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THE UNIVERSITY OF CHICAGO







THE  
FUR SEALS AND FUR-SEAL ISLANDS  
OF THE  
NORTH PACIFIC OCEAN.

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PART 2.

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PART II.

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OBSERVATIONS

ON THE

FUR SEALS OF THE PRIBILOF ISLANDS,

1872-1897,

AS EXTRACTED FROM THE LOG OF ST. PAUL ISLAND,  
AND AS RECORDED IN THE DAILY JOURNAL  
OF THE COMMISSION OF 1896 AND 1897.





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## INTRODUCTORY NOTE.

In the following pages we have grouped together the natural history facts of the fur seals as they have been observed during the past two seasons by the members of the commission and as they are recorded in the log of St. Paul Island.

During the past twenty-seven years it has been the custom of the agents in charge of the fur seal islands to set down in a daily log or journal a record of current happenings and of their observations upon the seals. Mingled with a vast amount of irrelevant matter are many facts which throw light on the past condition of the herd. These facts have been extracted and are here presented in condensed form.

From the voluminous record of St. Paul Island, consisting of some 2,500 closely written pages, the results are exceedingly meager. It is apparently by accident rather than by intention that the record has any value. As illustrative of its unsatisfactory nature we may cite the fact that the results of rookery inspections are regularly recorded in such phrases as these: "In a healthy condition," the "usual number of breeding seals present," "more" or "less" (as the case might be) "seals than in the preceding year," etc. The record in the latter case may have been kept by another person, or may contain no definite data at all.

The aim throughout has been to keep a record of the first arrival of the seals, but the record is a blank so far as their breeding habits are concerned. For the close of the season there are in many cases data fixing more or less definitely the departure of the seals. But here for the most part the record indicates that seals were present at a certain date, and we are left to guess when they actually disappeared. About all important matters there is this exasperating vagueness and uncertainty.

We probably have no right to complain of this record. The agents were doubtless not specially charged with this sort of work. They had no special training for it and its importance was not realized. But we may be pardoned for pointing out the fact that these men allowed to go to waste a most excellent opportunity to serve the interests of the Government. Had the record in the log of St. Paul Island been filled with the results of systematic observations of the rookeries, stated with some degree of mathematical exactness, it would to-day be a mine of valuable information regarding the past condition of the herd. The record of one year would have served as a guide to the next, and if this course had failed to bring an earlier recognition of the true condition of the herd, the record would at least enable us to-day to replace theory with positive proof in many matters of importance.

We call attention to this matter at the present time chiefly because it enforces what we have already had to say regarding the need of constant and systematic study of the fur-seal herd. From the time the fur-seal herd came into the possession of the

United States it should have been in charge of a competent guardian whose exclusive business it should have been to understand its condition and needs. It would then have received the attention which was so conspicuously lacking during its critical years.

Supplemental to this meager record of the log and in contrast with it is the journal of the commission itself for the seasons of 1896 and 1897. This gives a minute daily record of the observations and labors of the different investigators. It begins in 1896 with the 8th of July, or as the breeding season was just approaching its height, and ends with the 22d of October, a few weeks before the final departure of the seals from the islands. In 1897 the record begins with the first arrival of the breeding females and extends until September, thus covering in the two years practically the entire period of stay of the seals on the islands and giving a duplicate record for the period known as the height of the breeding season.

This record is published in full because it is the most important result of the work of investigation. It should furnish a valuable basis of comparison in subsequent investigations of the fur-seal herd.

DAVID S. JORDAN.  
GEORGE A. CLARK.

**LIST OF THE TREASURY AGENTS RESPONSIBLE FOR THE  
RECORD IN THE LOG OF THE ISLAND OF ST. PAUL.**

Charles Bryant, Mar. 31, 1872, to July 31, 1893.	A. P. Land, Aug. 2, 1886, to May 31, 1887.
Francis Lessen, Aug. 1, 1873, to Aug. 7, 1871.	G. R. Tingle, June 1, 1887, to Aug. 3, 1887.
Charles Bryant, Aug. 7, 1874, to Aug. 6, 1875.	J. P. Manchester, Aug. 4, 1887, to May 30, 1888.
William J. McIntyre, Aug. 6, 1875, to Nov. 1, 1875.	G. R. Tingle, May 30, 1888, to Aug. 11, 1888.
George Marston, Nov. 1, 1875, to Aug. 31, 1876.	J. P. Manchester, Aug. 15, 1888, to Aug. 12, 1889.
Charles Bryant, Sept. 1, 1876, to Dec. 31, 1876.	Charles J. Goff, Aug. 16, 1889, to Sept. 22, 1889.
J. M. Morton, May 15 to July 13, 1877.	G. R. Nettleton, Sept. 23, 1889, to Aug. 6, 1890.
J. H. Moulton, July 14, 1877, to Apr. 30, 1878.	Joseph Murray, Aug. 6, 1890, to Aug. 13, 1891.
J. M. Morton, Apr. 30, 1878, to Aug. 13, 1878.	Milton Barnes, Aug. 13, 1891, to June 9, 1892.
J. H. Moulton, Aug. 14, 1878, to May 27, 1879.	Joseph Murray, June 9, 1892, to Aug. 31, 1892.
J. W. Beaman, May 27, 1879, to July 16, 1879.	D. J. Ainsworth, Aug. 31, 1892, to June 10, 1893.
H. G. Otis, July 16, 1879, to July 29, 1879.	Joseph Murray, June 11 to June 19, 1893.
J. W. Beaman, July 29, 1879, to May 31, 1880.	J. B. Crowley, June 20, 1893, to June 26, 1893.
H. G. Otis, May 31, 1880, to July 29, 1881.	T. E. Adams, June 27, 1893, to June 29, 1894.
J. H. Moulton, July 29, 1881, to July 28, 1882.	James Judge, June 29, 1894, to Sept. 14, 1895.
H. A. Glidden, July 28, 1882, to June 3, 1885.	T. E. Adams, Sept. 14, 1895, to July 13, 1896. <sup>1</sup>
G. R. Tingle, June 3, 1885, to Aug. 2, 1886.	J. B. Crowley, Oct. 21, 1896, to June 12, 1897.

<sup>1</sup> The time intervening between the 13th of July and 21st of October, 1896, is covered by the Journal of Fur Seal Commission.



EXTRACTS FROM THE LOG OF ST. PAUL ISLAND, 1872-1896.<sup>1</sup>

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1872.

RECORD KEPT BY CHARLES BRYANT.

May 5.—The seals landed on the Reef to-day.

May 13.—A few fur seals and sea lions are reported from Northeast Point: the first of the season.

May 14.—First drive of seals made for food; 227 killed.

May 16.—A visit to Lukanin and Kitovi rookeries showed a few sea bulls hauled up. There is little snow or ice on the shores.

May 19.—Bulls are hauling out in small numbers on Reef rookery. A number of small males are on the point.

May 20.—Seals began landing on Na Spil rookery.

May 21.—Permission was given to shoot a sea lion sleeping on the point of the Reef. Although the shooting occurred within 200 feet of the seals they paid no attention to the report.

May 25.—Large numbers of beach masters are landing at Northeast Point, with few bachelors as yet.

May 26.—The number of beach masters on Tolstoi rookery compares favorably with that of former years, but of killable seals there are few.

May 27.—On Southwest Bay, English Bay, and Tolstoi a great number of beach masters are hauled up: but there are few young seals on the hauling grounds.

May 31.—On Lukanin, Tolstoi, Kitovi, and Reef the beach masters landed compare favorably in number with those of former years; but the number of young killable males is small in proportion.

June 1.—The first regular drive of the killing season was made from the Reef to-day; 752 were killed.

June 7.—Few seals suitable for driving are reported from the Southwest and English bays.

June 8.—Few seals are reported on Otter Island; on Northeast and Halfway points are an unusual number of beach masters, but very few killable seals.

June 16.—Beach masters are unusually numerous on the Reef, and cubs coming rapidly. Several young pups are already to be seen.

June 23.—A visit to the rookeries shows an unusually large number of old bulls and many females landing; many young pups, also.

July 7.—Visit to the rookeries westward shows the breeding grounds well filled, but the hauling grounds nearly cleared of killable seals.

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<sup>1</sup> Condensed from the original record, with notes, by George A. Clark.

July 13.—Killed 2,319 seals<sup>1</sup> from English Bay. Two females were killed for scientific purposes. One, a cow 4 years old, with her first pup,<sup>2</sup> weight 51½ pounds; the other, a very old cow which had bred many times, weight 103 pounds. The first measured 6 feet 8 inches; the other 7 feet 6 inches—a very large specimen.<sup>3</sup>

July 22.—A visit to the Reef showed many seals in the center of the peninsula.

July 24.—A small drive from Zoltoi yielded 628 skins, and a herd from English Bay, 2,070, making a total for the year of 70,253 skins.

October 2.—A herd of old bulls were driven and killed for blubber for winter use.

October 28.—(Sealing for quota resumed.<sup>4</sup>) Natives drive seals for the company from English Bay, securing 1,255 skins.

October 30.—Seals of killable size having left the rookeries near the village, the natives were sent to Northeast Point to try to get enough to make out the season's quota.

October 31.—A herd of young pups were killed for winter food, 1,250 in all; 70 to a native family.

December 6.—A food drive of 426 was made from Zoltoi. This completes the supply of winter food.

December 16.—Many fur seals are reported at Northeast Point.

### 1873.

February 26.—A party of hunters killed a bull seal at Tolstoi.

April 24.—A bull seal was seen in the open water off the Reef, the first this season.

May 9.—One seal is reported hauled out on the shore at Southwest Bay.

May 10.—A bull seal hauled for an hour on the lagoon and then went into the water again.

May 11.—Three seals are reported hauled up at Gorbatch; two or three bachelors are in the water off the point of the Reef. One seal was seen in the water at Lukanin. The shores there are obstructed with ice and snow.

May 13.—A few seals are hauled on all the rookeries.

May 15.—A few seals are landed at different places on the Reef and about 20 bulls and bachelors are on the point.

May 16.—The shores at Southwest Bay and Tolstoi are reported obstructed with ice, and few seals landing.

May 17.—About 50 beach masters have hauled at different points on the Reef; and 30 seals, partly bachelors, are gathered on the point.

May 20.—On the Reef the seals were found increased considerably, being about as numerous as ten days earlier last year. Zapadni is tolerably free from snow, and quite a number of seals are hauled out. English Bay and Tolstoi are still very much encumbered by snowdrifts along the water's edge, and but few seals have landed.

<sup>1</sup> Most of the drives at this time are noted as made in the afternoon, the seals being herded up over night and the killing occurring next day. It is noted occasionally that on account of the heat killing has had to be postponed until evening, etc.

<sup>2</sup> Either the age of the cow or the fact of its being her first pup is at fault. The cow has her first pup at the age of 3 years.

<sup>3</sup> These figures are manifestly incorrect. The length of the female averages about 4 feet.

<sup>4</sup> In the terms of the original lease June, July, September, and October were designated as the months during which seals were to be killed by the lessees.

May 23.—The first food drive of the season was made to-day, killing 193. The killing was made at Zapadni, the meat being brought home in the bidara.

June 3.—The first regular drive for skins was made from Zoltoi and Reef, 813 taken; 7 seals suffered from overheating in driving.

June 7.—It is reported from Northeast Point that many beach masters are hauled out, but few killable seals.

June 8.—The shores where seals breed are fast becoming free from snow, and no obstruction occurs to landing. Seals are beginning to haul rapidly at Zoltoi and other points. The first female landed at Gorbateh to-day, and the same report is given of Southwest Bay.

June 11.—A drive from Southwest Bay yielded 2,597 skins; 152 skins were spoiled on account of overheating of the seals.

June 17.—Snow fell in the night and drove the seals from the shores in large numbers.

June 25.—A visit to Reef rookery shows the conditions very favorable as compared with last year; females are landed in equal numbers, and many already have pups.

July 23.—Four hundred and forty-six seals were killed to-day, enough to fill out the season's quota.

#### RECORD KEPT BY FRANCIS LESSEN.

August 12.—On Reef rookery it was found that some of this year's pups had already learned to swim.

August 14.—Off Tolstoi and English Bay a mass of pups were learning to swim, and the water was full of seals.

August 20.—At Northeast Point the females and their pups were very thick on shore, as well as in the water. Comparatively few bull seals were seen, but many half bulls. The two latter classes are supposed to go out feeding about this time.

September 9.—Ten or fifteen seals are reported dead at Northeast Point, cut about the chest and back; supposed to have been killed by "killers."

September 18.—On Otter Island about 2,000 seals were found, but no actual rookery, because no pups were seen. It is evidently only a hauling ground for bachelors and old bulls.

October 21.—An inspection of all the near rookeries showed the old seals commencing to leave.

November 2.—Seals are reported to be diminishing at Northeast Point.

November 3.—Young pups were driven and killed for food; the sexes were separated just back of Kitovi rookery, the females allowed to remain and the males driven up to the village; 879 were killed.

November 24.—The chief reports a gradual diminution of the seals on the rookeries of Northeast and Halfway points.

December 7.—On the Reef were noticed in four different places about 2,000 seals.

December 15.—The seals have left Kitovi, Lukanin, and Polovina rookeries; but they still remain on both sides of the Reef.

December 28.—On the Reef are still about 1,000 seals.

1874.

January 20.—Seals are reported in two places at Southwest Bay; 100 in one and 25 in the other.

January 31.—About 1,000 seals are reported at Northeast Point on the north side; none were females, pups, or bulls; all were bachelors. Many seals were in the water. It is a surprisingly mild winter.

February 10.<sup>1</sup>—Natives at Northeast Point report seals on the beach and in the water.

February 21.—A few seals are in the water at Northeast Point; 6 on shore, seemingly very shy, smelling the rocks, and returning soon to the water.

March 1.—The chief reports seeing about 12 middle-class<sup>2</sup> seals in the water and on the beach at Zapadni; no bulls have been seen since the beginning of January. The middle class seals have not left the island this winter—something not remembered to have occurred before by even the oldest people.

March 5.—About 30 seals are reported, some in the water, some on land, at Northeast Point. A single seal is on the beach at Polovina.

March 19.—Four middle-class seals are reported present on Zapadni, Tolstoi, and English Bay rookeries.

March 27.—Natives at Northeast Point report 10 middle-class seals in the water and on the beach near Hutchinson Hill.

April 1.—The chief reports 5 seals in the water at Southwest Bay; no bulls are seen as yet.

April 10.—The first large half-bull seal was seen in the water to-day at Tolstoi.

April 19.—The first landing of bull seals was noted on Southwest Bay. This seems to be three weeks earlier than last year.

April 23.—One bull reported landed on south side of the Reef to-day.

May 1.—Two bulls have landed on Gorbateh, and several middle-sized seals are in the water.

May 3.—The first bull of the season landed on Lagoon rookery to-day.

May 4.—The chief reports from Southwest Bay a few seals landed on all of the western<sup>3</sup> rookeries, especially on Zapadni, where about 200 middle-sized seals and 20 bulls are out.

May 7.—Natives returning from Northeast Point report about 1,000 middle-sized seals on those rookeries, but only two bulls landed. Two bulls were seen at Polovina.

May 10.—About 1,000 middle-sized seals reported in two places on Zapadni, and a large number of bulls.

May 19.—(Notes from official instructions): 1. The number of fur seals from St. Paul shall hereafter be 90,000, and from St. George 10,000. 2. The time for taking seals shall extend from June 1 to August 15, and through September and October of the same year.

May 23.—The western rookeries are reported in good condition, especially Zapadni, where there are a large number of bulls and about 1,000 middle-class seals hauled up. The general condition on the rookeries is about fourteen days earlier than last year.

<sup>1</sup> The bachelor seals probably did not leave the vicinity of the islands this winter at all.

<sup>2</sup> This term probably means bachelors of three and four years' age.

<sup>3</sup> Zapadni and Tolstoi.



