STUDIES OF THE ALASKA FUR SEAL HERD IN 1944

Progress Report, November 1, 1944

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The following report is subdivided according to the filing system adopted in 1941 and described in letter to Dr. W. B. Bell, April 24, 1944. In some categories of the system there is nothing new to report at the present time. Field operations were carried out on St. Paul Island by the writer from May 16 to August 9, 1944. It is recommended that a later period, say from June 15 to October 1, be covered by the biologist in 1945.

Anatomical Studies, Miscellaneous.--A cryptorchid male seal, or "big cow" in the terminology of the Pribilof natives, was killed by revolver fire on Reef Rockery on July 15. Measurements and photographs of the living and dead animal (BDM no.86) were taken. Briefly, it weighed 222 pounds and had the long body and limbs of a normal bull but lacked the gross neck and mane. Only one testis, dwarfed and deeply imbedded, could be found. This creature was the sole possession of a normal bull who guarded it as though it were a cow.

Food Habits, Stomach Contents.--The contents of about 100 stomachs in 1944 were examined and tabulated as to number of ascarid worms and kind and number of fragments of squid beaks, mollusc

shells, stones, and other materials. The stomachs included about 35 branded 3-year males, 20 branded 4-year males, and 5 females. No stomachs were saved, although the contents of about 25 were preserved by drying and representative samples will be photographed and reported on later. The purpose of opening stomachs in 1944 was to provide more exact information on the contents of stomachs of hauling-ground seals than has hitherto been available.

Growth and Measurements.--Studies in this category were given highest priority in 1944, since this was the year when the approximately 5,000 male seals tagged in 1941 for study purposes attained killable size.

Twenty-one tagged 3-year males were killed between June 10 and July 26, 25-30 characters measured on each body, and the skins, skulls, bacula, and testes preserved for further study. Selected measurements (omitting here the standard errors) are:

	Standard length, mm.	Bled weight, lbs.
Observed range	1041-1257 = 217	42-69 = 28
Mean	1136.4	53.42
Coefficient of variation	4.79	15.72

Additional data obtained from the 3-year-olds include lengths in inches of 136 specimens measured on the killing field by native John Hanson, as follows:

Observed range	38 - 46 = 9 inches
Mean	41.7
Coefficient of variation	3.69

Twenty-two branded 4-year males were collected and studied in the

same way as the 3-year-olds:

	Standard length, mm.	Bled weight, lbs.
Observed range	1130 - 1414 = 285	45-111-1/2=67-1/2
Mean	1254.5	73.2
Coefficient of variation	5.80	21.67

In addition, length measurements in inches were obtained by John Hanson from 28 branded 4-year males (including the 22 seals collected and measured independently by Scheffer):

Observed range	41 - 51 = 11 inches
Mean	45.6
Coefficient of variation	5.28

Only one marked female was obtained in 1944, a 4-year-old accidentally killed on July 30. She had not born a pup in 1944. Length: in field, 42 inches; in lab, 1203 mm. Weight: 58 lbs. It would be desirable in 1945 to collect, by rifle fire, marked females on the rookeries. The experience of 1944 demonstrates that there is only a remote chance of finding a marked female elsewhere than on the breeding ground.

Measurements taken in 1944 show that seals of a given class appearing in early June are smaller than those appearing in late July. This probably represents growth of the seals during these two months, but it may indicate that the more mature seals of a given class haul out later in the summer. Analysis of the field data will probably clarify this point.

As was anticipated, a number of branded seals were classified on the killing field as being a year older or younger than their true age.

Branded male seals killed in 1944(3-and 4-year-olds), St.Paul Island

Branded 3-year-olds	Number	Percent
Measured and recorded as 2-year-olds (37-40")	23	17
Measured and recorded as 3-year-olds (41-45")	111	82
Measured and recorded as 4-year-olds (46-51")	2	1
Average length 41.8 inches	136	100
Branded 4-year-olds		
Measured and recorded as 3-year-olds (41-45")	14	50
Measured and recorded as 4-year-olds (46-51")	14	50
Average length 45.6 inches	28	100

On Zapadni killing field on July 8, the bacula of 203 seals were collected at random and were subsequently cleaned by the action of marine organisms. These will be weighed and measured to see whether their distribution parallels the distribution of total length measurements of the seals killed here on this day.

At the end of the 1945 season it would be desirable to prepare for publication a report on the growth and measurement of fur seals from birth to age 5 years. This span would include the ages of commercial importance.

Marking Seals (Branding, tagging, dyeing, etc.).--No seals were marked in 1944. Mr. Donald Gibbins of the Fouke Fur Company kindly prepared a set of dyes to be tried out on the fur of live seals but the writer left St. Paul Island shortly after the end of the sealing season and did not have a chance to use them. It is suggested that, in 1945, the biologist spend the latter part of the summer on the islands in order to work with the August-September pups. Experiments might be tried in ear

tagging, punching holes in webs of the flippers, and slicing tips off the flippers, as well as dyeing fur.

The recovery, in 1944, of 1940-and 1941-branded seals was satisfactory. Examination was made of 177 three-year males, 29 four-year males, and 1 four-year female. These comprise perhaps one-third or loss of the marked animals returning in 1944, but it was not possible for the writer to see them all, since he was obliged to spend a good deal of time in the skinning room and on the rookeries and could not attend all of the drives. The following observations were made:

Recoveries of tagged-and branded 3-year males in 1944

Efficiency of metal tags on 3-year-old males (1944)

	No. seals ~~killed~~ with	Percent	Percent each kind tag applied in 1941
Monel metal tags, 8x69 mm. (before folding)	82	46	50
Stainless steel tags, 11x81 mm. (before folding)	76	43	50
Tag lost; only neck brand remaining	19	11	--
	177	100	100

Thus it appears that about 89 percent of the seals retained their tags at the end of the third year, and there was no significant difference in loss of the two kinds of tags.

Relative efficiency of tags on fore and hind flippers

	Tags Intact	Tags Lost	Total	Percent Intact	Percent Lost
On fore flippers (10,000 tags applied)	96	22	118	81	19
On hind flippers (2,000 tags applied)	14	15	29	48	52

It was not necessary to tabulate these data to realize that there was a considerable loss of tags from the hind flippers, since the abundance of torn hind flippers was noticeable on the killing fields. Wilke and Banner, in 1941, varied the position of the hind flipper tag, sometimes putting it on the web and sometimes clasping it over the bony part of the digit. In the latter position, the tag is as efficient as when applied to the fore armpit.

