth) tied to the end of a long bamboo pole was used. After dipping in paint the daub was jabbed against a seal and rotated or rubbed to work the paint into the fur. Marking by this method is rapid and simple. There is no equipment to get out of order. If a daub is damaged it is quickly and cheaply replaced. The paint was found to adhere with great tenacity to the fur of seals collected a month after marking.

Another excellent marking method is the use of tags (cattle-ear tag type) together with flexible colored plastic strips. The strips are perforated and slipped over the tag to the bend before clinching. Marking with tags of this type has a more limited application than paint because the seals must be snared and held until the tag can be clinched on a hind flipper. Because of its reliability and the variety of color combinations that can be used it is probably the best marking method for intensive harem observations. Young pups are quickly marked with the ear-tag plastic-strip combination if a snare on a long bamboo pole is used to extract them from the harems.

Weighing.--When large animals such as sea-lions or bull seals are to be weighed, 4 x 4 timbers or strong poles are needed to make a tripod. If a 3/4 inch hole is drilled near one end of each timber a stout line can be used as the hinge for the upper end of the tripod. A heavy tripod can be easily set up in this way in a few minutes.

A spliced loop of line about 30 inches long will be found useful for hanging seals on a scales or steelyard. If looped around one fore and one hind flipper, the seal is held high enough from the ground to permit weighing on a light portable tripod.

Carrying and dragging.--Seals are easily carried if a light pole is slipped through slits cut in a fore and a hind flipper. If the seal must be carried a long distance it is best to run the pole through all four flippers in order to avoid ripping.

Large animals can be dragged behind a truck by fastening a line through a strap of skin prepared by making two parallel cuts about two inches apart.

Retrieving.--Retrieving specimens from a rookery during the breeding season when the bulls are pugnacious is usually troublesome. If the scope of operations can be limited to animals that can be reached with a pole from a catwalk or cliff, live or dead seals up to the size of mature cows can be lifted out of a harem with a snare. Effective snares with great gripping power can be made from the light, flexible steel cable used for airplane controls. A pull parallel to the axis of the pole should be made on seals larger than pups. Otherwise the pole is likely to crumple or snap.

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