May 31.—On Lukanin and Kitovi there are but few middle-sized seals.

June 3.—At the first regular drive to-day from Southwest Bay 2,395 were killed, and at a second drive from the Reef 538 were killed.

June 11.—On the Reef and Gorbach the females have commenced to arrive in large numbers. Some already have their pups.

June 12.—The sun came out hot at the killing to-day, and in order to save the skins the seals were driven into the lagoon to cool off. This proved to be a good move and saved many skins from spoiling.

June 20.—The number of seals taken this week was 17,173, and is probably the largest ever taken on this island in a single week. The condition of all the rookeries is favorable, many females and killable seals are arriving, and the prospects for a good sealing are favorable.

June 26.—A drive was made to-day from Kitovi and Lukanin. The former is a small rookery.<sup>1</sup> About 500 seals were obtained from it, and double the number from Lukanin.

July 4.—The drives made this morning both turned out badly. One of the mules ran near Lukanin rookery and scared the seals, while the sheep did the same thing on Zoltoi.

July 7. About the same number of seals as last year are on the breeding grounds of Northeast Point. Killable seals are not so numerous. Webster says that the bachelors have taken to hauling out at a new place about 2 miles away, near the big lake.

July 16.—Elliott and Maynard arrive. They visit Otter Island, seeing about 5,000 bachelors, but no breeding seals.

July 17.—A drive is made from Lukanin, and 533 seals killed. This completes quota for this season, 89,993 seals. Only 130 of the 720 skins cut were rejected. This proportion of loss is exceedingly small.

July 29.—A walk about the rookeries shows the arrival of many of last year's pups, and the spreading of the seals on the upland; some of this year's pups are beginning to learn to swim in small pools near the water's edge.

August 6.—The total shipment of skins for this year from Northeast Point was 34,516.

#### RECORD KEPT BY CHARLES BRYANT.

August 16.—The seals on the upland of the Reef are quite numerous, both females and young. The young show senry from the mud and rain. There is almost an entire absence of 3 and 4 year olds.

August 17.—A drive for food was made from Zoltoi and 131 killed. About 800 seals were driven in, but only the above small number were 2-year-olds. There is but slight indication of shedding.

August 18.—Went to Sea Lion (Sivutch) Rock, and found many seals and sea lions hauled out.

September 9.—Seals in considerable numbers are to be seen at English Bay; at Zapadni not so many as usual are visible, and there is a scarcity of half-grown seals on all the rookeries.

<sup>1</sup>Mr. Elliott reported 165,000 "breeding seals and young" for Kitovi rookery at this time.



September 27.—Lukanin rookery is full of females and pups; but there are only about 200 bachelors, a great decrease over former years.

October 18.—Females and young seals are to be found in numbers on the uplands of Reef rookery.

October 19.—The seals having left Zoltoi, it was necessary to go to the Reef for a drive for food; 176 seals were killed, of which 57 were stagy.

November 13.—A drive of 87 more pups was made from Gorbatch, making a total of 4,897 pups for the winter food supply.

December 11.—A large number of seals suitable for killing reported on the point of the Reef. Many sea lions on Sea Lion (Sivutch) Rock.

### 1875.

January 19.—A few seals are on the rocks, and several groups in the water, about a thousand in all, between Tolstoi and English Bay.

January 20.—The rookeries of Northeast Point show small groups of seals on the rocks and in the water, about 600 or 700 in all.

February 10.—Several small groups of seals are reported on the shore and in the water at Northeast Point. Many sea lions also; the stomachs of two killed contained recently taken codfish.<sup>1</sup>

February 15.—Men were sent to Northeast Point to kill some of the seals to determine whether and on what they had been feeding. The contents of the stomachs of six was too far decomposed to permit of identification, beyond the fact that kelp or sea cabbage was present.<sup>2</sup>

February 18.—An inspection of the Reef showed but one seal; several heads were found showing where someone had recently killed seals and carried their bodies away.

February 20.—There are no seals on Lukanin. The carcasses of about 70 pups were found, that had evidently been killed in November by stealth with a view of secreting their meat.<sup>3</sup>

March 17.—Fifty or 60 seals are reported at Northeast Point; 16 were killed for fresh meat, the winter supply of seal meat having spoiled on account of warm weather.

March 31.—Two fur seals are reported off the Reef.

April 5.—No seals are in sight on the Reef, though it is time for them to arrive.

April 11.—Two seals are reported in the water at Zapadni.

April 15.—Fifty seals were seen in the water off the Reef, showing no disposition to land. One old bull reconnoitered the shore from the point to Gorbatch and back deliberately and then returned to the group playing in the water off the Point.

April 20.—Two polosikatchi, or half bull seals, are reported on the rocks at Tolstoi Point.

April 22.—Quite a number of seals are in the water about the Reef, but none attempting to land.

May 2.—Three bulls and 200 bachelors hauled out at Southwest Bay; 2 bulls at Tolstoi, 1 at Lukanin.

<sup>1</sup> Probably pollack.

<sup>2</sup> This is probably a mistake, or if the kelp were present, that it was swallowed by accident.

<sup>3</sup> Probably the bodies of pups, killed in the drives for food in the fall, which had not been removed. See record under date of November 1, 3, and 6, 1879.

May 6.—A food drive from Southwest Bay of 600 or 700 animals was made; 6 seals killed on the ground were brought home in the bidara; the others were driven slowly to the village.

May 10.—On the Reef about 20 bulls are hauled out; a few bulls are reported at Northeast Point and on other rookeries.

May 16.—On the Reef, about 100 bulls are hauled out; also a small body of holostiaki. In the afternoon 60 bulls were found on Lukanin; several hundred seals are reported at Zapadni, English Bay, and Tolstoi.

June 1.—The first regular drive of the season was made to-day from Tolstoi and Zapadni: Tolstoi furnished 203, Zapadni 1,201.

June 3.—Bulls are plentiful on the Reef, but the killable seals few; the same condition exists at Lukauin.

June 7.—Two females have landed at Gorbateh, the first of the season.

June 10.—An inspection of Lukanin and Reef rookeries showed the conditions to be less favorable than in former years: the bulls are not up to the former standard. The reserves are wholly wanting,<sup>1</sup> except on the upper part of the Reef, and there are very few holostiaki. The number of females is about equal to former years, and at Gorbateh are two young pups, apparently 2 days old.

June 20.—On Tolstoi the bulls were found occupying the breeding grounds in full numbers, while the reserves<sup>2</sup> were more limited; several small groups of females had landed, and a considerable number of holostiaki are hauled out on Tolstoi and English Bay beaches. On Lukanin the same conditions exist, except that there are fewer bachelors.

June 23.—Complaint having been made that women gathering wood at Southwest Bay disturbed the seals, orders were given to keep away from the hauling grounds.

June 26.—A drive from Zapadni yielded 3,943 skins. Eleven skins were lost from overheating of the seals on the drive.

June 28.—An examination of the Reef shows that the breeding places are fully occupied by the bulls, while the reserves are less than in former years. Lukanin rookery shows the same conditions.

July 6.—The rookeries of Northeast Point show a full stock of breeding bulls but a scarcity of reserves on the upland. The number of females indicates either a later hauling or diminished numbers, while the stock of young breeding bulls to mature for the next two years is very small; in fact, below the number necessary for the insurance of the full supply needed. Yearling seals are arriving in full numbers, compared with former years.

July 10.—A drive from Lukanin yielded 1,108. This drive shows that about half the seals now on the rookeries are yearlings or small 2-year-olds. (It was noted in connection with the drive of July 8, in an erasure, that the number of seals killed was 50 per cent of the drive.) An examination of the rookery showed it to be well filled with females. A less number of beach masters were with them than formerly; while the reserves of old males on the uplands and the half bulls along the shore appear

<sup>1</sup> The observations of the season of 1897 show this to be natural; the idle and reserve bulls, as a class, do not arrive until later.

<sup>2</sup> Compare record under date of June 10.

considerably less than formerly, and apparently less than sufficient.<sup>1</sup> The 1 and 2 year olds are fully represented.

July 16.—The sealing season is practically over; the remaining skins will be taken for food.

July 23.—The schooner *San Diego* was captured off Otter Island by the Treasury agent in a whaleboat. She had 1,660 skins and 15 tons of salt on board.

July 25.—the Reef was thoroughly examined, and the bulls on the breeding ground were found diminished<sup>2</sup> on account of heat and exhaustion. The reserves had nearly all gone to take their places. The show of half bulls is less than on former years. Most of the females are absent, partly from effect of bright sunshine, but the number of pups affords ample evidence of the regular annual increase, though the average time of the landing of cows this year has been about ten days later than former years. There is a full number of 1 and 2 year olds present, but of the 3-year-olds<sup>3</sup> and 5-year-olds there is a decrease on former years. All the indications are that more have been killed than should have been and allow a sufficient number to escape to make a full supply of breeding males.<sup>4</sup>

August 4.—The Reef rookeries are broken up and many seals of all classes are on the upland. The bulls have mostly left the breeding grounds. A full supply of 1 and 2 year olds, but a scarcity of 3, 4,<sup>5</sup> and 5 year olds.

August 6.—Zapadni rookery is in a good condition, showing a fair proportion of killable seals.<sup>6</sup> Lukanin rookery is in a fair condition as compared with former years.

#### RECORD KEPT BY WILLIAM J. McINTYRE.

August 10.—Owing to the heat few killable seals and females are on Lukanin and Kitovi rookeries.

August 11.—The seals on Reef rookery are reported in diminished numbers, due to heat.

August 21.—Two albino pups were brought from Zapadni. The bodies were a rich cream color, the eyes and flippers pink, but in every other respect they were like the ordinary pup.

August 24.—Tolstoi, Holm (Middle Hill), and Zapadni rookeries are lessening in population; few bulls are present.

August 30.—The hauling ground of Otter Island was found to contain 1,500 bachelors. There is no rookery on the island. The island is 4,000 feet long with a

<sup>1</sup>If there was an actual scarcity, which the history of the succeeding years does not bear out, it is traceable to the effects of the close killing of 1868, when practically all males were taken. We can not, however, accept as more than mere opinions these statements regarding the scarcity of males. If definite figures had been given it would be different.

<sup>2</sup>This is a regular phenomenon of the breeding grounds. After July 25 the old bulls begin to withdraw and the idle and young bulls enter the breeding grounds. It will be noted here that there are reserve bulls to take the places of the regular beach masters.

<sup>3</sup>The scarcity of 3-year-olds is not unnatural after the quota of 100,000 has been taken.

<sup>4</sup>See same record for 1896, and compare with that of 1877 showing proportion of bulls rejected in the drives. From the irregular and uncertain movements of the bachelors it is plain that no definite determination of their relative condition from year to year can be made. Their movements are governed largely by the state of the weather. The subsequent record shows no dearth of breeding males when the reserves of this year came to enter the rookeries in 1880.

<sup>5</sup>See note 2 under date of July 25.

<sup>6</sup>Compare statement under date of August 4.

mean width of 1,200 feet, equal to 105½ acres. The westward cliffs are bold, attaining a height of 350 feet.

October 21.—A large school of “killers” was observed near East Landing.

#### RECORD KEPT BY GEORGE MARSTON.

November 6.—The natives were informed that the number of pups to be killed for food would have to be cut down to 3,000, as it had been too large. This was objected to, and a compromise placed the number at 3,800.

November 11.—The total of pups killed for the year was 3,745.

November 16.—A drive of seals for food was made from Tolstoi, where they were found in good numbers. A number of old bulls got into the drive.<sup>1</sup>

November 21.—There are a good number of seals on Reef rookery; a few old bulls.

November 27.—A visit to Lukanin showed but a few seals there.

November 30.—The seals have gone from the Reef.

December 29.—Natives returning from Northeast Point report 2,000 seals still there.

#### 1876.

January 15.—Seals were seen to-day in the water off East Landing.

March 12.<sup>2</sup>—Four or 5 seals were reported in the water off North Shore.

April 27.—The native chief reports 2 seals in the water off the Reef.

March 3.—The chief reports 2 old bulls hauled out at the Reef this morning, the first seen this season.

May 5.—While walking about the Reef 13 old bulls were seen—8 hauled out and 5 in the water.

May 17.—The first bull came on Na Spil rookery to-day. Quite a number of old bulls are on the different rookeries. They begin growling and snapping at each other, “acting as if at home.”

June 1.—On the Reef are a goodly number of bulls, but few holostiaki. The rookery appears now about the same as it did last year ten days earlier.

June 2.—About 500 holostiaki have hauled out at Southwest Bay and many old bulls are on the rookery.

June 3.—First drive for skins from Southwest Bay; 836 animals were killed.

June 4.—Captain Bryant, after a visit to all the rookeries, concludes they are just about ten days later than last year.

June 5.—The first female of the season came to Na Spil to-day; the old bulls had a hard fight for her.

June 6.—A drive was made from the Reef and 673 seals killed. From the above drive 80 were turned back, some able-bodied males, some that will be able for duty in a year or two,<sup>3</sup> and some yearlings too small.

June 14.—Captain Bryant made a visit to the Reef and found about 200 bachelors on the point, 100 on the south side, and some 200 on Zoltoi. Five females were lauded in the bight on Gorbateh. About 20 per cent less bulls are on the breeding grounds than at the same date last year. In the afternoon a visit was made to Kitovi and

<sup>1</sup> In this note we have proof of the return of the old bulls after feeding.

<sup>2</sup> Evidently the bachelor seals have not left the vicinity of the islands this winter.

<sup>3</sup> See reference to scarcity of reserves in preceding year, July 10 and 25.



Lukanin and but few bachelors were found. Thirty per cent<sup>1</sup> less bulls are present than were out at this time last year.

June 23.—Captain Bryant found quite a number of females on Tolstoi and many 1 and 2 year old seals along the different rookeries about the bay. He thought there was a lack of bulls.

June 25.—A party of natives were sent to drive off the seals on Otter Island. About 5,000 were driven off. On the 18th 2,000 were driven off.

June 26.—A drive from Zoltoi gave 862 seals. A raid was made to-day on Otter Island; 370 seals were killed.

July 10.—A drive from Tolstoi yielded 2,039 seals. Several schooners are shooting seals about the island.<sup>2</sup>

July 29.—A drive from Zoltoi gave 1,040 skins. The average of seals killed to the whole drive was 12 per cent,<sup>3</sup> the others being mostly yearlings.

August 1.—A drive of seals from Lukanin gave 1,538 good skins; the drive was large, but only 7 per cent of them were fit to kill, the greater part being last year's pups.

August 2.—The drive from Tolstoi and Middle Hill yielded 2,139 seals. This drive was much better than yesterday's, yielding 40 per cent.<sup>4</sup> Sealing was closed for the season.

August 17.—A drive for food was made from Kitovi and 134 killed; 5 stagy. A large number of females were found hauled with the bachelors.

August 23.—A drive for food from Kitovi yielded 207 good and 7 stagy skins. About 25 per cent of the drive was over one year old and no females were mixed in.

#### RECORD KEPT BY CHARLES BRYANT.

September 10.—A visit to Reef and Lukanin showed a large number of seals, mostly pups and yearlings. The pups seem to be twenty days to one month behind last year and to have suffered from the bad weather of the past month.

October 7.—At a drive for food from Zoltoi, 133 seals were killed, all stagy. Examination of the rookeries shows that the pups are hovering on the uplands; a large number have not yet begun to shed their pup hair.<sup>5</sup> There are very few bulls on the shores and those mostly yearlings.

October 14.—A visit to the Reef showed pups in good numbers on the uplands. They seem smaller in size for this time of year than they should be, and backward about shedding their first hair. Few females are on the shore. Only a few holostiaki are on the lower end of the Reef.

<sup>1</sup>These references to reduction of bulls can only be conjectures. They doubtless form a continuation of the conditions depicted by Captain Bryant the year preceding. See notes date of July 10, 25, etc., 1875, and record for 1877 ff.