A record was kept of the size of the brand scar on 100 three-and four-year males, usually to the nearest 1/4 inch. No record was kept of the total area of light tan fur surrounding the brand scar, simply of the area on the freshly killed, unskinned seal where the hair follicles had been destroyed.

	Number	Range, sq.in.	Mean area, sq.in.
3-year males	85	0 - 2.25	0.73
4-year males	15	0 - 3.13	0.75

The scars increased in size and often split open when the pelt was stripped forcibly from the body. An occasional split scar was seen on a living animal, probably caused by the strenuous movements of the seal while it was being driven over land.

The accuracy of the sexing and tagging operations in 1941 is indicated by the examinations of seals three years later:

	No.	Percent
Tag or tag-scar found on left side in 1944; recorded as a female in 1941	6	5.1
Tag or tag-scar found on right side in 1944; recorded as a female in 1941	5	4.2
No record of location of tag or scar in 1944, but recorded as female in 1941	2	1.7
Tag or scar found on right side in 1944 recorded as male in 1941	105	89.0
	118	100.0

Since only the seals in the fourth category were correctly identified as to sex and correctly entered in the branding book in 1941, an efficiency of 89% is indicated. In future work of this kind the sexing of the seal pups should not be left in the hands of the natives.

Two 3-year(?) males wearing rubber necklaces were killed during the summer, as follows: No. 1 (July 16, Polovina?), St. Paul Island; length of seal 40 inches; dimensions of rubber ring 3/16-inch cross-section diameter x 5 inches total outside diameter; color dark brown. No. 2, July 31, Northeast Point, St. Paul Island, length of seal 40 inches; dimensions of rubber ring 1/4-inch cross-section diameter x 5-3/8 inches total outside diameter; color creamy to dark brown. Scar tissue about 1/8-inch wide encircling the neck indicated that the rings had been on for some time. One ring was later submitted to the headquarters of the 13th Naval District in Seattle and the reply received that "no information is available which would tend to identify the enclosure as being any part of either Army or Navy equipment." The other ring

was submitted to the B. F. Goodrich Company whose research staff replied, "...we may conclude that there is substantial evidence that this ring was made in some country other than the United States." Pending further information, it is the opinion of the writer that these rings were slipped over the heads of seal pups in the fall of 1941 by Japanese fishermen operating nets in Bering Sea. A second guess is that Japanese or Soviet scientists were tagging seal pups on the Asiatic shore in 1940 or 1941.

Migration: Arrival and Departure.--The tendency of 3-year males to return to the rookery where they were tagged as pups is shown in the following table:

Rookery where tagged	Number recovered ~~here~~ 1944	Number recovered elsewhere	Percent seals returning to this rookery	Recovered here ~~but~~ without tag, perhaps tagged elsewhere	Total
Reef-Gorbatch	31	24	56	3	58
Polovina Group	18	6	75	2	26
Northeast Point	21	4	84	9	34
Zapadni Group	10	7	59	0	17
Tolstoi	17(1)	10	63	4	31
Lukanin-Kitovi	4(2)	6	40	2	12
Totals	101	57	64 (Mean)	20	178

(1) Two tagged on Tolstoi were recovered on a T-L-K drive, presumably on Tolstoi.

(2) One tagged on Kitovi was recovered on a T-l-K drive, presumably on Kitovi.

A tabulation to show what might be termed the relative "attractiveness" of the various rookeries is given below. This indicates the percent of "foreign-born" seals in all of the tagged seals which were observed on a given rookery.

Rookery	Tagged 3-year males recovered here but not originally tagged here	Total tagged 3-year males observed here in 1944	Percent foreign-born seals here
Zapadni Group	17	27	64
Northeast Point	17	46	37
Tolstoi	11(1)	32(2)	34
Lukanin-Kitovi	3(1)	9(2)	30
Polovina Group	5	26	19
Reef-Gorbatch	4	38	11

(1) Four seals recorded from combined drive on T-L-K have been prorated T:3, L-K:1.

(2) Eight seals recorded from combined drive on T-L-K have been prorated T:5, L-K:3

Thanks to the cooperation of agent Dan Benson it is possible to record an interesting case: On July 19, 1943, Mr. Benson caught a 2-year male on Staraya Artil killing field, St. George Island, and held it down with a bar while he noted tag no. 3541 on the right foreflipper. The seal was 40 inches long. On July 17, a year later, this seal was killed at Northeast Point, St. Paul Island (the record of length after death was not preserved).

Under the heading of "Arrival and Departure" it is pertinent to discuss the abnormal pattern of return of bachelors in

1944. The small take of seals has impelled the writer to analyze information on the return of hauling ground seals this year and, by way of comparison, to review the behavior of hauling ground seals in past years. It is difficult to interpret the behavior of seals simply by watching them daily on the killing field, and still more difficult to compare in one's memory the observations of the present year with those of the past. It is possible, however, to make certain deductions by comparing the statistics of the kill from one year to the next, that is, to utilize the counts of seals killed, together with their measurements, and the counts of seals rejected each day throughout the sealing season. For the purpose of the present report, the kill of 1944 has been compared with the individual kills and the average of the six years 1935-1940. This average will be referred to as the "normal". In years before 1935 the order of the killing rounds was irregular, and in the years 1941-1943 sealing operations were not typical because of war circumstances. Thus the period 1935-1940, although admittedly short, is the only satisfactory yardstick with which to measure the 1944 take.

The take of seals on both islands (47,651) was the lowest since 1930 (42,500) in spite of the fact that breeding elements of the herd are increasing. The question uppermost in the minds of those who were observing the return of seals last summer was: had something happened to the 3-year class or was it of normal size but simply slow in returning to the islands? A second question was: if the 3-year class was small, were previous sealing practices responsible for the reduction in size?

The answers to these questions are, we believe, fairly well revealed by study of the sealing statistics. Killable seals returned slowly to the islands during June and the first half of July. A graph (No. 1) of their return shows a gradual increase in numbers with no indication of the usual peak around the middle of July.* The rate of hauling out did not attain its normal value until July 21 or 22. From then on, however, the seals arrived rapidly and, at the end of the season, were hauling out at a rate 60-70% greater than normal. From the data at hand it appears that the height of the season had been attained and passed by July 31 on certain hauling-grounds (Northeast Point, Reef, Polovina Group) while on others (Tolstoi Group, Zapadni) the seals were still arriving in increasing numbers (Graph 2). The average of all grounds had certainly reached its maximum by July 25-27.

It is hardly proper to say, however, that the height of the season in 1944 was two or three weeks later than normal for there was no characteristic "height" in 1944, --the return curve was abnormally flattened. In this connection also it should be pointed out that a season in which the return of seals is slow and prolonged, as in 1944, cannot be expected to produce the exciting 3,000-a-day kills, a few of which appear in the normal season. The pattern of return of killable seals in 1944 indicates that they were simply late in arriving, rather than fewer in numbers.

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* July 10 is the average peak of the season, calculated on the return of measured 3-year males between July 1 and July 30, 1930-1940 inclusive, on St. Paul Island. The date when half of the season's total has accumulated is usually 1-3 days later than this.

Further evidence is furnished from another source. When it became apparent that the seals were arriving slowly in 1944, a count of rejects was started on July 12 in order to obtain data for study (Graph 1). The count was not started in time to furnish information on the early season composition of the drives, but it did serve to show that in the mid-season period, July 12-14, the percent of rejects in total seals driven was satisfactory (105% of normal), the total number of rejects was low (60% of normal), and the total number of seals killed was low (70% of normal). The mid-season rejects and killable seals in 1944 were not only fewer than the average but were, in each case, fewer than the rejects and killables in any individual year in the period 1935-1940. The data for the middle of July would therefore indicate that all bachelor seals, ages 2-5, were present in fewer than usual numbers and, by inference, there was nothing particularly wrong with the 3-year-olds. In other words, if some unknown agency had suddenly decimated the 3-year-old class, there is little likelihood that it would affect adjoining age classes at the same time.

As regards the late season period, the 3-year males increased steadily until, during the period July 25-29, they were present in numbers 66% greater than normal. The rejects did not follow suit. They were present in small numbers throughout the period of observation (July 12-31), never more abundant than 79% of normal. The data do not indicate why the rejects were scarce in 1944, but from the rising trend toward the end of the season it may be speculated that the 2-year-olds, which normally domin-

ate the reject class at this time, were slow in arriving, like the killables, and had not attained their peak by the end of the killing season. The writer presumes to say that whatever factor (low seawater temperatures?) caused the bachelors to return reluctantly to land in 1944 also operated selectively on the various classes. The impetus for a male to haul out on land becomes progressively more urgent as he approaches breeding age, hence any factor tending to keep the bachelors at sea in June and July might reasonably be expected to affect a greater proportion of the 2-year-old class than, say the 5-year-old. Graph 3, showing that the percentage of rejects in late July, 1944, was abnormally low, tends to strengthen the theory that a greater proportion of the 2-year class stayed at sea than of the 3-year class.

The 1944 season was quite normal with respect to the proportion of seals other than 3-year males which were killed. The writer was formerly of the opinion that, if seals of a single class, say 4-year males, appeared in very small numbers in a particular summer, this fact would be revealed by a drop in the proportion of measured 4-year-olds in the total kill, on the deduction that the native clubbers would have fewer chances of accidentally striking a 4-year-old. While such a relationship between the hauling ground population and the tally sheet probably does exist, it is overshadowed and nearly obscured by the fact that the native clubbers, through long years of practice, select about the same proportion of age and sex groups from year to year regardless of the proportions available to them. In the following table a comparison is made between the total kill by age and

sex groups for 1944 as compared with the 6-year average for 1935-1940. It will be seen that, with minor exceptions, the kill in 1944 was normal. The slightly higher take of 4-year-olds and slightly lower take of 2-year-olds in 1944 was brought about by instructions to the clubbers at the start of the season to kill larger animals.

Age and Sex	1935 - 1940 Lowest %	1935 - 1940 Highest %	1935 - 1940 Average %	1944 Percent
ST. PAUL ISLAND				
Males 2 yrs	1.9	3.6	2.7	2.2
Males 3 yrs	91.5	95.3	93.5	91.5
Males 4 yrs	2.3	4.4	3.5	6.0
Females	.2	.5	.3	.3
ST. GEORGE ISLAND				
Males 2 yrs	.8	4.2	2.5	3.7
Males 3 yrs	88.7	97.9	92.7	87.4
Males 4 yrs	1.1	6.9	4.3	8.7
Females	.2	.7	.5	.2
PRIBILOF ISLANDS				
Males 2 yrs	1.7	3.4	2.6	2.5
Males 3 yrs	91.9	95.8	93.4	90.8
Males 4 yrs	2.1	4.4	3.6	6.5
Females	.3	.5	.4	.2

The slowness of the 1944 season was observed on both St. George and St. Paul Islands, and, as a matter of record, the behavior of seals on both islands has been similar for many years (Graph 5).

It would be advisable to obtain a record of daily surface seawater temperatures at St. Paul Island, year in and year out. With accumulated information it might be possible to clari-

fy the relationship which probably exists between the hauling out of seals and the water temperature. A Negretti-Zambra continuous recording thermometer costing $150-$200 could be read once a week with little effort.

Mortality: On Pribilof Islands.--Hookworm disease was observed in seal pups on St. Paul Island in 1944 by Edward C. Johnston, Clarence Olson, and the writer during the annual harem count. Although no special search of the literature has been made, we are under the impression that the disease has not been reported since 1912. It is undoubtedly present at all times in some individuals. On July 17, on Vostochni Rookery, 127 dead pups were found in the tidal zone along 65 yards of sandy beach, all of them appearing to have died within the last 10 days. Ten bodies were selected at random and examined in the laboratory and all contained Uncinaria and clotted blood in the gut. Details of the autopsies and measurements of the pups are on file. No information is available as to the prevalence of the disease on the Pribilof Islands because no one has had time, in recent years, to examine systematically the dead pups found on the beaches. On October 26, 1944, Mr. Ellsworth Daugherty, parasitologist of the University of California, talked with the writer in Seattle. Mr. Daugherty said that a specific name has not yet been given to the Uncinaria of the fur seal and further study is needed. He also said that the lungworm Otostrongylus, which he has found in sea lions, might be expected to occur in the Alaska fur seal. Search for this nematode will be made in 1945.

On August 29, 1944, fourteen vials of endoparasites of

fur seals were sent to the Bureau of Animal Industry for identification, but it is not anticipated that a report will be forthcoming for many months due to the pressure of war work on this bureau. The collection included acanthocephalans from the colon (probably Corynosoma, found by the writer in harbor seals but hitherto unrecorded from fur seals), tapeworms (fairly well known in the fur seal but not described in scientific literature beyond the genus name Bothriocephalus), hookworms (slightly known), roundworms (well known), and unidentified nematodes from the testes, hitherto unrecorded.