<sup>2</sup>It is evident from this that irregular pelagic sealing was carried on prior to 1883 in Bering Sea.

<sup>3</sup>This must be an error, as the drive would under these circumstances have numbered 8,600. In the note of August 1 a similar but more striking error occurs, since the average of seals killed would make the drive number 21,900 seals, which would be impossible.

<sup>4</sup>The reference here and under date of August 23 would seem to indicate the appearance of fresh seals, making it likely that the earlier scarcity of these seals was due to temporary causes.

<sup>5</sup>The natives are said to have reported that the sea birds they shot late in November were late also in shedding their feathers. That many black pups should be found at this time is not strange. Such pups were to be seen after the middle of October in 1896. They merely represent belated births.



October 31.—A drive for food from Tolstoi gave 163 seals, all stagy. The drive contained a good proportion of 5 and 6 year olds<sup>1</sup> with a few females.

November 12.—It took the sea-lion drive six days to come down from Northeast Point; 188 were killed.

November 15.—Pups were driven from Kitovi and Lukanin for food; only 400 were obtained. The earlier-born pups have left the island.

November 16.—Pups were driven from the south side of the Reef and 1,172 taken.

November 17.—Another drive from the Reef gave 1,172.

November 19.—The Reef was redriven<sup>2</sup> and 706 were obtained. These must have come ashore since the former drives.

November 22.—An attempt to drive pups from Tolstoi failed on account of their having left. Reports from Zapadni show a few young seals there. Females without pups are on the shore and quite a number of bachelors are on the hauling ground of Tolstoi.

November 23.—Men were sent to Zapadni to drive pups, but they were all gone and holostiaki had to be driven instead. This is the first time since the transfer of the islands to the United States that there has been difficulty in getting the young seals, there usually being considerable numbers late in December.<sup>3</sup> The theory of the natives is that the greater mass of young seals (pups) were driven into the water during the severe snowstorm and gale on the 30th of October, and that they were unable to find the shore again and had gone away, while their mothers, being stronger and better able, returned to the shore without them.<sup>4</sup>

November 29.—A visit to the Reef shows that most of the females have gone and that there are only a few bachelors on the point.

December 2.—Reports from Northeast Point show very few seals there. It is plain that the seals have left the island about a month earlier than usual.<sup>5</sup>

December 9.—A visit to Tolstoi discloses the fact that there are 200 or 300 seals hauled up there.

December 13.—A food drive is made from Tolstoi; 825 are taken; a few are stagy. The entire drove contained about 5 per cent of half bulls,<sup>6</sup> 50 per cent of 2, 3, and 4 year olds, and the remainder yearlings. An examination of Reef rookery shows a few seals in the water, but none on shore; a few hundred are on Sea Lion Roek. Reports from Northeast Point and other rookeries show that the seals have nearly all left the island.

December 21.<sup>7</sup>—A few seals are reported at Northeast Point.

<sup>1</sup> See reference to scarcity of young bulls under earlier dates for the year.

<sup>2</sup> This and the two preceding entries are interesting as showing the effect of disturbance on the rookeries.

<sup>3</sup> The records of other years show that it was usual for the pups to leave with their mothers in the first half of November. It is therefore not strange that they should be wanting in the latter part of November.

<sup>4</sup> Captain Bryant observes, in this connection, that Kitovi and Lukanin rookeries would ordinarily have furnished the required 4,000 or 5,000 pups—male pups, of course. This gives some index to the size of the rookeries then, their yield being about 10,000 pups. Captain Bryant remarks also that we may expect a larger proportion of the pups to be lost at sea. The thought seems never to have occurred to him that the slaughter of the pups so earnestly sought for food tended to still further diminish them. As a matter of fact no scarcity of killable seals was noted from this cause in 1879, when the quota must have been made up of these pups.

<sup>5</sup> See later entries in the log showing the return of the seals.

<sup>6</sup> See earlier notes on scarcity of young bulls.

<sup>7</sup> No further record is made in the Journal until May 15.

1877.

## RECORD KEPT BY J. M. MORTON.

May 16.—No bachelor seals are to be seen on the rookeries; 2 sea lions are on Sea Lion Rock.

May 17.—The first seal appears at Village Hill (Spilki) rookery.

May 21.—The chief reports about 60 bachelor seals at Reef Point.

May 22.—Two bulls land at Village Hill (Spilki) rookery; a drive of 329 seals is made from the Reef for food.

May 23.—Natives return from Otter Island and report no seals.

May 29.—Northeast Point shows 60 young seals hauled out; 31 sea lions are driven; the sea lion cows are beginning to give birth to the pups.

May 30.—Several hundred young seals are hauled out at Halfway Point.

May 31.—About 300 young seals are at Reef Point.

June 3.—Apparently about 800 young seals are at Southwest Bay.

June 4.—Of the animals driven to day, 14½ per cent were allowed to escape, being undersized; 5 per cent<sup>1</sup> were 5 and 6 year animals.

June 5.—The drive to-day consisted mainly of 3 and 4 year olds; 6 per cent were allowed to escape, being 5 and 6 year animals; 9½ per cent were small.

June 6.—Many "killers" were seen to-day, and several seals bear evidence of having been attacked by them.

June 7.—No young seals are on the Reef and a scarcity of this class is reported at Northeast Point.

June 9.—Of the seals driven to-day 15 per cent, large and small, were allowed to return to the water. Nine females are seen at Lukanin, being the first reported this year.

June 11.—A house is being built on Otter Island as a residence for a lieutenant and two sailors, who are to guard that island.<sup>2</sup>

June 12.—Of animals driven to-day about 20 per cent were too small, and allowed to return to the water; of the rejected 7 per cent were of 5 years and upward.

## RECORD KEPT BY J. H. MOULTON.

June 13.—Of the animals driven to-day most were 3, 4 and 5 year olds: about 30 per cent were allowed to escape, 12 to 20 per cent being aged 5 years and upward.

June 14.—Of the drive to-day 20 per cent were undersized; 10 per cent were of 5 years and upward.<sup>3</sup>

July 29.—The young seals (pups) are hauling out by themselves: the cows are off in the water.

August 4.—The skins from Northeast Point (20,348) were shipped to-day. The total from St. Paul for the year is 60,526; from the two islands, 75,526.<sup>4</sup>

<sup>1</sup>With this and subsequent entries compare the statement of Captain Bryant regarding the scarcity of bulls in the rookeries during the past two seasons. We are forced to conclude that Captain Bryant's are merely erroneous conjectures.

<sup>2</sup>So persistent had been the attempts to raid this island that, on account of its isolated position, it was deemed necessary to station a guard there.

<sup>3</sup>It is probable that these figures were taken with a view to refuting Captain Bryant's statements in 1875 and 1876 regarding the scarcity of males for breeding purposes, and they effectually do so.

<sup>4</sup>The reduction in the quota was voluntary on the part of the lessees.

August 10.—Not more than 15 or 20 seals are reported on Otter Island to-day.

August 27.—Lieutenant Rogers reports no seals on Otter Island.

October 13.—A great change has taken place in the appearance of the seal rookeries within a few days past. The large seals are in the water and the small ones are hauled out on the water's edge.

October 24.—A food drive was made to day and 140 killed, all stagy.<sup>1</sup>

November 8.—The natives began to drive pup seals for food.

November 12.—Driving of pups for winter food was completed, a total of 5,007 pups having been killed.

December 25.—Several thousand seals are reported hauled up on Sea Lion Rock.

### 1878.

January 4.—Great numbers of seals are still in the water about the island and on Sea Lion Rock.

January 15.<sup>2</sup>—The natives report large numbers of seals in the water about the islands.

#### RECORD KEPT BY J. M. MORTON.

May 1.—The first seal was seen in the water to-day.

May 6.—Two bull seals and two sea lions are reported at Northeast Point.

May 7.—Snow and ice still prevent the free landing of seals.

May 9.—Two bulls are on Gorbatch rookery.

May 11.—Four bulls are reported on Gorbatch; 2 at Reef; 1 at Kitovi; 1 at Lagoon; several at Zapadni.

May 19.—Seals are killed for food on Sea Lion Rock, 206 in all.

May 26.—At Reef Point from 200 to 300 bachelors are hauled out.

May 29.—The first seals arrive at Zoltoi to day.

June 5.—Observations on Gorbatch rookery show that the bulls are appearing somewhat behind time.

June 8.—Driving for the quota was begun to-day from the Reef; 21 per cent were rejected as too small and about 5 per cent as too big—five years and upward.

June 10.—Three cows were seen at Lukanin, the first for this season.

June 18.—The quota of 82,000 skins was completed to-day.

#### RECORD KEPT BY J. H. MOULTON.

August 31.—The month has been unusually wet. The seal rookeries and grounds, however, present about the same appearance this year as at the end of August last year.

October 18.—A drove of 125 sea lions were killed for food.

October 31.—The small seals are leaving in schools every day. No bachelor seals are to be seen on the hauling grounds of this end of the islands.

November 1.—Food drives of pups begun.

<sup>1</sup> Attention is directed here and elsewhere throughout this record to the waste involved in thus killing seals while their skins were in a condition unsuitable for use. In the same connection should be noted the waste of the pups as indicated by the record for November 12.

<sup>2</sup> No further record until May 1.

November 8.—A final drive of 571 pups was made from Zoltoi and Reef. The total number of pups killed was 5,206, the increase over last year being allowed because of the absence of bachelors.

November 9.—A few cows and pups are still to be seen on the several rookeries.

November 30.—The month of November has been warm. A few thousand seals are to be seen on the islands at various points; 300 or 400 are hauled out on Sea Lion Rock.

December 17.—Seals in large numbers are to be seen daily on the islands and in the water.

December 31.—A few hundred seals are hauled out on Sea Lion Rock and hundreds are in the water on all sides of the island.

#### 1879.

January 21.—A few hundred seals are hauled out on Sea Lion Rock, and a few are seen nearly every day on all sides of the island in the water.

April 29.—One seal is out on Zoltoi and 1 on Reef rookery; a number are in the water on both sides of the village.

May 3.—Chief reports bulls on all rookeries except Tolstoi and Polovina.

May 9.—Bulls are arriving in large numbers daily; 16 are already on Lukain; 15 bachelors are hauled out near Tolstoi, and quite a number can be seen on Sea Lion Rock.

May 15.—The chief reports many bulls on all the rookeries; about 50 bachelors are at Southwest Bay.

May 16.—The chief reports many bulls at Northeast Point.

#### RECORD KEPT BY J. W. BEAMAN.

May 31.—The quota is fixed for the year at 80,000 from St. Paul, 20,000 from St. George.

June 2.—The first regular drive was made to-day from Reef, 162 skins. Seals are appearing in considerable numbers on all the rookeries. A visit to Village rookery (Spilki) showed numerous bulls.

June 7.—Of the seals driven yesterday from 25 to 33½ per cent were released, being under or over size, or choice individuals for breeders.

June 10.—The rookery at Halfway Point (Polovina) shows a couple of thousand bulls hauled out waiting for cows, which begin to come up in small numbers.<sup>1</sup> The bulls are fearless, and passing along the herd within 40 paces failed to create any considerable alarm. Bachelors, cows, and yearlings are mingled with the bulls in the proportion of not more than 1 to 10 on the breeding rookery.

June 12.—The Reef is well covered with bulls for this time of the year; they maintain their positions with obstinacy.

June 18.—A pup was seen near the village.

June 20.—There are 23 bulls<sup>2</sup> on Nah Speel (Spilki) rookery, 2 cows, and 1 pup. The first cow was seen on the 16th; its pup was noticed on the morning of the 18th.

<sup>1</sup>This statement is significant. At this date certainly the full quota of harem masters were present, and we are informed that there are 2,000 of them. Mr. Elliott in 1874 ascribed fully 10,000 bulls to this area, or 300,000 "breeding seals and young."

<sup>2</sup>This figure should be contrasted with Elliott's estimate for 1874 of 260 breeding families for this rookery.



June 23.—A drive from Middle Hall and Tolstoi yielded 2,300 skins; about 25 per cent of the drove were released. More cows are out on Nah Speel rookery.

June 24.—A drive was made from Southwest Bay and 1,822 skins taken. A walk along the driveway showed that many seals had fallen out on account of the heat and the length of the drive.

July 2.—At the drive from Lukanin and Zoltoi, 1,885 skins were taken; about 25 per cent were released<sup>1</sup> on account of the size, being 5-year-olds and upward.

July 4.—Cows are still arriving on Nah Speel (Spilki) rookery; about 80 per cent have pups.

July 9.—We found on passing around the Lagoon the bodies of numerous dead seals with fur on, probably 100.<sup>2</sup>

July 10.—The bad weather of the week has driven the seals from the hauling grounds so that only 11,978 skins were taken during the four working days.

July 12.—The guard on Otter Island reports the hauling out of several hundred seals, which he drove off.

#### RECORD KEPT BY H. G. OTIS.

July 16.—To-day ends the sealing season; a drive was made from Middle Hill, yielding 2,282 skins, making up the full quota for the island.

July 27.—At a conference with the native chiefs complaint was made by them that the smoke and offal from the oil-making plant was driving away the seals. The agent promised to report the complaint to the Treasury Department.<sup>3</sup>

#### RECORD KEPT BY J. W. BEAMAN.

July 29.—In footing up the tally sheets it was found that the quota has been exceeded this year to the extent of 572 skins, and these were withdrawn and charged to quota of 1880.

July 31.—The Reef was visited to-day; the hauling grounds are thickly covered. A pup was taken from the Reef plateau for dissection and investigation by Dr. White. The rookeries seemed quite destitute of cows, which were probably off in the water.

August 1.—The pup taken from the Reef was examined for heart pulsation and respiration; heart pulsation 22 to one-fourth minute; respiration 12 to the minute.

August 4.—The young pup from the Reef was probably not a week old, but was provided with a full set of teeth in upper jaw, viz. 20. The nerve running to the whiskers was found to be very large.

August 5.—The Reef was visited. Seals were quite thickly hauled upon the plateau. The inspirations of pups were counted; result in one case, 10 in one minute; in another, 23 in three minutes; a 4-year-old bull gave 12 in three minutes. There are 16 teeth in the lower jaw of a pup.

August 8.—On Reef seals are hauled out about as usual. The young half bulls seem to be holding pods of two or three cows on the upper grounds away from the water edge.

<sup>1</sup>This should be contrasted with Captain Bryant's claim that a sufficient reserve was not being left in 1875 and 1876.

<sup>2</sup>These were evidently seals that had died on drives from Zapadni or Tolstoi.

<sup>3</sup>What evidence was given this absurd complaint is not known. The seals show utter indifference to the smoke of the vessels that ply about the islands.

August 13.—Seals are out in force on Tolstoi rookery. Fewer seals are on the hauling grounds, as the bachelors are now distributed over the rookery.

August 16.—A pup taken from Speel, upon dissection, showed the *foramen orale* and the *ductus arteriosus* to be open. These ducts near the heart are usually closed up after birth in the animal world. The bulls have left the rookeries within a few days, making not far from three months' shore duty without food or entering the water.

August 18.—It is reported that seals have not hauled on Otter Island for two weeks.

August 20.—Three seals were examined by Dr. White. In all cases the *foramen orale* and the *ductus arteriosus* were closed. They were found open only in the two months' old pup from Speel. Microscopic examination revealed a probable parasite to the flat parasitic worm that infests the intestines of the seal. The long, flat worm is found in the upper part of the bowels. The cylindrical worm, with pointed conical ends, is only in the stomach, so far as observed.<sup>1</sup>

August 22.—The plateau of the Reef was quite uniformly covered with cows, pups, and bachelors. The females are more silvery gray<sup>2</sup> in appearance than formerly. All appear fat and healthy.

August 23.—The seals were found hauled out in large numbers over and well back from the rookeries. In a pup which was found dead on the rookery ground at Lukanin the *foramen orale* was found open and the *ductus arteriosus* was short, large, and open. This pup was evidently newly born at the time of death, which must have taken place ten days at least before this date. No bladder was found, but a large duct passing from the umbilicus to the urinal vent.