The writer was most interested in rediscovering, in all adult seals examined in the laboratory, nasal mites of the species Halarachne attenuata. This organism was described in 1910 from a single specimen obtained on St. Paul Island from "a seal pup" by James Judge. It is indicative of the blank pages in our knowledge of the fur seal that these mites could be so abundant and yet be so little known. On the freshly skinned head of a 3-year male, July 25, 1944, about 300 mites were counted emerging from the nasal passages. Dr. G. F. Ferris, of Stanford University, is preparing a paper on the specimens collected last summer.

Specimens of a colorless, threadlike nematode were collected from a dozen or more testes of fur seals. These were found in the sheath (tunica vaginalis) and have not been described from the fur seal. One of the natives was rather disturbed to have these worms pointed out to him, since the testes are a common item of the native food supply.

A case of fatality at birth was observed and photographed.

The pup's head had emerged but the shoulders were locked in the cervix and both mother and pup were dead.

Oceanography.--Seawater temperatures were taken daily at St. Paul Village from October 1, 1941, to June 11, 1942, when the village was evacuated. The series was resumed on June 12, 1944, in order to obtain a 12-month record (even though not consecutive) of the temperatures. A report will be made when the September data arrive by mail in Seattle. Average temperatures for the 5-day periods ending on the following dates were:

Date	Original °C	Translated °F
June 17	3.2	37.7 - 40.4
June 22	3.4	38.1 - 42.3
June 27	4.5	40.1 - 43.4
July 2	4.6	40.2 - 42.3
July 7	4.7	40.4 - 42.7
July 12	4.8	40.6
July 17	5.3	41.5
July 22	5.5	41.9
July 27	5.8	42.4
Aug. 1	6.2	43.1

Unless funds are made available to install a recording thermometer it is not planned to continue the daily readings because of the time required for a man to walk to East Landing and back.

Pelage.--The salted skins of 47 fur seals (42 branded 3-and 4-year males, 1 branded 4-year male measuring as a 5-year-old and so excluded from the commercial kill records, 1 branded 4-year female, 1 unborn pup, 1 bull, 1 cryptorchid male) were de-delivered to the Fouke Fur Company in September to be tanned for scientific study. Probably more 3-and 4-year skins were saved than will be needed for pelage studies but it was necessary to

kill this many animals in order to obtain an adequate sample for study of body weights and measurements, and condition of gonads. Some of the surplus skins can perhaps be traded at a later date for other specimens, e.g., skins of Russian, Japanese, or South African seals.

Since the writer's time was occupied with other duties last summer there was no opportunity to do a job which should be considered in 1945, namely, a quantitative study of pelt staginess from July 15 to the end of the season. The question to be answered is: Could a routine count be made daily in the blubbering shed of the percent of pelts showing certain specified degrees of staginess? Each day, 100 pelts could be examined and the percent falling into each of the 3-5 prearranged categories, or degrees of staginess, could be recorded. We believe that this system, if practical, would enable comparison from year to year of "earliness or lateness" of the season and would also be of aid to the superintendent when he is deciding upon the date to close the killing season.

Population: Methods of Estimating.--Counts of bulls on Zapadni and Zapadni Reef were made on seven visits previous to the annual harem count of July 18. The data have not yet been analyzed but at first glance they show little promise of value because of the difficulty of distinguishing harem, idle, and surplus bulls.

The Navy turned down a request to take aerial photographs of certain rookeries in mid-July, 1944. A little thought has been given to the possibility of using a small captive balloon with a

lightweight camera for taking aerial photographs, and a description has been obtained of the University of Chicago's apparatus for photographing archaeological ruins by this method.

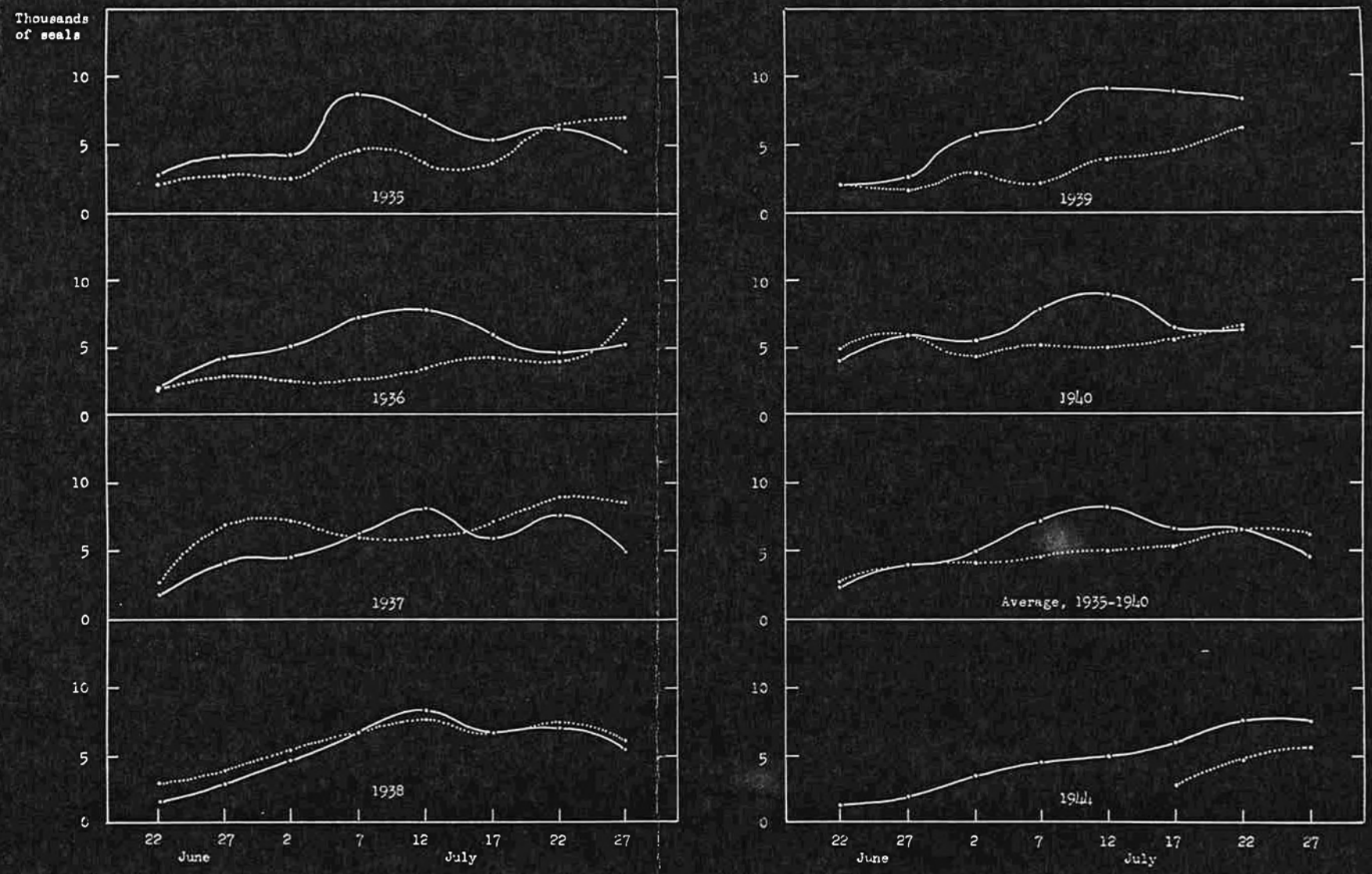
Population: Records of Rookery and Total Herd Sizes.--A graph has been made to enable visual comparison of 1) the estimated size of the Pribilof herd with 2) the sizes of various elements in the herd as counted yearly (Graph 6). These figures are from the annual reports of the Alaska fishery and fur seal industries. Does the fluctuation in take of fur seals, starting some time after 1941, indicate that the herd is approaching its maximum size? It is common knowledge that fluctuations are more pronounced in the population of a wild species which is being maintained at or near its maximum size than fluctuations in a population which is growing rapidly and upon which natural limiting factors (e.g. food supply) do not operate so forcibly.