August 26.—Found a dead female seal 3 years old cast upon the rocks along Speel. She was given to Dr. White for dissection.

August 28.—A drive from Zoltoi for food yielded 203 seals.<sup>3</sup> Only 3 skins were accepted; of these 2 were females accidentally killed.

August 29.—Cows and pups are distributed quite numerous over Lukanin rookery. Many fine 5-year-old males are to be seen in different parts of the rookery.

September 5.—The rookeries at Tolstoi, English Bay, and Southwest Bay seemed to be in good condition for this season of the year.

September 12.—The old bulls are all gone from Lukanin and Kitovi. A few half bulls still remain. Cows, pups, and bachelors are numerous, but not so many are on shore as at my previous visit. Two female seals were found insensible under the bluff at East Landing, where they had evidently fallen from the top.

September 23.—A favorite hauling ground for the pups is the shore line south of the village, though unoccupied by any of the other classes of seals during the season. The north side shore is also frequented by pups as far as the new warehouse.

<sup>1</sup> These observations seem to have approached very closely the discovery of the parasite *Uncinaria*.

<sup>2</sup> Due to the presence of 2-year-olds and yearlings, the younger seals coming in later and being lighter in color as a rule.

<sup>3</sup> A discussion is noted between the Aleuts and the agent as to the age of the seals to be killed for food, the people preferring the smaller seals. The custom had been to kill the larger ones. The agent at this time, however, apparently granted the request to kill the smaller seals. Complaint was urged against the disturbance of the rookeries in getting the specimens for Dr. White. The skins of the smaller seals were naturally rejected and so wasted, while nothing is said of the disturbance created by driving Reef Rookery three times for food.

September 25.—The seals are largely diminished in numbers on the plateau of the Reef. Evidently they live more in the water and haul out less frequently and for shorter periods at this season.

September 30.—Pups are still abundant on the south shore of the bluff under the village, and in the water edge along the edge. On Speel are three old bulls which seem to have come back to their old eamping ground.

October 8.—The sea-lion drive from Northeast Point arrived at 6 p. m., having left Northeast Point at noon Sunday, the quickest drive on record. The 195 sea lions killed were all females.<sup>1</sup>

October 20.—In a drive for food from Lukanin 10 females were killed by accident. The seals still hold the plateau of the Reef in about the same number as upon the 25th ultimo.

October 21.—On Speel the cows and pups are holding both sides of the point. One old bull is hauled up among the cows. The pups are still nursing.

October 25.—No seals are hauled south of the village. It is evident that many cows and pups have gone since the cold weather set in.

October 26.—Permission was granted to kill 5,000 male pups. Complaint was made that it would be difficult to get 5,000 pups of sufficient size if the females were excluded. Permission to include females was positively refused.

October 29.—Upon knocking down a pod of pups driven from Lukanin such a large proportion were found to be females that orders were given to kill each one separately after examination; 540 were killed.

October 30.—In the morning the balance of the drive was killed—335. Direction was given to the chief to see that the female pups were driven back into the water. Undoubtedly a large number of these will be unable to recover from the effects of the drive and will perish.<sup>2</sup>

October 31.—From a drive of pups at Kitovi 999 were killed. Care had evidently been used in selecting this lot, as only one or two females were noticed.

November 1.—The pups which were killed by accident or exhausted on the drive from Kitovi were brought up in a wagon and distributed—90 in all; 7 were reported crushed by the larger seals while sorting the sexes. These were too small for food or use. Ten were brought in by the men engaged in the work of selection. A total of 1,106 from Kitovi were killed, making 1,985 pups to date. A number of pup carcasses weighed 8 to 10 pounds each after the viscera, pelt, and blubber had been removed.<sup>3</sup>

November 3.—At a drive of pups from Lukanin 1,142 were killed; 42 which had been killed in selecting or on the drive were brought in by the men.

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<sup>1</sup> In this indiscriminate slaughter of the sea lions we probably have the cause of their great diminution.

<sup>2</sup> The probable careless methods of handling these pups in preceding seasons here suggested is worthy of note. The agent during this season seems to have given the matter close personal attention, and it is strange, in view of what he found, that the wasteful practice should have been allowed to continue. It is not likely that this agent's course of action endeared him to the natives, but it was certainly directed toward the best interests of the Government.

<sup>3</sup> As the skins of these pups, if allowed to grow up, would have been worth to the Government in tax alone \$3, it becomes evident that the supplying of pup meat to the Aleuts was an expensive luxury.



November 6.—The pups killed by accident on the drive of yesterday—79 in all—were brought in and distributed.

November 10.—A drive of pups was made from Gorbateh; 356 were killed, making a total of 5,070. On this drive 4 females were overcome by the exertion or smothered by the piling of the drove. The drives from Gorbateh were composed of mothers and pups, which were driven on the level north of Zoltoi sands, and the pups caught and examined. Mothers and female pups were then released and driven into the water.

November 13.—In a drive for food made from the Reef several females were killed by accident; probably eight or ten.

November 19.—Only 7 cows and 2 pups were on Speel rookery this morning and these took to the water on seeing a human being.

November 25.—The Reef was visited to-day. The first plateau was found deserted and the second with about 100 seals upon it. The bluffs had quite a number on their sides.

November 30.—No pups and very few other seals are reported from Southwest Bay.

December 27.—It is reported that 600 seals are at Northeast Point; none at Polovina; a large number on Sea Lion Rock.

#### 1880.

January 10.—A visit to Reef to-day showed about 2,000 seals hauled out at the extreme point. Sea Lion Rock was thickly covered with seals and in the water south of the point there were numerous pods.

April 30.—Bull seals are reported on the Reef, Tolstoi, and Lukanin, the first of the season.

May 1.—A visit was made to Gorbateh and 2 bulls were found hauled up and holding their positions.

May 3.—The 2 bulls previously noted on Gorbateh were gone. Two others were on the Reef. These did not seem to be holding definite positions and they took to the water.

May 14.—A drive of 406 for food was made at Southwest Bay and 204 seals were killed. The killing is earlier than last year. All along the shore the bulls were holding their positions; quite a pod of bachelors were hauled up at Tolstoi.

May 21.—Eighty-six bulls holding positions were counted on Gorbateh. The number on the other side could not be counted. There were probably 300 in all, including both sides.

May 24.—An inspection was made on Kitovi and Lukanin rookeries; 112 bulls counted on Kitovi, and 142 on Lukanin, with a possible error in the count of 25 to 50.<sup>1</sup>

May 28.—A single bull seal which hauled out at Speel yesterday, the first of the season, is gone to-day.

May 29.—No seals of consequence hauled at Northeast Point yet.

<sup>1</sup>In the foregoing record by Mr. Beaman we have an approach to what should have been the wide-awake agent's record. He gave in 1879 a count of the bulls on Polovina and Nah Spil. Here he has made a count of the bulls on Kitovi and Lukanin, which enables us to arrive at some idea of the true status of these breeding grounds. Had such a beginning been followed up and expanded it would have soon thrown the needed light upon the condition of the herd, but Mr. Beaman does not again appear in the record, and it again sinks into generalities.

## RECORD KEPT BY H. G. OTIS.

June 1.—The regular sealing season began to-day, with a drive from the Reef, 216 seals being killed.

June 10.—Reports show the rookeries at Northeast Point in favorable condition. The first seal pup of the season was seen on the Reef. Bulls numerous on the rookeries; killable seals scarce.

June 16.—Some difficulty is being encountered in obtaining killable seals in satisfactory numbers; 25 or 30 per cent of each drive has to be released, being either too large or too small.

June 23.—A visible improvement in the quality and number of killable seals is noticeable, a larger proportion of medium-sized 3-year-olds having appeared on the hauling grounds. The date of their appearance corresponds with last year.

June 24.—Large increase of cows is noticeable on the Reef.<sup>1</sup>

July 2.—A visit to Kitovi, Tolstoi, and Lukanin showed a marked increase in the number of cows and pups, especially at Tolstoi, where they lay like sardines packed in a box.

July 3.—The agent visited Otter Island, as directed, to keep lookout for vessels. A number of seals hauled out on the shore; no females or pups.

July 15.—Frequent visits to the Reef and other rookeries find them filled to the utmost limit of their apparent expansion of former years, the rookeries being packed closely with cows, bulls, and pups. Several freshly born pups seen. The rutting season appears to be at its height.

July 17.—A drive from Zoltoi yielded 534 skins, making up the island's full quota of 80,000 for the season; of this number 75,000 have been taken since the 1st day of June, an average of 2,167 skins per day for the thirty-five days actually consumed in the work.<sup>2</sup>

August 11.—On recent visits to Reef, Zoltoi, Lukanin, and Tolstoi countless multitudes of seals of all classes have been found hauling out and spreading over ground not occupied earlier in the season. The shores along the front of all the rookeries are black with seal pups which are just learning to swim. The cows now go freely in and out of the water, released as they are from their more urgent family duties. Their masters pay little attention to their movements compared with the jealous watchfulness shown them during the breeding and rutting periods.

August 15.—About 1,000 seals reported hauled out on Otter Island.

August 21.—The appearance of Tolstoi and Reef rookeries at this time show them to be occupied by a larger number of seals, apparently, than at any previous period of the season. On the Reef the entire space from shore to shore is thickly covered with seals of all classes and ages. At Tolstoi all the ground held during the height of the season, together with the slope to the top of the bluff, is similarly though more densely covered. The pups, waxing strong, have hauled out far backward from the shore.

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<sup>1</sup>It can not be determined from this and the following entries what is meant by the increase, whether it is over some date in the same season or over the preceding season. It is evident, however, that we can not infer a diminution as yet in the seal herd.

<sup>2</sup>It must be noted here that this result of the season's sealing is wholly incompatible with Captain Byant's claim of a scarcity of bulls in 1875-76.

September 8.—Seals are present in large numbers everywhere, the pups hauling out for play near the village, indifferent to the presence of human beings. The waters of the cove are alive with them and they literally swarm the shore about the Point Warehouse.

September 12.—Seals in undiminished numbers remain at Northeast Point and far down the north shore.

October 20.—Seals are hauled out at Tolstoi and the Reef in nearly as great numbers as in August; less numerous at Zoltoi, Kitovi, and Lukanin. The larger proportion by far are cows and pups. The latter class is also to be seen in large numbers in the water.

October 31.—The natives urged permission to begin killing pups, claiming 5,000 would be needed. With a view to protect the seal life, the number of pups to be killed was fixed at 4,400, the natives being required to take more bachelors, their skins to go into the quota. It was shown that the natives were supplied during the year ending July 30, 1880, with no less than 11,801 small seals, making an average net weight of 8 pounds for the pup seals and 32 pounds for the larger seals, a total weight (estimated) of 255,928 pounds, or an average of 700 pounds a day for every day of the year, or more than  $2\frac{1}{2}$  pounds a day for every native man, woman, and child on the island.<sup>1</sup>

November 6.—A drive of pups was made from the Reef to make up the total of 4,400 for the season.

November 22.—The majority of the seals have disappeared; comparatively few are at the Reef, Kitovi, Lukanin, Tolstoi, and Southwest and English bays.

December 31.—Seals have been scarce on land since the late heavy storm; but to day several hundred appeared upon the Reef, while Sea Lion Rock and the water about it are black with them. A number are reported at Tolstoi and Southwest Bay, but more at Kitovi and Lukanin.

#### 1881.

January 3.—Small drive was made from Tolstoi, the last of the season, and 123 killed. A total of 2,308 large young seals and 4,413 pups killed for winter food.

February 1.—A few seals are reported in the water at Northeast Point; none on land.

April 24.—Three or 4 fur seals were seen near Sea Lion Rock in the water, possibly bachelors which have been about the islands all winter.

May 1.—A bull seal was seen at Speel, near the village.

May 4.—Five seals, including 1 bull, are in the water off the Reef.

May 5.—A dozen bull seals are hauled out at Kitovi, 2 at Northeast Point, and a number seen in the water off Lukanin.

May 6.—Two bull seals are hauled up on the Cove Spit (Lagoon). Fourteen bulls are reported at Lukanin.

May 10.—Ten bulls are at Kitovi and 20 at Lukanin.

<sup>1</sup>This entry puts the matter of waste through the killing of pups and under-sized seals in its true light; but as though the agent who had undertaken "to protect the seal life" had survived his usefulness, we hear nothing of him after this year, and nothing farther is said about the killing of pups and small seals.

May 12.—Thirty-eight bulls are counted on the Reef, some of them hauled up as much as 200 yards from the shore.

May 13.—About 63 bulls are hauled up at Southwest Bay and a number are seen in the water.

May 18.—About 130 bulls and 2 bachelors are hauled up on Reef.

May 21.—About 175 to 200 bulls are on Reef to day.

May 29.—The first food drive of 165 seals was made to-day, fifteen days later than last year.

June 6.—The first killing (421 seals) of the regular sealing season was made from Reef and Zoltoi.

June 8.—A few cow seals are reported out at Lukanin.

June 10.—A small drive was made from Halfway Point, 474 skins. The season is slightly behind last year, apparently attributable to cold weather. Bulls are numerous.

June 12.—Two pups were seen to-day at Tolstoi, the first of the season.

June 28.—A raid on Otter Island was discovered and nipped short.

July 8.—A drive from Halfway Point gave 1,118 skins and 1,151 were taken at Northeast Point. Killing at the latter point was discontinued for the present.

July 20.—The last drive of the sealing season was made from Tolstoi, Zoltoi, and Lukanin, 2,530, making a total of 80,000 for St. Paul.

#### RECORD KEPT BY J. H. MOULTON.

August 9.—About 1,000 seals are reported on Otter Island.

November 17.—An unusual number of seals remain on the islands at this date, probably owing to the mild weather.

November 30.—Seals in large numbers still remain on the island. (Apparently no killing of pups this season.)

#### 1882.

January 24.—Four thousand to 6,000 seals are still to be seen on Sea Lion Rock and a few still remain at Northeast Point.

February 8.—A food drive was made from the Reef and 103 seals killed.<sup>1</sup>

April 26.—One bull seal was seen in the water off Lukanin.

April 28.—One bull seal has hauled out at Kitovi; one is in the water off south end of Reef.

May 2.—Two bull seals are reported on Southwest Bay.

May 8.—Five bulls are on Tolstoi.

May 16.—A few young seals are on Sea Lion Rock.

June 2.—The first drive for the quota is made from Southwest Bay, Middle Hill, and Tolstoi; 400 killed. The quota for this year is 78,000 from St. Paul; 22,000 from St. George.

June 13.—A drive from Halfway Point yielded 217 skins; 366 were taken at Northeast Point. A few females and pups are present on the rookeries. An unusual number of "killers" are about the rookeries this month.

July 20.—A killing from Southwest Bay yielded 729, filling the quota of 1882.

<sup>1</sup> Again the seals seem to have remained about the islands all winter.



## RECORD KEPT BY H. A. GLIDDEN.

September 25.—The rookeries at Tolstoi, English Bay, and Northwest Bay are all occupied by cows and pups hauled out upon land, in many places quite a distance from the shore.

October 14.—The seals have left the breeding rookery (Lagoon) opposite the Warehouse. Most of the seals have disappeared from Tolstoi; none are left at English Bay.

December 31.—No seals are visible except on Sea Lion Rock.

## 1883.

April 30.—The ice is still firm about the island.

May 6.—The chiefs report the appearance of seals on the Reef and Lukamin.

May 8.—Seals reported on Tolstoi. Some ice still remains.

May 16.—Several bull seals are on the Reef.

June 4.—The first regular drive of the season gave 592 seals from Southwest Bay and Tolstoi.

June 10.—But very few small seals have arrived as yet upon the island, a considerably smaller number than at this time last year.

July 10.—Owing to the small number of large seals, the work at Northeast Point was suspended and the sealers returned to the village.