Reproduction: Genital Tract Studies.--The testes of approximately 130 males, including branded 3-and 4-year-olds and non-branded seals, were measured in three dimensions, weighed, and preserved for study. The measurements have not yet been analyzed, but it was observed in the field that certain 3-year-old testes were very much larger than others, suggesting that spermatogenesis starts in the third year of the seal. The ovaries and associated structures extending to, and including, the cervix were saved from approximately 52 females, only one of them branded. According to present plans, all genital tracts will be examined by a collaborator of the Service at Swarthmore College, Pennsylvania.

Research Laboratory, St. Paul Island.--Plans and specifications for a 3-room laboratory were submitted to the Division of Wildlife Research on September 15, 1944.

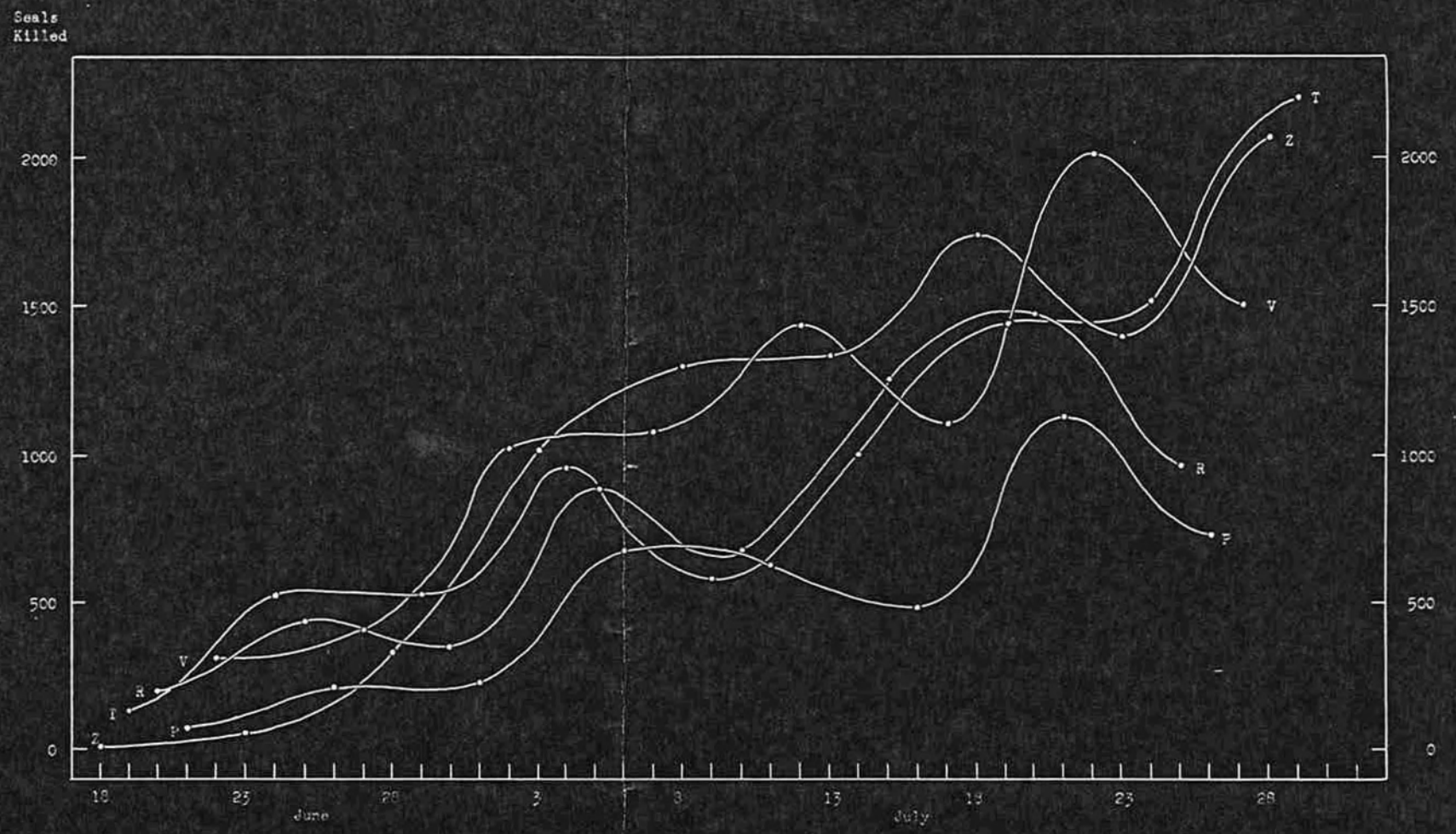
Sealing: Commercial--Information that could be placed in this category has been reported on under the heading "Migration: Arrival and Departure of Seals".