July 13.—A drive from Southwest Bay yielded 2,144 seals. Seals are arriving late at St. George; only 7,500 seen there to date.<sup>1</sup>

August 2.—There are 400 skins yet to be taken to fill the quota of 15,000 for St. George.

October 26.—Seals are leaving the island very fast; the rookeries and hauling grounds show that more than half have left; at Northeast Point but few remain.

November 2.—The quota of pups for food, 3,000 in all, was completed to-day.

November 18.—But few seals remain on the rookeries; more are on the Reef than anywhere else.

November 24.—About 2,000 large young seals have hauled up on Southwest Bay within the last two or three days.

December 4.—Trapping of foxes has been suspended, because the setting of traps near the rookeries tends to frighten the seals into the water.

December 5.—Seals have left Tolstoi, English Bay, and Halfway Point. A few are still at Southwest Bay, mostly cows and pups. A few small seals are on the Reef, but so near the water that it is impossible to drive them for food.

December 12.—A food killing from the Reef gave 420 seals. Seals are hauling out again at Southwest Bay and Northeast Point.

December 26.—Natives report many seals hauled out at Northeast Point. Great numbers are seen daily in the water on the east side. A few hundred are on the south end of the Reef and many on Sea Lion Rock.

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<sup>1</sup> In this and other entries during this season we see evidence of a growing scarcity of seals on the hauling grounds. This is in part doubtless due to the growing pelagic catch, but must in part also be due to peculiar seasonal conditions.

## 1884.

January 11.—A few hundred seals are on Sea Lion Rock.

January 12.—A few large seals are hauled out on the beach at the end of the island.

January 20.—The seals have left Northeast Point and Sea Lion Rock.

March 6.—Orders were given to shoot or house all hogs which had become a nuisance and had been visiting Zoltoi, Reef, and Nah Speel, driving the seals into the water.

April 26.—The first fur seal of the season was seen to-day.

April 30.—The large seals have hauled out at Southwest Bay; two at Tolstoi, and many in the water about English Bay.

May 2.—The large male seals are beginning to haul out on the rookeries. Several are already on the extreme south end of the Reef rookery, and quite a large number in the water.

May 3.—Two bulls are on Lukanin.

May 11.—Bulls are reported by the natives on all the rookeries. The first on Warehouse Point came last night. A few bachelor seals are hauled out at Southwest Bay and a few are in the water near the point of the Reef.

May 15.—“Killers” are quite numerous.

May 21.—Drives for food were made from Halfway Point and Reef; 187 killed. “Killers” drove a shark (?) on shore at Halfway Point.

June 3.—A drive was made from the Reef and 318 killed.

July 21.—A drive from Middle Hall, Kitovi, Zoltoi, yielded 1,911. This killing closed the season. The total number killed was 88,995, of which 85,000 were accepted by the company.<sup>1</sup>

July 29.—Eight hundred seal skins are yet to be taken on St. George to complete the quota of 15,000 for that island.

August 26.—The number of large seals in the food drive to-day was unusually small. In a drove of 2,000 only 57 were killed, the skins of which were accepted. The state of affairs is very different from previous years and difficult to account for.<sup>2</sup>

November 5.—Since the 3d, 2,731 pups have been killed for winter food.

December 31.—The weather is unusually mild. The seals have nearly all gone. Those remaining are at Southwest Bay, Reef, and Sea Lion Rock.

## 1885.

April 27.—The first seal seen this season is hauled out at Southwest Bay.

## RECORD KEPT BY G. R. TINGLE.

June 3.—A drive (place not stated) was made and 49 seals killed.

June 19.—A drive from Lukanin and Halfway Point yielded 1,307 skins. The natives found an albino pup; it was dead, having been bitten in the head.

<sup>1</sup> The securing of this quota shows that a more normal condition of the hauling grounds existed in this season. One can not help noting in passing the rejection here implied of nearly 4,000 skins in skins in a quota of 85,000; or at \$3 a skin, a loss of \$12,000.

<sup>2</sup> Here we begin to see the actual scarcity of bachelor seals resulting from the diminished birth rate of 1880 and 1881, when the pelagic catch exceeded 15,000 as against a normal catch of 5,000 in the ten years previous.

July 18.—In the drive from the Reef was an old bull with his ear cut off. The natives testified to the fact that the right ear of a number of male pups on the Reef had been cut off in 1871. The left ear was similarly cut off of a number of male pups on Lukanin rookery. The presence of this 14-year-old bull shows the fact that seals return to the rookery where they were born and live to be at least 14 years of age.

July 27.<sup>1</sup>—A drive from Zoltoi Reef and Middle Hill yielded 983 skins, and closed the season.

November 2.—The natives killed pups from the Reef, separating them on the ground and killing only males.

November 7.—The remainder of the quota of pup seals were killed, making in all for the season 2,788.

November 30.—Examination of the rookeries during the past week shows no seals at Kitovi, Lukanin, Zoltoi, Village Reef (Lagoon), and Halfway Point; very few were on Reef, Tolstoi, English Bay, Middle Hill, Southwest Bay, and Northeast Point. Probably less than a thousand seals, all told, are on the islands.

December 17.—The natives make food drive from Reef, killing 708 seals.

December 31.—There is not a single seal left on the island. Their departure may have dated from Christmas night, as about 20 were seen on the Reef at that time, but were not there the next day.

### 1886.

January 8.—One bull seal is hauled out to-day on the Reef, and about 50 in the water.

January 19.—Fully 2,000 seals are in the water between Sea Lion Rock and the Reef. Some seals were hauled out on the point of rocks.

January 21.—The natives made a killing of seals on Sea Lion Rock for food, getting 83. The weather for some time has been mild, this probably inducing them to haul out. No seals are on any of the rookeries.

January 29.—The natives killed seals for food at Southwest Bay.<sup>2</sup>

April 16.—A killable seal, the first this season, was seen in the water at Northeast Point.

May 2.—Two bulls were seen trying to land on Sea Lion Rock; 6 killable seals were in the water; 2 bulls were on Garbotch, and one was in the water trying to make a landing. One bull reported from Halfway Point in the water; 2 were hauled out at Northeast Point on April 28, and 2 in the water. Seals were seen in the water at Tolstoi and 2 had landed.

May 5.—A drive of 20 killable seals was made to-day, of which only 7 were killed. This is the earliest drive in years.

May 6.—I measured the Zapadni rookeries, on which at least a dozen bulls had already taken position. A dozen more bulls were found on Northeast Point yesterday.<sup>3</sup>

<sup>1</sup> The retardation of the date at which the quota was filled is worthy of note as showing the growing scarcity of seals under the diminishing birth rate due to pelagic sealing.

<sup>2</sup> The frequent departures and returns of seals for this season as here recorded are interesting.

<sup>3</sup> As a result of the measurement here referred to, Mr. Tingle found the breeding territory doubled and the breeding population greatly increased over the conditions of 1872-1874. The absurdity of this appears presently when the decline of the herd already under way at this time becomes so plainly evident in 1889.



May 8.—Nah Speel has long since<sup>1</sup> been abandoned by the seals.

May 9.—Three bull seals have hauled up on the Lagoon rookery.

May 17.—A food drive was made from Southwest Bay and 74 killed.

May 19.—Seals are reported hauling fast at Northeast Point. Old bulls are located in considerable numbers as far as the top of Hutchinson Hill. "Killers" swarm around the point driving seals and sea lions on shore.

May 24.—A few cows were seen about a bull on Gorbatch, the first family of the season.<sup>2</sup>

June 4.—Made the first drive of the season from the Reef, killing 561.

July 26.—The company finished the killing of the season to-day, getting the full quota of 85,000 skins.<sup>3</sup> A sealing schooner was captured with 574 skins on board.

#### RECORD KEPT BY A. P. LAUD.

August 3.—Five sealing schooners are reported in the neighborhood of the islands.

October 1.—At Northeast Point the rookeries are filled with seals.

1887.

January 1.—An examination of the rookeries shows them in good condition, with quite a number of small seals present.

January 5.—The weather is very mild; a large number of seals are about the island and on the different rookeries.

January 11.—An examination of the rookeries shows that all of the seals have left.

February 28.—The weather still continues mild; four fur seals are seen on North (probably Northeast Point) rookery.

May 1.—One bull is reported on Reef; one at Southwest Bay.

May 3.—Two bulls are reported at Tolstoi; three at Southwest Bay.

May 14.—There are 23 bulls on the Reef; 14 at Southwest Bay; 8 at Tolstoi; 7 at Lukain; 2 on Lagoon Reef; 24 at Northeast Point.

May 21.—Fifty killable seals are reported at Northeast Point.

May 24.—A drive for food was made from Reef and Southwest Bay, 275 being killed.

June 6.—The first drive for the quota was made from Tolstoi, 419 being killed.

June 19.—A number of cows have landed and some pups are born.

July 24.—Falling short on drives of yesterday, made small drive from Tolstoi, getting the needful 232 skins to make up the quota of 100,000.<sup>4</sup>

#### RECORD KEPT BY J. P. MANCHESTER.

August 16.—A drive of seals was made for food at Zoltoi, Reef, and Lukain. Only 207 were obtained out of a very large number.

<sup>1</sup> This is a mistake. See note under date of May 11, 1884. The abandonment occurred this very year.

<sup>2</sup> This was probably a group of bachelors with a bull among them.

<sup>3</sup> The retardation of the quota continues; prior to 1883 the quota was filled by, if not before, July 20.

<sup>4</sup> The filling of the quota was assisted in this year by the reduction of the age and size of the killable seals to be taken, thus anticipating the quota of the year following.

The cutter *Rush* reports having captured four schooners—the *Bering Sea*, with 151 skins; *Ann Beck*, 336 skins; *W. P. Sauger*, 479; *Dolphin*, 600 skins.

Schooners have been shooting seals for days off Northeast Point. Watchmen have fired into boats five times to keep them off the rookeries. A schooner was seized off Otter Island with 161 skins.

August 20.—The *Rush* reports the capture of another schooner with 800 skins.

October 29.—Men sent to Northeast Point to examine rookeries report very few seals.

October 31.—A distribution of 2,178 seal pups for food for the natives was made.

November 20.—Men were sent to Reef, Middle Hill, and Tolstoi to see if seals for a food drive could be found, but the storm of last night had driven them into the water.

November 26.—A drive for food was made from Middle Hill and Tolstoi. Very few fit to kill were found, many cows and small seals being mingled with them.

December 5.—Men were sent to Sea Lion Rock to kill seals for food.

### 1888.

January 11.—No seals are in sight on the island except at Sea Lion Rock.

January 20.—The natives report 700 seals at Northeast Point. They were ordered to drive them to the village, being careful and going slow if it took a week, killing all that gave out on the way.

January 24.—The first drive from Northeast Point reached the village at 2 p. m. in good condition, the time from Northeast Point being eighty-two hours.

January 25.—The second drive from Northeast Point came in at 8 a. m. in good condition, 100 hours on the way. Five hundred seals killed and the meat salted.

January 26.—Boats were sent for seal meat left on Sea Lion Rock. The living seals have left the rock.

May 5.—Two bulls are reported on the north side of the Reef; 3 on Tolstoi.

May 7.—Eleven bulls are reported at Southwest Bay; 4 on the Reef; 1 on Lukanin.

May 9.—The Reef has 8 bulls and 1 was seen landing.

May 10.—Four bulls are out on the Village Reef (Lagoon).

May 11.—Twenty-five killable seals are reported from Northeast Point. The Reef has 15 bulls; Lukanin, 4.

May 26.—Watchmen report 1 pup born at Northeast Point on May 21. The seals and bulls are hauling very fast on all the rookeries for this time of the year.

May 28.—A drive for food was made from Reef. "Killers" are in sight around the island close in to shore.

### RECORD KEPT BY G. R. TINGLE.

June 6.—The first regular drive of the season was made from Reef, 121 skins being secured.

June 21.—The rookeries are still very sparsely populated and killable seals are hauling slowly.

July 27.—The season's sealing closed to-day, completing the full quota of 100,000 skins; 85,000 from St. Paul; 15,000 from St. George.<sup>1</sup>

<sup>1</sup> The quota was this year, as last, composed of an increasing number of undersized seals, thus anticipating the quota of 1889.

## RECORD KEPT BY J. P. MANCHESTER.

October 30.—The heavy gale has done damage in killing pups on different parts of the islands; the damage to seal life by such storms as this must be great.<sup>1</sup>

November 9.—Driving of pups for winter food, begun on the 5th, was completed to-day.<sup>2</sup>

November 24.—A drive of seals could not be made to-day, all being in the water on account of the snow and wind.

November 26.—A drive from Reef was secured and 104 killed. The bachelors are very scarce now on this side of the island, and when you find them they are mixed up with the cows.

December 11.—Three unsuccessful attempts to get a drive have been made since the 1st instant. The seals have all gone from this end of the island, with the exception of a few at Tolstoi, and they can not be reached. A good many seals are reported still at Northeast Point.

December 13.—After many efforts, a drive of seals was made from Tolstoi and 206 were killed. Seals are very scarce, except at Northeast Point. The bad weather of the fall probably accounts for it.

December 26.—The boats went to Sea Lion Rock, securing 78 seals.

## 1889.

May 3.—One bull seal is reported on Sea Lion Rock.

May 4.—The chief reports 1 bull seal this afternoon on Reef. The ice about the island makes it hard for the bulls to land.

May 7.—Three bull seals are on the Reef; 1 on Kitovi.

May 10.—Eight bulls are on the Reef; 1 on Zoltoi; 20 on Northeast Point, and 21 at Southwest Bay, English Bay, Tolstoi, Lukanin and Kitovi; total to date, 50. The bulls are hauling faster than last year, but the spring is very late. The island is still surrounded with ice and plenty of deep snow lies on the beaches.

May 11.—Three bulls are on the village reef (Lagoon); 9 on Tolstoi.

May 22.—Natives kill 124 seals on Sea Lion Rock.

May 31.—“Killers” are numerous about the island.

June 4.—A visit to Tolstoi showed 2 cows and about 200 or 300 killable seals.

June 7.—Only about 60 seals are on the reef; about 200 on Southwest Bay; very few at English Bay and Tolstoi.

June 10.—Made a drive from reef; obtained 120 only. A good many cows with pups are reported on the rookery.

June 26.—The killing of 4,200 seals to date is reported from St. George; killed 1,314 seals to-day from English Bay and Middle Hill. At Northeast Point 441 were taken.

June 27.—Killed seals at Southwest Bay, 311; and at Northeast Point, 844. About 2,000 killable seals were found on Otter Island.

<sup>1</sup>This statement is too vague to be of value, but it is probable that here as later the phenomenon of dead pups on the sands of English Bay, Zoltoi, and elsewhere, after a heavy gale, is alluded to. The investigations of 1896 and 1897 show that these were wormy pups washed from the rookery fronts and deposited on the sand beaches. Few pups are killed by the surf.

<sup>2</sup>In view of the continued decrease of the young male life on the hauling grounds this premature killing of its product seems wholly inexcusable.

June 29.—A drive from English Bay and Tolstoi yielded 1,058 skins. The quota is 5,000 skins short of the conditions of last year at this time.

July 2.—A drive at Halfway Point yielded 831 skins. At Northeast Point 968 skins were taken. Seals are coming in slowly this year and seem to have diminished.

July 6.—A drive from English Bay and Tolstoi yielded 1,302. At Northeast Point 376 were taken. The quota is now 7,000 short as compared with last year, the shortage being chiefly at Northeast Point. St. George is reported to be 1,300 skins short as compared with last year.

July 10.—A drive from Halfway Point yielded 654, and one from Northeast Point, 800 skins. The quota is 7,370 short as compared with last year.

July 13.—At Southwest Bay 1,006 skins were taken; at Northeast Point, 793. There is an evident decrease also in the breeding rookeries.<sup>1</sup>

July 25.—Two schooners, having 418 and 76 skins, respectively, were captured. A drive from English Bay and Middle Hill yielded 1,752 skins.