Taxonomy of Callorhinus.--The increasing use of the name Callorhinus ursinus cynocephalus (Walbaum) in place of Callorhinus alascanus Jordan and Clark is noted in scientific literature. For recent synonomy see "Extinct and Vanishing Mammals of the Western Hemisphere... ." by Glover M. Allen, 1942, American Committee for Wild Life Protection, Special Publican No. 11 (Washington, D.C.), pp. xv, 620.



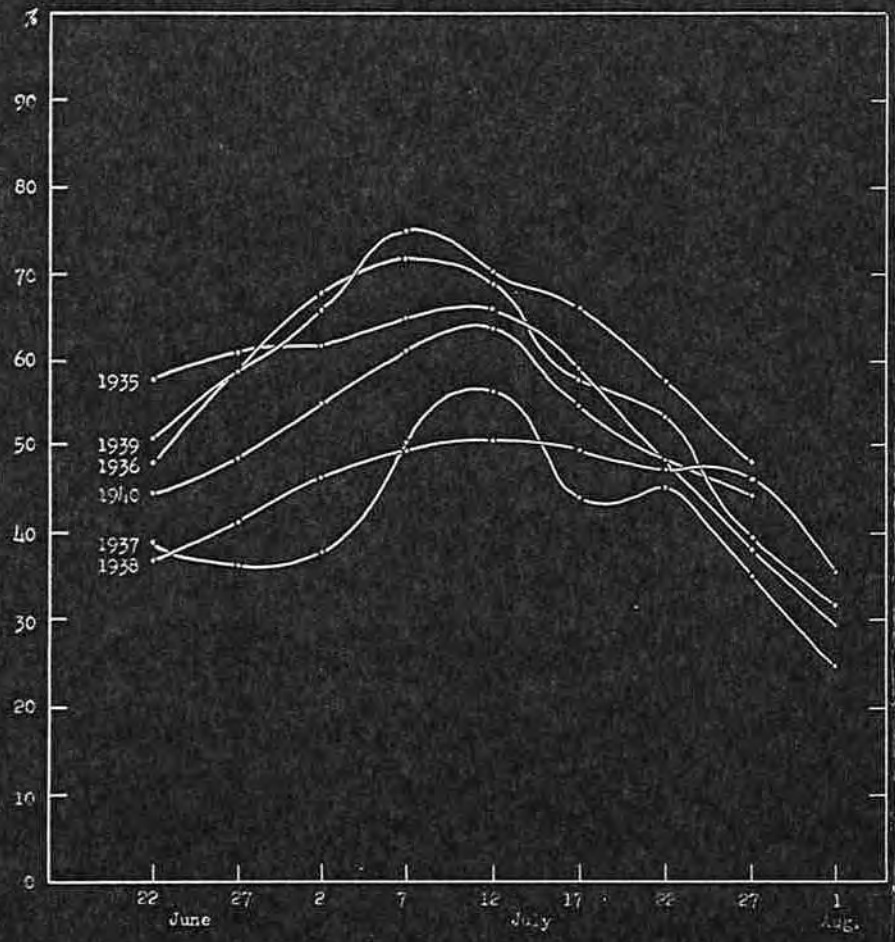
FUR SEALS KILLED AND REJECTED, 1935-1940, AND 1944, ST. PAUL ISLAND

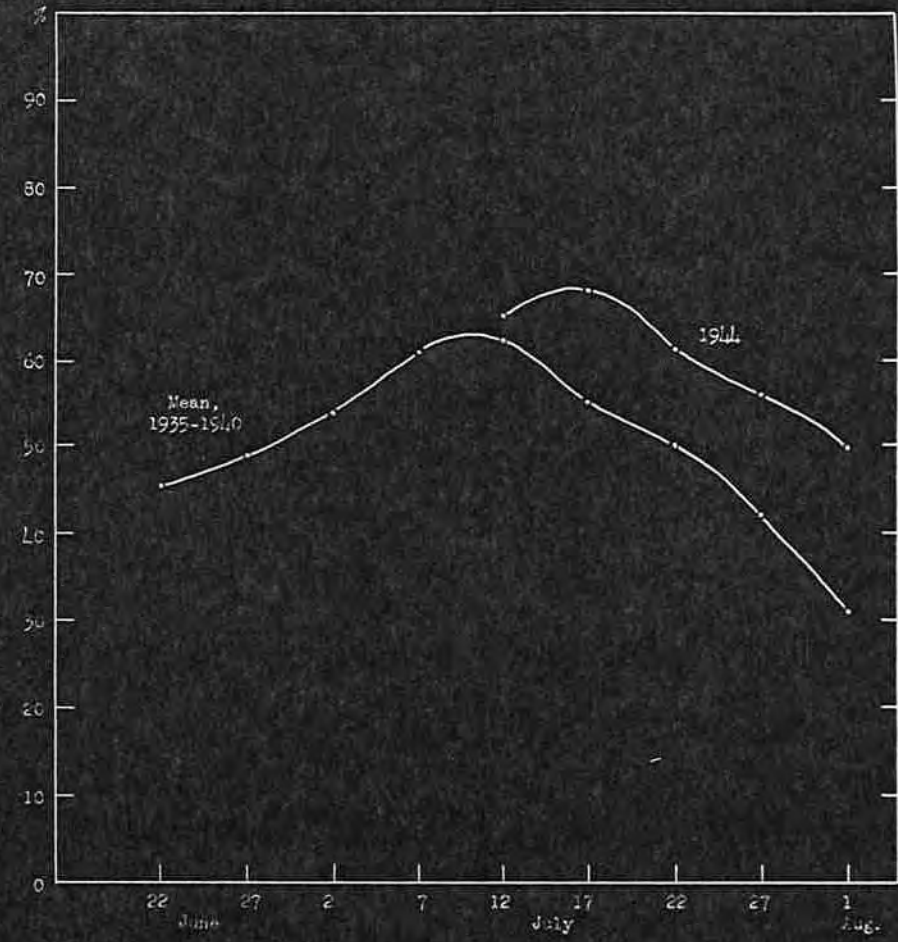
(Solid line total seals killed; dotted line seals rejected, during the 5-day period whose middle date is indicated.)



FUR SEALS KILLED DAILY BETWEEN JUNE 18 AND JULY 29, 1911, ON ST.PAUL ISLAND

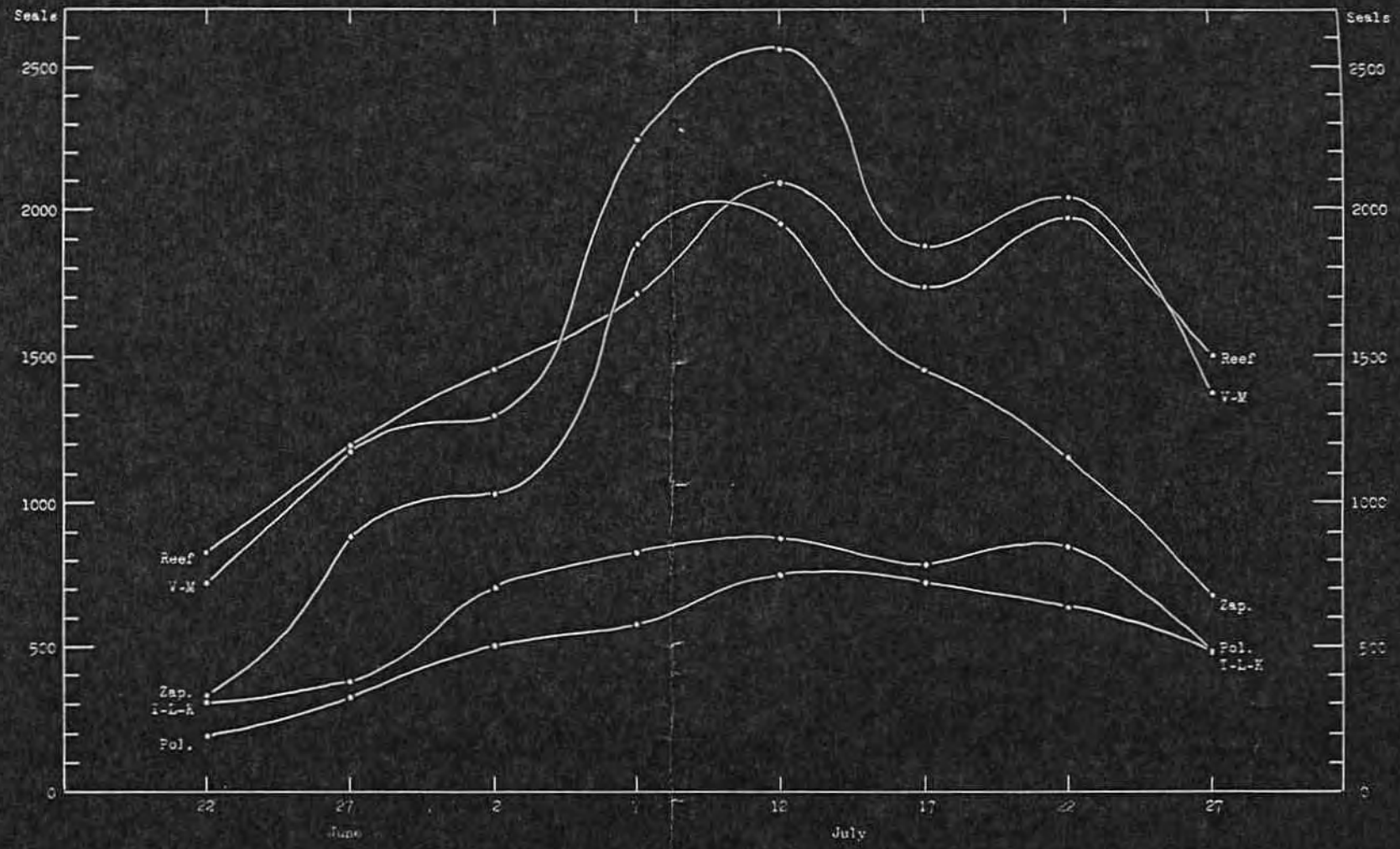
(Initials represent hauling-ground groups, as follows: Vostochni-Morjovi, Reef-Gorbatch, Tolstoi-Lukanin-Litovi, Polovina-Little Polovina-Polovina Cliffs, Zapadni-Little Zapadni.)





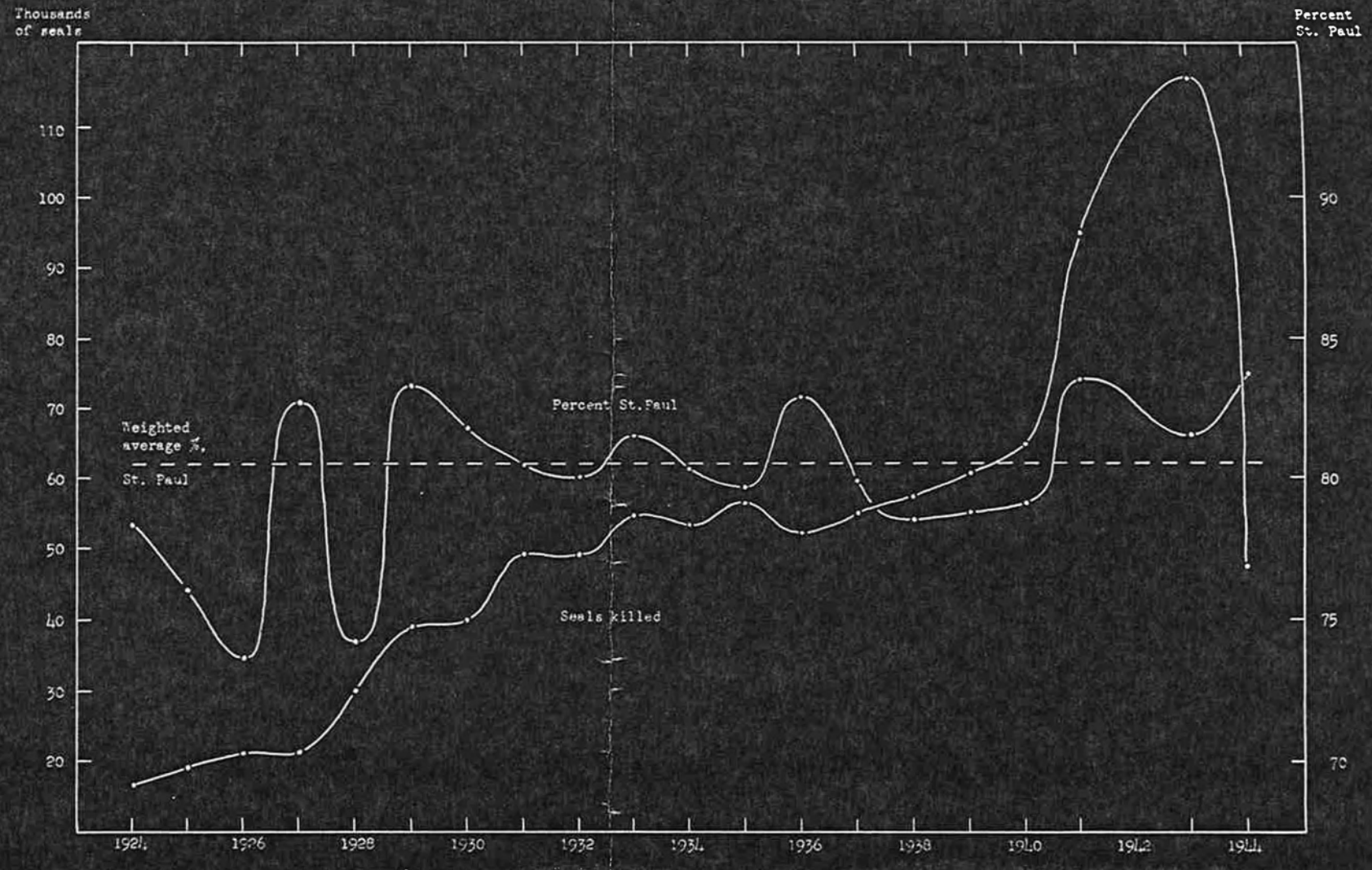
PERCENTAGE OF SEALS KILLED IN TOTAL DRIVEN, 1935-1940, AND 1944, ST. PAUL ISLAND