July 31.—At Northeast Point 538 skins were taken to-day, making the total of 85,000 for the season.<sup>2</sup>

August 9.—St. George furnished only 14,978 skins.

#### RECORD KEPT BY CHAS. J. GOFF.

September 1.—The old bulls have about all gone from the Reef. The pups are getting rather large and can be seen by the thousands playing in the water, but they are not nearly so numerous as in the past.

#### RECORD KEPT BY G. R. NETTLETON.

October 6.—Captain Healy, of the *Bear*, reports that in several days' cruise about the islands he had not seen a dozen seals in the water within 10 miles of shore. All the bull seals which held places on the breeding grounds have gone. The rookeries are well covered with cows and pups, mixed with bachelors. The water adjacent is full of seals as far out as 2 miles.

November 7.—At a drive of pups for food 1,044 were killed and distributed.

November 18.—The killable seals are in the water or near its edge and mixed with cows.

November 23.—A raid was made on Zapadni; 7 dead cows were found and 1 wounded bull. A drive from Reef was made, yielding 347 seals for food.

December 2.—There are few seals on the Reef. They have all left Lukanin and Kitovi. A number remain at Zapadni and large numbers are reported at Northeast Point.

<sup>1</sup> Here we have the first intimation that there is any diminution in the breeding seals.

<sup>2</sup> This quota, as we know, for 1889 was made up almost wholly of undersized seals, which would not under normal conditions have been taken at all. This course of action was pursued because the lease under which the islands was then held was drawing to a close. The conditions were well enough understood by the lessees, if not by the officers of the Government, as the following statement by Superintendent McIntyre ("Seal Life," Senate Doc. 137, Part 1, 1895) will show: "I repeatedly pointed out to our company and to the special Treasury agents during the seasons of 1887, 1888, and 1889 that the seals were rapidly diminishing, and that in order to get the full quota allowed by law we were obliged to kill, in increasing numbers in each of those years, animals that should have been allowed to attain greater size, and finally the catch of 1889 was mostly of this class." This admission makes clear the conditions of these years and fully explains the gradual progress of the decline notwithstanding the abrupt collapse of the bachelor herd.



December 4.—No seals remain on Lagoon.

December 11.—A food drive was made from Zapadni. It was two days in reaching the village. Six seals perished on the way. The drive yielded 240 skins.

## 1890.

January 22.—Four hundred seals are reported hauled up under Hutchinson Hill. Natives were sent to secure them.

January 26.—Two hundred and one seals were killed at Northeast Point.

January 27.—Natives sent in boats to Sea Lion Rock, succeeded in killing 180 seals.

April 28.—The first bull of the year hauled out at Tolstoi Rookery to-day.

April 29.—Three bulls hauled out at Zapadni.

April 30.—One bull is on Sea Lion Rock.

May 6.—Ten bulls are on Zapadni and 6 on Reef Point.

May 7.—Three bulls hauled out on Lagoon.

May 9.—Eighteen bulls are on Zapadni.

May 10.—One hundred bulls are reported at Northeast Point; a large number in the water.

May 12.—Six bulls are hauled out at Halfway Point.

May 14.—Fifty bachelor seals are reported hauled out on Sea Lion Rock.

May 21.—The first killing for food was made on Sea Lion Rock, 131 seals.

June 15.—Mr. Goff made an examination of the Reef, comparing its conditions with those of the same date last year. He found more bulls and a better class, i. e., uniformly larger and covering more ground. The bachelors on the extreme point are not as numerous as a year ago.

June 6.—The north end and middle part of Lukanin show fully as many seals in sight as last year; while the western end does not make so good a showing.

June 10.—The first cow arrived on the Reef on the 5th. The first pup was born to-day.

June 11.—The first drive for the quota was made from the Reef, yielding 574 skins.

June 18.—A drive from Middle Hill and Tolstoi yielded 274 skins. Nineteen half-grown bulls were turned away. As many yearlings as seals killed, and half as many 2-year-olds, were allowed to return to the water. These figures constitute a fair average for the work of the season thus far; the bulls actually counted; the others are a close estimate.

June 23.—At a drive from Middle Hill and Tolstoi 521 were killed. Seventy-five per cent of the seals driven to the village were turned back into the sea, 10 per cent being 2-year-olds and the balance yearlings.

June 24.—Of the drive from Reef and Zoltoi 426 seals were killed. About 65 per cent of the drive was turned back into the sea, about all being yearlings.

June 26.—From the drive at Southwest Bay 117 were killed; 65 per cent were rejected. Of those turned away half were yearlings, one-fourth 2-year-olds, and the rest old bulls.

June 28.—A drive of 1,417 seals was made from Reef—206 were killed; 1,211 were turned back. At Northeast Point 79 seals were killed out of a drive of 2,000.

June 30.—A drive from English Bay, Middle Hill, and Tolstoi yielded 209 skins; 83 per cent of the drive was rejected.

July 1.—At a drive from Reef 246 were killed and 95 per cent turned back.

July 2.—At a drive from Halfway Point 242 seals were killed and 95 per cent turned back.

July 4.—At the drive from Tolstoi 481 were killed and 90½ per cent turned back. To day the lessees lowered the standard of weight of skins taken to 5½ clean.<sup>1</sup>

July 5.—A visit to Otter Island showed not more than 50 seals hauled out, and not more than a dozen seals were seen in the water between here and the island.

July 17.—Of the 1,514 seals driven from Polovina, 87 per cent were rejected; of 1,320 from Lukanin and Kitovi 85¼ per cent were rejected.

July 18.—At the drive to-day from Zapadni 241 seals were killed out of a drive of 1,192. The lessees began taking "wigs" this morning, 82 being taken.

July 19.—Out of a drive of 4,620 from the Reef and Zoltoi, 556 were killed.

July 20.—The drive from English Bay, Middle Hill, Tolstoi, Lukanin, Kitovi, and Rocky Point furnished 780 skins; 3,956 were rejected.

August 1.—Mr. Goff visited Kitovi, Lukanin, English Bay, Middle Hill, and Tolstoi to-day and estimated that 5,000 seals could be driven from these rookeries and that 10 per cent of them would be killable.

#### RECORD KEPT BY JOSEPH MURRAY.

August 14.—A drive for food was made from Lukanin and 124 killed; 6 were smothered in the drive.

September 7.—A schooner has been shooting seals off Northeast Point, within a mile of shore, for several days; 100 shots were counted in some cases for one seal taken.

November 12.—Pups from Reef rookery were killed, 324 in all, making a total of 2,364, or 12 each for the 197 natives on the islands.<sup>3</sup>

December 4.—A food drive from Reef yielded 258 skins, of which 235 were prime.

#### 1891.

April 24.—A native reports a bull seal landed at Northeast Point.

April 29.—No seals are hauled out on the Reef, but seals are in the water about Sea Lion Rock.

April 30.—The first bulls are hauled out on the Reef to-day and on Sea Lion Rock.

May 2.—Bulls are hauling out to-day on all the rookeries.

May 15.—At a food drive from Reef 233 were killed.

June 4.—A drive from Reef was made for the lessees and 476 killed; 13 small seals died on the drive.

<sup>1</sup> Heretofore an attempt was made to get a better grade of skins than were taken in 1889, but such seals being wanting it was necessary to take smaller ones. The weight of skins here authorized would include 2-year-olds.

<sup>2</sup> This closed the season by order of the Treasury agent under protest from the lessees. In view of the percentage of rejected seals in the drive even after lowering the weight to the unprecedented figure of 5½ pounds, and then authorizing the taking of "wigs," this course would seem to have been fully justified. The seals were simply not to be had. This view is borne out by the small showing of the hauling ground visited on August 1 after two weeks' rest. The quota of 1890 had been anticipated in filling that for 1889.

<sup>3</sup> In view of the depleted condition shown the bachelor herd of this year, it is incomprehensible that this wasteful practice of slaughtering pups to furnish an article of luxury for the natives should have been allowed. We are glad to note that this is the end of the matter, but that it should have continued so long is hard to contemplate with patience.



June 11.—Seals were driven from the Reef and 718 killed; 1,112 seals were killed at Northeast Point. The first cows of the season were reported to-day.

June 12.—At the killing to-day at Zapadni 418 seals were taken; 50 per cent of seals driven were turned back.

June 13.—A drive was made from Tolstoi and 232 killed; 430 were killed at Northeast Point; 50 per cent of those driven were turned back. The killing this year has been limited under the *modus vivendi* to 7,500—6,000 from St. Paul and 1,500 from St. George.

June 14.—The first pups were reported to-day.

June 16.—A drive was made from the Reef and 649 killed; about 65 per cent were turned back. Fifty per cent of these could have been taken, furnishing skins of 6 pounds and over, except for the order of the Government limiting the catch to 7,500.

June 20.—Killed seals from Tolstoi, 116, to complete quota of 7,500.

June 27.—The natives were informed that they would be allowed to kill seals for food until the stagy season, but that none would be killed while stagy.

July 12.—During the past five or six days the rookeries have been carefully scanned, and it is believed that at this date they are at their very best for this year. To all appearances the pups are fully 95 per cent of the cows.

#### RECORD KEPT BY MILTON BARNES.

September 1.—Mr. J. Stanley-Brown reports a very large number of young pups lying dead upon the rookery at Northeast Point, which, from their emaciated condition, have evidently died of starvation. Others still alive but in a starving condition.<sup>1</sup>

September 21.—Five "killers" are reported off East Landing.

November 23.—A small drive was made from the Reef but was found to be largely of cows and let go. A drive was made from English Bay and 133 killed.

December 2.—The seals are rapidly disappearing.

December 3.—Natives returning from Zapadni report no seals there.

December 5.—Watchmen were recalled from Northeast Point. Only a few seals are reported there and those in an inaccessible place. No seals are at Halfway Point.

1892.

April 27.—The chiefs report 2 bulls hauled up at Southwest Bay, the first arrivals of the season. Seals have been seen in the water some distance from the shore off Reef rookery, but none have hauled up there yet. This is three days earlier than the first arrivals of last year.

April 30.—One bull seal is reported on Reef rookery this morning.

May 6.—A native returning from Northeast Point reports 18 bulls hauled out there and 10 killable seals.

May 10.—Northeast Point watchman reports 40 to 50 bulls hauled out; 10 or 12 killable seals.

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<sup>1</sup>This is the first record of starved pups which we have, though they must have been starving by the thousands ever since 1886. This fact, together with the failure to recognize the deaths due to the parasitic worm *Uncinaria*, show how little real inspection of the rookeries was done in all these years.

## RECORD KEPT BY JOSEPH MURRAY.

July 6.—One bull, 1 cow, 1 pup, and 3 or 4 bachelors are reported at Southwest Point.

July 8.—A food drive was made from Middle Hill. The natives complained through their chief that the meat of the older bulls was not relished by the people.

August 5.—Captain Hooper, returning from cruise of *Corwin* with Jacob Kotehuten as hunter, reports seals more numerous at 200 miles out than at any other point visited in Bering Sea. Seals killed by his hunter were mothers in milk.

## RECORD KEPT BY LIEUTENANT AINSWORTH.

September 1.—Thousands of seals—bulls, cows, pups—are on Reef rookery. Numerous dead pups were seen.

November 12.—One hundred and forty-eight seals from Middle Hill and Tolstoi were killed for food. One pup was smothered on the killing ground. Three seals died on drive.

December 10.—A visit to Halfway Point rookery showed that all the seals had left.

1893.

April 17.—Three men left for Northeast Point to clear off the rookeries.

April 19.—A few seals were seen swimming in the water near Reef rookery and some were hauled out on Sea Lion Rock.

April 27.—A native reported seeing a bull hauled up at Zapadni rookery.

April 28.—There are no seals on the Reef rookeries. They were probably driven away by the Arctic ice.

April 30.—There are no seals at Tolstoi and Middle Hill. One old bull is hauled out at Lagoon rookery.

May 1.—There are no seals at Lukanin, Kitovi, and Reef. One old bull hauled up at Gorbateh.

May 5.—One old bull is seen at Kitovi, 2 at Lukanin. The chief reports, on returning from Northeast Point, 9 old bulls hauled out at Halfway Point.

May 13.—Two old bulls are hauled up at Tolstoi. Native watchmen returning from Northeast Point report 57 old bulls, 27 sea lions, and 50 bachelors hauled out there.

May 15.—Ten old bulls are at English Bay, 17 at Zapadni, and 25 bachelors hauled out. None on Middle Hill.

May 17.—Twenty-seven old bulls and 20 bachelors are hauled up on the Lukanin; 29 old bulls at Kitovi.

## RECORD KEPT BY JOSEPH MURRAY.

June 15.—Seals are slowly coming on the rookeries.

June 16.—Seals were driven from Tolstoi for food and 471 killed.

## RECORD KEPT BY THOS. E. ADAMS.

June 26.—From Zoltoi 2,000 seals were driven and 736 skins taken.

July 4.—A schooner was reported off Northeast Point with boats down and shooting seals.<sup>1</sup>

<sup>1</sup>This is one of the years of the *modus vivendi*, when Bering Sea was supposed to be closed.

July 6.—A drive was made from the Reef and 489 killed. A schooner is hovering about Southwest Bay and Northeast Point.

August 7.—Seals were driven from Zoltoi and 43 killed. (A protest is made by the agent of the company to the Treasury agent in charge of the islands against the practice of Lieutenant Ainsworth, while acting agent, of visiting the rookeries. The injurious effect of this upon the seals is urged.)

November 9.—The weather is blustery and cold. No seals are out and the snow and wind have driven them into the water.

November 26.—The seals are leaving Polovina rapidly.

November 27.—One hundred and eighty-eight seals were killed from Tolstoi and Reef. After the killing 8 dead pups were found on the road. Their death was due to the darkness and the impossibility of the drivers distinguishing the seals.

December 8.—No seals are inland at Lukanin, Kitovi, and Reef rookeries. Some are in the water. None anywhere about Lagoon.

December 15.—The seals have left Northeast Point rookeries. A few are in the water.

#### 1894.

April 26.—Three fur seals are reported in the water at the Reef. It is impossible for them to haul up on account of the ice. If there is no better prospect next week an effort will be made to cut a way for them.

May 1.—The native chief reports 10 seals in the water and 1 bull hauled out on Reef rookery.

May 4.—No seals are hauled up on Reef, Lukanin, and Kitovi. A few seals are in the water.

May 6.—One bull hauled up on Lagoon rookery.

May 7.—Heavy ice comes from the north. In the evening men returning from Northeast Point report 9 bulls hauled out and 10 on ice, also 1 bull at Lukanin.

May 9.—A drive and killing was made on Sea Lion Rock, securing 87 seals.

May 11.—A native returning from Halfway Point reports 1 bull hauled out there, another is hauled out at Lukanin, and 3 on the Reef.

May 13.—Seals are hauling out slowly; they come in on the ice; 9 bulls are on Reef, 5 on Kitovi, 3 on Lukanin, 5 on Zapadni, and 1 on Tolstoi.

May 20.—Owing to the ice, it will be necessary at Northeast Point to cut a way for the seals, the ice being too high and too steep for them to climb. Five men are sent to Northeast Point to cut the roads.

May 24.—One native returns from Northeast Point. He reports 13 roads cut for the seals. Two men remain as watchmen. Five hundred seals haul out as soon as the roads are cut. Four are killed by the men for food.

June 19.—A drive made from Tolstoi resulted in the killing of 541 seals. The killing was made at Ice House Lake to shorten the drive. A few cows have arrived at Tolstoi.

June 23.—Cows are arriving in fair numbers on the rookeries at Zapadni; a drive was made from there one-fourth of a mile long; 850 seals killed.

## RECORD KEPT BY JAMES JUDGE.

July 24.—Drives were made yesterday and to-day at Northeast Point, resulting in killing of 1,395 seals. Five seals were smothered in the drive because so small that they could not protect themselves. The skins were tanned with a view to determining whether skins taken thus within a short time after seals had died in this way would be good. (There seems to be no record of the results of this experiment.)