(Total driven equals females killed plus rejected. Each point represents the mean value of a 5-day round whose mid-date is shown.)



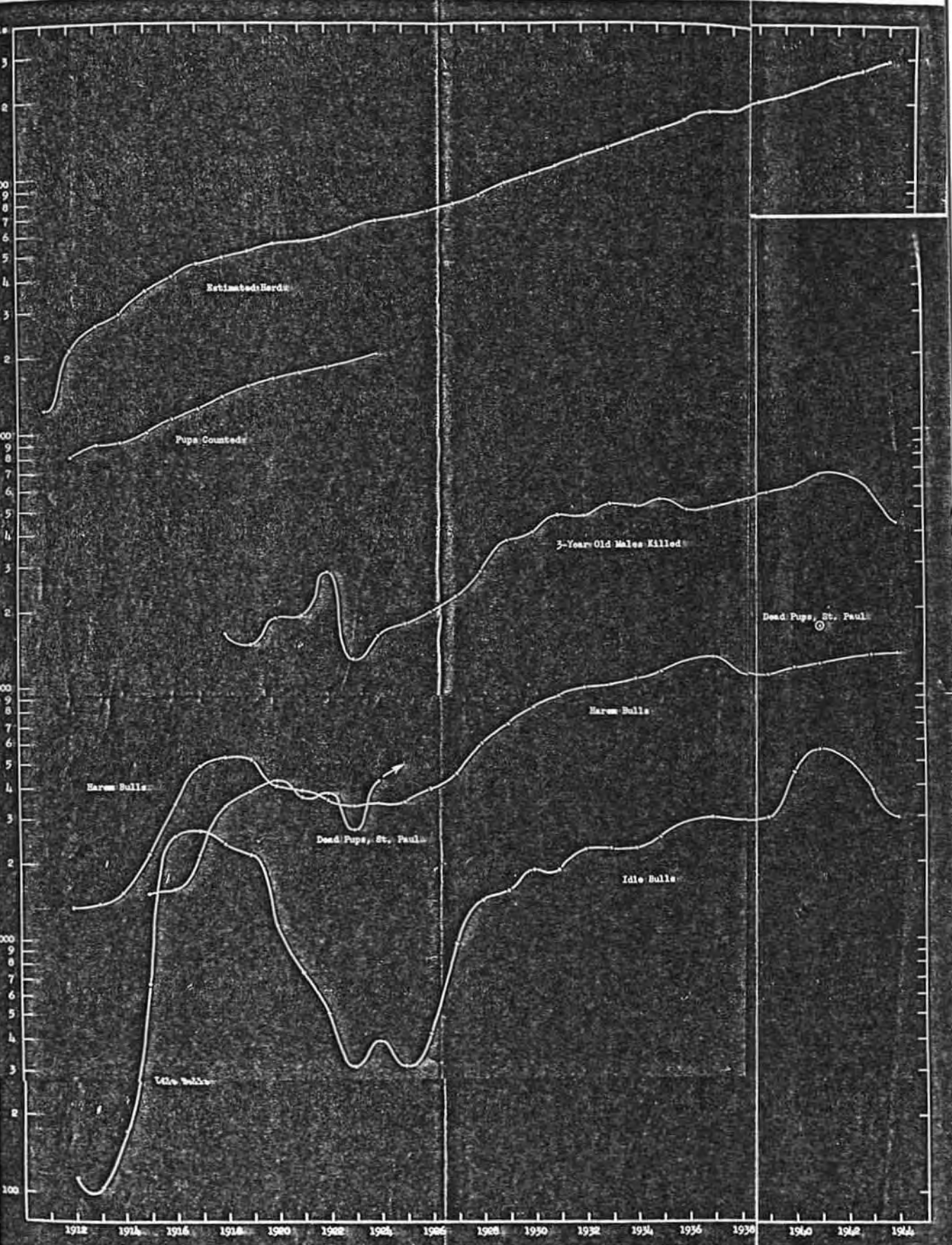
AVERAGE NUMBER OF SEALS HAULED ON EACH HAULING-GROUND GROUP, 1935-1940, ST. PAUL ISLAND

[Each date shown is the middle of a 5-day round; total period covered is June 2-July 29. Hauling-ground groups are: Reef-Gorbatch, Vostochni-Morjovi, Zapadni-Little Zapadni, Tolstoi-Lukanin-Kitovi, and Polovina-Little Polovina Polovina Cliffs.]



PERCENTAGE OF SEALS KILLED ON ST. PAUL ISLAND COMPARED WITH TOTAL KILL ON PRIBILOF ISLANDS

(In certain years, especially the earlier ones, the number of seals shown killed does not represent the total kill for the calendar year; seals having been dropped from the beginning or the end of the season in order to effect a fair comparison. There was no commercial kill in 1942 because of war.)



INCREASE OF FUR SEAL HERD (ESTIMATED) AND INCREASE OF CERTAIN CLASSES OF SEALS WITHIN THE HERD (COUNTED) FROM 1911 TO 1944, PRIBILOF ISLANDS

(Kills indicated for 1941 and 1943 are through July 31 only.)