August 28.—A live but blind albino pup was caught by natives at Northeast Point and brought to the village.

August 29.—Instructions were given the remaining agent not to kill for food before October 10, and to discontinue then till the end of the month if many of the skins were still stagy.

September 9.—A visit to Gorbateh was made and 100 dead pups discovered.

September 12.—A count was made of the dead pups on the Lagoon, part of Tolstoi and Lower Zapadni rookeries, resulting in the finding of several hundred pups. The count was not thorough, because such a count at this season of the year would work great damage to the rookeries.<sup>1</sup>

October 3.—The agent in company with two natives counted dead seal pups on the east side of Reef, finding 1,901; 7 dead cows and bulls were also found.

October 6.—Eight hundred and forty-nine dead pups and 3 dead cows were counted on Lukanin; 377 pups, 1 bull, and 1 cow on Kitovi.

October 11.—Northeast Point rookeries were counted for dead pups and 2,847 found. Owing to the heavy surf of the past few weeks, rookeries have been well washed and many of the dead pups carried to sea. At Halfway Point were counted 784.

October 23.—Dead pups were counted on Zapadni, between sand beach and Government watchhouse, and found to number, 2,143.

December 1.—Most of the rookeries are deserted by the seals. Those still remaining are very shy, taking to water easily.

December 2.—A few seals are on Tolstoi and Lukanin, none on Middle Hill. But few seals on Gorbateh and Reef. A number are on Sea Lion Rock, but they can not be reached.

December 11.—A few seals are in English Bay, but none on Zapadni, Tolstoi, or Middle Hill. None are on land on the Reef; a few in water.

December 12.—Natives returning from Northeast Point report a few seals in water but none on land there or at Halfway Point or Lukanin.

December 18.—Lukanin and Kitovi rookeries were visited, but they failed to show seals, either on land or in the adjacent water.

1895.

May 2.—Not a single seal has yet been seen on the island by anyone. The earliest arrivals are doubtless kept off by the barrier of ice which surrounds the island.

May 5.—The first seal, a bull, is reported hauled out on Zoltoi sands. He can not leave on account of ice.

May 9.—The bull from Zoltoi crossed over to Gorbateh Bay during the day and then over to east side of Reef, where he was in the evening.

<sup>1</sup>This is nonsense, but shows plainly why the condition of the rookeries was so little known.



May 10.—The lone bull seal departs.

May 14.—Natives returning from Southwest Bay report 20 seals in water near Zapadni; none at English Bay or Tolstoi. Two bulls hauled up last night on the Reef and 4 more this morning. Ice at Southwest Bay makes it impossible for bulls to haul out except at high tide.

May 16.—Natives were sent to Northeast Point and report about 20 killable seals in water and 6 bulls, 2 hauled up. The ice is in such a condition as to make it seem necessary to cut roads for them to haul. A force is sent to Southwest Bay; they cut 7 roads there. Similar work is done on the Reef and Gorbateh. Eight bulls are reported at Zapadni and about 50 bulls and bachelors in water.

May 17.—One bull on Kitovi and 2 on Lukanin are reported to-day.

May 19.—Two bulls hauled on Lagoon rookery during the day.

May 26.—“Killers” are seen on east side.

May 27.—Passes are cut in the ice at Northeast Point; 75 to 100 seals are estimated at the Point. Reports from Southwest Bay give 60 bulls at Zapadni; 8 bulls and 3 killable seals are at Tolstoi. Forty killable seals are reported from the Reef.

May 28.—A drive for food is made from the Reef and 79 killed.

June 13.—A drive was made from Tolstoi; 184 seals killed.

June 16.—Five cow seals reported at Northeast Point; 1 at Halfway Point; none at Lukanin.

June 18.—Not a solitary cow to be seen on the Reef.

June 20.—At Northeast Point 1,961 are killed.

September 2.—Judge Crowley visited Tolstoi, reporting an enormous number of dead pups.

September 5.—Hundreds of dead pups are reported on Reef.

#### RECORD KEPT BY THOS. E. ADAMS.

September 23.—The dead pups were counted on Lukanin and Kitovi, finding 854 pups and 7 cows on Kitovi; 1,347 pups and 8 cows on Lukanin.

September 24.—Scarcely any pups are to be found dead on the lower portion of rookeries, as they have been swept away by the surf.

September 29.—Dead pups were counted on the Lagoon. But 1 pup found adjacent to water's edge on account of surf. Total count—300 pups, 2 cows, 1 bull; 40 starving and dying pups were noted.

October 3.—Dead pups were counted on Sea Lion Rock—361 and 1 cow.

October 6.—Dead pups were counted on Halfway Point—1,748 pups, 1 cow; all the bodies were well back, the rookery being washed by surf. On Gorbateh, 1,514 pups, 7 cows, and 2 bulls were found.

October 8.—On Zapadni 4,860 pups, 13 cows, and 3 bulls were found west of sand beach; 371 pups and 2 cows east. On English Bay, 381 pups, 2 cows, and 1 bull were found; on Reef, 3,376 pups, 25 cows, and 8 bulls; on Tolstoi, 2,582 pups, 8 cows, and 1 bull.

October 10.—On Northeast Point 4,017 pups, 25 cows, and 4 bulls were found. Little Polovina had 222 dead pups and 1 cow.

November 11.—Examination of Reef, Lukanin, Polovina, and Tolstoi demonstrates the fact that the seals there are mixed bachelors, pups, and cows together, and hauled

well back from the water—a condition which it is said has never existed before to such an extent. The seals have seemed restless ever since my return to St. Paul on September 13. Whether this is due to constant disturbance during the summer and breeding season when they were constantly subject to daily scientific and photographic investigation can not be said positively, but such is believed to be the case. The counting of pups starved on the rookeries necessitates the driving off all the seals and is detrimental; it should be stopped.<sup>1</sup>

November 21.—No seals are on Halfway Point and Lukanin, and the outlook is not very cheerful.

November 22.—Few bachelors are on the Reef, and those present are mixed with cows and pups. A drive was ordered and 57 killed; cows outnumbered the bachelors in the drive.

November 25.—On Middle Hill is the only place where killable seals are to be found. The cows are leaving the islands.

November 26.—A drive from Reef resulted in the killing of 78 seals.

December 9.—Seals have left Lagoon on account of blizzard.

December 13.—No seals remain on the island; a few are in the water.

#### 1896.

April 13.—Native reports 1 bull seal landed on the Reef, the first seen this season.

May 5.—Two roads for seals were cut on the Reef; another bull has landed there.

May 7.—Six roads were cut at Zapadni; 6 bulls are reported hauled out at this rookery and many are in the water.

May 11.—Nine bulls are reported at Zapadni; 4 at Southwest Bay; 1 at Tolstoi; 16 at Reef; 15 at Northeast Point; killable seals are reported at Zapadni and at Northeast Point in the water, also about 60 on Sea Lion Rock. There are 2 bulls at Polovina.

May 13.—One hundred and twenty-one seals are killable for food.

June 1.—A dead cow is reported on Rocky Point, crushed by the ice.

June 5.—No cows have hauled as yet. About 700 bachelors and bulls are reported at Northeast Point.

June 14.—Five cows and 1 pup are on the Reef; about 200 bachelors on the end of Reef; 4 cows, 1 pup, and about 50 killable seals are out on Lukanin.

June 23.—A seal drive was made from the west side of Northeast Point and 1,414 seals taken; the following day the east side was driven and 1,408 skins secured.

July 13.—A drive was made from the east side of Northeast Point and 1,169 seals killed; the following day the west side was driven and 1,045 killed.

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<sup>1</sup>This is a mere expression of opinion, and as a matter of fact is an erroneous one. As the experiments of 1896 and 1897 show the seals do not mind such disturbance any more than they do being driven from the hauling grounds. The mixing of seals of various classes, as here noted, always occurs late in the season. See date of August 7, 1876.



## DAILY JOURNAL OF OBSERVATIONS,<sup>1</sup>

BY DAVID STARR JORDAN, GEORGE ARCHIBALD CLARK, AND FREDERIC  
AUGUSTUS LUCAS.

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1896.

The United States Fish Commission steamer *Albatross* steamed from Seattle at 9 o'clock a. m., June 24, having on board Dr. David Starr Jordan, commissioner in charge of the American fur-seal investigation; his associates, Dr. Leonhard Stejneger, Mr. Frederic A. Lucas, Capt. Jefferson F. Moser, Mr. Charles H. Townsend, Col. Joseph Murray, and Mr. George A. Clark, and Prof. D'Arcy W. Thompson, representative for Great Britain, and Mr. James M. Macoun, representative for Canada. The vessel reached Dutch Harbor, Unalaska, at 10 o'clock p. m., July 2, and after taking coal steamed, at 8.15 p. m., on July 6, for the Pribilof Islands, arriving at St. George on July 8 at 4 o'clock p. m.

JULY 8.

NORTH ROOKERY.

The members of both commissions immediately landed and visited North rookery, which is located near the village of St. George. This rookery, in the eastern part, lies on a narrow rocky beach at the foot of cliffs 50 to 75 feet in height, affording excellent opportunities for observation. Toward the western end the breeding grounds extend up the slope of the hill formed by the breaking down of the cliff.

A count of 23 harems made by Mr. Clark gave a total of 334 cows, an average of  $14\frac{1}{2}$  to each harem. The harems ranged from 56 cows in the largest to 1 in the smallest. In another part of the rookery a count of 18 harems by Dr. Jordan gave a total of 218 cows, an average of 12 to a harem.

The harems were well defined and carefully guarded by the bulls, which were constantly moving about their outskirts rounding up the cows. Occasionally a bull would dash through a harem scattering and trampling the cows in his haste to seize one attempting to escape. The size of the harem seemed not to depend upon the strength of the bull, small bulls having in some cases large harems while large bulls had small ones. Location seemed to be a determining element.

In the larger harems the bulls were more active than in the smaller ones, probably because more exertion was necessary. Bulls in neighboring harems were frequently seen to lunge at one another as if about to fight, but nothing came of it. The females,

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<sup>1</sup> Where not otherwise stated these notes are the work of David S. Jordan and George A. Clark.

for the most part, occupied their attention. The real fighting seen was among the unoccupied bulls, of which there were many holding positions back of the harems. A bull from a harem lower down the slope was seen to seize a cow and drag her down into his circle.

An effort was made to count the pups in the 23 harems already referred to, but it was difficult in many cases to tell to what harem scattering pups belonged. In many cases they were grouped in pods, playing among themselves like puppy dogs. In harems where an absolute count was possible, slightly more than one-half as many pups as cows were found. Including the pods, in certain cases they seemed to outnumber the cows. One outlying pod numbered 37.

The birth of one pup was witnessed from a distance. The little fellow was soon able to move about and in a few minutes was nursing. The mother passed her nose over the pup several times, uttering a noise like that of a sheep, shaking her head, but did not lick or otherwise help it. The old bull sat near by looking on without showing any interest. A number of fresh placentas were to be seen lying about in various places, giving evidence of recent births. No pups were seen to nurse except the newly born one. No dead pups were seen.

A considerable number of seals were constantly swimming to and fro in the water in front of the rookery. For the most part the animals seemed to be cows.

Messrs. Townsend and Miller photographed the rookery for the American commission. Mr. Macoun also photographed the rookery.

Dr. Jordan, Professor Thompson, and Colonel Murray remained overnight at the Government house, the others returning to the ship.

#### JULY 9.

Colonel Murray, Professor Thompson, and Treasury Agent Judge went early in the morning to Zapadni to witness the drive and killing there. Dr. Stejneger and Mr. Lucas spent the day in making a count of North rookery. Mr. Macoun remained with them and completed his photographs of that rookery. Dr. Jordan and Mr. Clark counted the cows and harems on East, Little East, and Staraya Artel rookeries, and Messrs. Townsend and Miller photographed them. Mr. Marrett photographed them for Professor Thompson. Captain Moser and Mr. Parmenter, from the *Albatross*, made hydrographic observations on North rookery.

#### NORTH.

The water being rough at the village, it was necessary to land at the end of North rookery in the runway up which the bachelors haul. At the approach of the boat a few of the bachelors hastened into the water, but the main flock remained undisturbed on the hillside above. The harems, which extended up to the edge of the runway, were prevented from stampeding by the bulls in charge, and several idle bulls along the water's edge, at the point of landing, showed fight and would not be driven off.

The count of North rookery was made by Dr. Stejneger and Mr. Lucas. A total of 1,413 cows in 78 harems were actually counted, and for 51 other harems bulls were counted and the cows estimated on the basis of the harems counted. The count and estimate give a total of 2,280 cows for the greater part of the rookery; but as the nature of the ground made it impossible to see all the cows, a correction seemed necessary, and, in the opinion of Mr. Lucas 3,000, and in that of Dr. Stejneger, 2,700 would

be nearer the correct figure for this rookery. This would give for this rookery a total of from 159 to 177 harems and from 2,700 to 3,000 cows.<sup>1</sup>

On comparison with Mr. Townsend's maps of last year, this rookery shows in several places a shrinkage. Compared with Mr. Tru'e's estimate of last year, the harems thus counted by us on North rookery show practically the same average. His total of 5,528 cows counted for 342 harems gives an average of about 18. The total of 1,413 cows for 78 harems gives an average of 18 also. (Lucas.)

The pups are podding, i. e. gathering in little groups away from the harems. From their number, one would judge that no cow failed of impregnation last season through lack of virility on the part of the bulls. A harem counted last night contained 43 cows; it contained the same number to-day and at least 40 pups. From their abundance it would seem that nearly all pups are born.<sup>2</sup> No dead pups are seen: 1 pup seen to nurse. (Lucas.)

One small harem was located in the path frequented by the bachelors in reaching their hauling grounds. A number of idle bulls, and some half bulls, were holding positions at the foot of the runway and others were hanging about the rear of the rookery; some were very bold. Many of the bulls were active and vicious. One charged 20 feet at an outlying idle bull. A bull lying at the top of the cliff, having a cow and pup, charged a considerable distance at Dr. Stejueger. Three bulls were observed to copulate; time, 6, 6, and 5 minutes, respectively. (Lucas.)

## LITTLE EAST ROOKERY.

Little East rookery is located on a surface strewn with blocks of boulder lava. It lies back on a gradual slope formed by the breaking down of the cliffs, which everywhere, between the rookery and the village, rise perpendicular from the water.

The following detailed count of harems and cows was made by Dr. Jordau:

*Detailed count of Little East rookery.*

2	78 (2)	2	3	6	1
16	9	7	10	30	10
3	4	20	9	2	6
40	8	5	24	60 (4)	

Total cows.....	355
Total harems.....	27
Average size of harem.....	13+

A duplicate count made by Mr. Clark gave substantially the same results.

A group of 78 cows contained 2 bulls, and another of 60 cows contained 4 bulls. These could not be separated into harems. The bulls seemed to have reached some sort of an understanding and were holding the females in common.

<sup>1</sup>The results of this count, when compared with that made on July 31 by Colonel Murray, in company with Mr. Lucas, which showed 225 harems, seems to give warrant for the belief afterwards arrived at, that the original counts on St. George were made before the rookeries had attained their maximum. The investigations of 1897, however, showed that the count late in July was still less reliable, the real status of the rookery lying somewhere between the two counts.

<sup>2</sup>Later it was found that the pups exceeded the cows two to one; but at this time the current notion that all, or practically all, the cows were present was shared in by us.

Fewer idle adult bulls were seen on this rookery than on North. Only two were noted, but there were from a dozen to fifteen young half bulls hanging about the rear of the harems.

The females seem to be a finer and larger lot than those on North rookery. Fewer pups were seen.

Passing by the hauling ground of Little East, from which the small group of holostiaki had stampeded into the water, a seal, either a cow or a bachelor, was seen lying in the shallow water, apparently in distress and unable to get on. It could not be reached for examination and nothing could be done.<sup>1</sup>

#### EAST ROOKERY.

The bowlder-strewn sloping shore extends from the beginning of Little East rookery all the way down to East rookery, about a mile below Little East, and seems to indicate that the two may have formed at one time one great rookery. East rookery begins with a few scattered harems just beyond the point. Its greatest mass of harems lies back on a gradual slope at the angle of the perpendicular rocky cliff, which is here resumed and continues along the eastern side of the island. On the narrow beach at the foot of this cliff the harems extend for a considerable distance, gradually fading out. From the brow of the cliff, 100 to 150 feet high, there is a good opportunity for observing and counting the seals.

The following detailed count of harems was made by Mr. Clark:<sup>2</sup>

#### *Detailed count of East rookery.*

6	7	3	5	1	3	8	3	11	10	24	8	5	11	32
29	5	20	11	5	15	2	3	5	6	4	1	11	7	12
16	5	15	11	7	23	6	1	15	18	22	17	18	27	5
38	7	7	2	11	29	11	3	1	8	1	17	20	3	15
22	2	1	5	8	2	3	8	7	19	3	18	5	1	1
2	1	7	7	5	7	1	15	21	15	5	39	12	7	9
5	5	6	10	9	1	20	3	8	15	23	15	5	15	2
7	31	14	1	27	23	2	25	9	1	10	5	15	32	3
1	22	5	15	14	2	1	11	4	38	15	20	12	6	36
6	1	3	2	15	24	7								

Total cows.....	1,584
Total harems.....	112
Average size of harem.....	11

Dr. Jordan's count gave 128 harems and 1,682 cows. The average of these two counts gives 135 harems and 1,634 cows, which is very near to the population of this rookery.

Eleven idle bulls were counted on East rookery. In addition to these were a number of bulls stationed along the water front, which were attempting to round up and form harems of passing cows.

<sup>1</sup> Later observations show that the animal was affected by a form of temporary paralysis due to fright. Several instances were noted while making the counts of pups in October. The animals always quickly recovered.

<sup>2</sup> It was found in 1897, when this rookery was more closely inspected, that a section containing in this season about 100 cows was omitted from the count for 1896. The section lay in close proximity to a hauling ground, and it was assumed without close inspection that no breeding seals were there.



A bull was seen to strike an escaping cow in the mouth; she, however, got away from him and ran down into the water. In two cases cows coming in from the water were seen to break away, after being held for a few moments by water bulls, and climb up the rocks to harems above, where they evidently belonged. They were probably cows which were returning from feeding.

Many seals here, as on North rookery, were seen sporting in the water, the light-colored bottom making their movements very distinct.

The hauling ground of this rookery now occupies a space of about two acres. The seal grass area behind would point to an area of fully 20 acres as once hauled over by the bachelors. A herd of 300 or 400 bachelors were lying on the hauling ground. Pups seem less numerous here than at North rookery.

Forty to 50 large sea lions lay sleeping on the rocks just out of the water. The seals lie about them and pass to and fro, apparently unnoticed by them and not noticing them. The sea lions look like great logs. When disturbed they roll into the water in a lumbering fashion, but soon haul out again. They are doubtless bachelors from the sea-lion rookery farther to the southeast on Tolstoi Point.

#### STARAYA ARTEL ROOKERY.

Staraya Artel rookery lies to the west of North rookery and about  $2\frac{1}{2}$  miles distant from the village. It occupies a limited shore line, rising into a rather steep slope by a succession of rocky shelves. The hillside breaks off into a perpendicular cliff on the western side and drops in a gradual slope down to a basin-like depression containing a small pond. On the rocky shelves of the beach the harems are well defined, but on the smooth slope above the seals are massed and the harems merge into one another without definite boundaries.

This rookery is a very difficult one to count. The very large number of idle bulls which occupy the slope behind make it impossible to closely approach the harems. In order to make any count at all it was necessary for one person to keep off the bulls while the other did the work. Then many of the harems on the shelves could not be seen at all, while at a distance the massed portion of the slope could not be separated into harems. A combination of the partial counts made by Dr. Jordan and Mr. Clark gave a total of 59 harems and 910 cows for this rookery.

The number of idle bulls on Staraya Artel rookery was unusually large and they were very fierce. Forty-five were counted. They were spread out over a considerable area of ground and were constantly fighting among themselves. Most of the fighting witnessed amounted to nothing more than a bluff. Two bulls would run at one another, lunge forward nearly touching each other, and then return to their stations. The number of scarred and bleeding animals, however, showed evidence of a great deal of actual fighting. The wounds for the most part were upon the scalp, the breast, or at the angle of the fore flipper with the body, this latter seeming to be a favorite place of attack.

One of the idle bulls, crowded too near the harems by our approach, made a break for the sea through the rookery. He was immediately attacked by the harem masters, escaping from the clutches of one only to be seized by another below. Sometimes two had him at once. He was passed along through the whole line of harems until finally he was thrown over the cliff into the sea at the foot of the slope. Great confusion was created in the harems by the fighting, but no general stampede occurred. Each bull soon had his cows rounded up and forced into quiet.



One dead pup partly eaten by the foxes was found on the path toward the village at some distance from the rookery. It may have been driven off by the foxes and killed, or dragged away after dying from some other cause, but the body was fresh.

This rookery shows shrinkage more clearly than the others. The whole area occupied by idle bulls has evidently been within recent times covered with breeding seals.<sup>1</sup> Beyond this area there is a region covered with seal grass which marks an earlier abandonment. The area of the rookery is about one-eighth to one-tenth its former extent.

The same evidence of shrinkage is to be seen in the hauling ground which lies at the foot of the slope and back toward the little lake in the basin. There are 300 or 400 bachelors asleep on the hauling ground. As they lie there stretched out they suggest the appearance of the killing ground before the village. The hauling ground, as now occupied, is but about one-tenth its former area.<sup>2</sup>

Professor Thompson, on his return from Zapadni, displayed a handful of buckshot which had been taken from the bodies of seals at the killing there.

#### JULY 10.

The day was unsuitable for photographing. Dr. Jordan, Professor Thompson, and Colonel Murray came on board and the *Albatross* steamed round to Zapadni with a view to landing and counting that rookery. It was not possible to land and the ship anchored to await the following morning, it being desirable that this rookery should be counted and photographed, if possible, before leaving for St. Paul Island.

#### JULY 11.

A landing was made at Zapadni in the morning and the rookery counted. At noon the photographs were taken. In the afternoon the *Albatross*, with all on board, steamed for St. Paul, arriving at 6 o'clock in the evening.

#### ZAPADNI ROOKERY.

Zapadni rookery lies on the western shore of the island,  $5\frac{1}{2}$  miles distant from the village. It occupies a long sloping hill which breaks off into a cliff on its seaward edge. It resembles in this respect Staraya Artel rookery. The harems were massed upon the side of the hill, on the bench-like plateau at its foot, and on the shingle of the beach beyond the slope. In the latter place they lie in two detached groups.

The present area of the rookery seems to be roughly about one-tenth what it once was. Compared with Mr. Townsend's maps of last year, all three sections of the breeding ground show decrease, the southernmost end showing the most. The north and middle sections do not now come above the upper limit of the beach. The decrease of this rookery is even more marked than that of Staraya Artel.

<sup>1</sup> Later observations showed that this area was regularly occupied by the cows and pups as they hauled back after the breeding season.

<sup>2</sup> It was found later in the season that the bachelors shifted much upon the hauling grounds, and so the abandonment in territory can not be taken as a direct measure of the reduction of the bachelor herd, as a few seals can denude a considerable area of ground in a short time if they move about over it.

The southern part of the rookery was divided into three parts. The bench itself was counted by Mr. Macoun and Dr. Stejneger. Twenty-five bulls with harems and 500 cows were found. The slope was counted by Dr. Stejneger, and contained 10 harems, 160 cows. The beach below could only be estimated, and was placed by Dr. Stejneger and Mr. Macoun at 40 harems, 600 cows. Messrs. Macoun and Townsend counted the middle part, finding 36 harems and 450 cows. The northern portion was counted by Dr. Jordan, Professor Thompson, and Colonel Murray, their counts being respectively 298, 312, and 263 cows. Mr. Townsend counted 29 harems; Professor Thompson 32.

For the whole rookery, combining these results, there were found to be 143 harems, 2,006 cows, an average of slightly over 13 per harem. A record of individual harems was not kept on this rookery. The count was necessarily imperfect and unsatisfactory.

The number of idle bulls on Zapadni was unusually large. Between 150 and 175 were counted, the greater part being behind on the slope of the hill, and apparently indicating a greater falling off in the southern portion. The idle bulls here, as on Staraya Artel, were very bold and quarrelsome. They could scarcely be made to move. One fellow held his position, and even charged up the hill at us, though repeatedly struck with stones. While the photographing was in progress a bull charged at the camera, which had to be abandoned and was rescued with difficulty. On this rookery, as on Staraya Artel, there are apparently twice as many bulls as needed. It would be well if half of them were shot.

Among the outlying bulls was seen one of the largest and best looking on the rookery. The success of a bull in securing a harem evidently depends more upon favorableness of location than upon fighting qualities. Bulls near the water have the best chance. The incoming cows are taken by them or absorbed by other harems before they reach the rear where the idle bulls are. If the idle bulls get cows they must steal them.

Many attempts to steal cows were witnessed. None seemed to meet with success, so far as the idle bulls were concerned, though one instance was noted where a bull in a harem lower down the beach stole a cow from the harem above and transferred her to his own.

Every commotion among the seals is the signal for numerous fights. The bulls usually roar and blow out their breath in a threatening manner before biting. They have a wholesome dread of each other's teeth.

Two half-bulls, each alone, were seen on the top of the hill at a considerable distance from the rest, probably driven off. Occasionally a half-bull attempts to break through the harems. But woe to the one attempting it. The harem masters make common cause against him, and he is lucky if he gets away to the sea with his life.

Many of the bulls on Zapadni show scars, evidence of fights they have been in. One pretty cow was seen with a badly bitten shoulder. One unlucky bull lay near by with several bad cuts. A bull with a single cow seized and shook her, making a cut in her neck apparently 6 inches long.

One female pup, an stray, very feeble, was found on the crest of the hill above the rookery. Many bones of pups lay just inland of the northern section of the rookery. Pups were numerous and podding. One dead pup lay at a distance from

any harem, probably drowned and washed up; it was gnawed by the foxes. One dead and one living pup were found in another spot at a distance from the rookery, probably carried away by the bachelors.

The yearling bachelors are to be seen in little pods of half a dozen or so. They appear to be as much afraid of the idle bulls that fringe their hauling ground as of men. All the bachelors, large or small, are timorous and flee from man, as well as from the bulls. Where the bachelor yearlings are at a distance from interference they play among themselves like little dogs, rolling about and biting each other, squealing when bitten. They compare with dogs of the same age much as Aleuts do with white children. There is not much intelligence, flexibility, or *savoir-faire* about them. In like manner the big, senseless, howling bulls compare to great, lusty boys. Similar comparisons might be made for the 2-year olds, which are bigger than the yearlings—nearly as large as the cows. Cows are females of 3 years or more. Half-bulls are males of 4 or 5 years.

In our efforts to count the harems it frequently happens that a herd of bachelors will be startled, but on crouching down they soon become quiet. They seem not to have good eyesight, but their sense of smell is more acute,<sup>1</sup> and if you are on the windward side they become excited at much longer range, and when startled seldom stop until they reach the sea, if the way is clear. They behave much as a flock of sheep would. Sometimes they watch you with curious, but ineffective intelligence, behaving like squirrels. One good-natured, sleepy bull was disturbed by the commotion and awakened yawning and bleating in a high-pitched tone like that of a cow.

One case of copulation was seen.

Yellowish excrement, apparently voided by bachelors, was seen on Zapadni rookery in two places outside the harems.

#### PRELIMINARY CENSUS OF ST. GEORGE,<sup>2</sup>

We may here summarize the results of the foregoing counts on the rookeries of St. George as follows:

Rookeries.	Harems.	Cows.
North <i>a</i> .....	168	2,850
Little East .....	27	355
East .....	135	1,634
Zapadni .....	143	2,006
Staraya Artel .....	59	910
Total .....	532	7,755

<sup>a</sup> An average of the estimates of Dr. Stejneger and of Mr. Lucas, the former estimating 159 harems and 2,700 cows; the latter 3,000 cows, which would increase the harems to 177.

#### JULY 12.

Landing was made at St. Paul Island during the morning, Colonel Murray taking up quarters at the Government House, the others at the company's house. In the afternoon Dr. Jordan and Mr. Clark made a partial count of Kitovi rookery.

<sup>1</sup> Subsequent observations lead us to doubt the reported superiority of the sense of smell in the seal. It is probable that from the windward side the sense of hearing and of smell both are quickened.

<sup>2</sup> These figures were considerably altered after completing the census in St. Paul.

## KITOVI ROOKERY.

This rookery lies on the eastern side of the island about half a mile from the village. It begins with a few scattered harems along the bowlder beach of Kitovi Bay, widening out at the point where the seals lie on the broken lava columns. The space to the northward is very irregular, with numerous cross ridges. At the northern end it spreads out into a broad amphitheater-like slope. A sharp ridge of rocks forming the angle of Lukanin Hill separates it from that rookery. The two rookeries are really one large breeding ground.

The hasty count made showed 174 harems with 2,510 cows. A more accurate count will be made later.

JULY 13.

Dr. Stejneger and Mr. Lucas spent the day in making a count of Kitovi rookery. Colonel Murray counted breeding bulls on this and Lukanin rookery. Mr. Townsend and Mr. Miller photographed Kitovi, Lukanin, and Gorbateh, Mr. Townsend making a count of the cows on that part of the Reef commonly known as the "slide." Dr. Jordan and Mr. Macoun counted the cows on Lagoon rookery from a boat. In the afternoon Dr. Jordan and Mr. Clark visited Gorbateh.

The weather was characterized by moderate westerly winds. The sky was cloudy, with light rain and fog at intervals in the afternoon. Temperature, 42; barometer, 29.90.

## LAGOON ROOKERY.

This rookery occupies the middle portion of the rocky spit which projects from the cliffs of Tolstoi Point and shuts off the entrance to the salt lagoon except for a narrow channel. The waterworn bowlders are piled up in a ridge, probably in large part by the action of the ice. On the seaward slope of this ridge most of the harems are located. A few lie on the flat behind, at the top.

The following is the detailed count of Lagoon rookery by harems:

*Count of Lagoon rookery.*

2	12	3	2	17	8	11	27	29	7	30	11
15	11	10	8	10	17	12	12	2	3	64	12
13	24	12	13	4	12	5	10	15	8	40	4
15	10	15	10	15	8	1	25	5	6	1	1
4	20	21	8	10	18	20	2	5	14	20	2
6	7	16	3	45	2	3	7	20	10	32	14
6	5	24	18	38	20	10	10	42	6	7	5
11	7	10	10	15	20	15	27	4	19	19	18
20	8	15	3	1	8	1	1	1	1	13	19
14	2	12	8	3	19	1	7	10	13	6	6
Total cows .....											1,474
Total harems .....											120
Average size of harems .....											12.3

There were very few idle bulls on this rookery, and as a result but little fighting. A small pod of bachelors are hauled out on the lagoon side of the ridge. They either come around through the narrow channel or else cross over at the foot of the cliff, where the harems fade out. The rookery is not accessible for driving and no seals are taken from it.



The cows are almost as cowardly as the yearling bachelors. They run away from their pups without scruple unless prevented by the bulls. They also show a disposition to bite and maltreat strange pups that come within their reach. They show no fondness for nor care of their young. No dead pups were seen on this rookery.

A bull was seen to take a cow by the hind flippers and carry her a considerable distance. She was afterwards rescued by the bull in the harem to which she belonged.

#### GORBATCH ROOKERY.

A visit was paid in the afternoon to Gorbateh rookery by Dr. Jordan and Mr. Clark, but no attempt at a count was made.

The rookery lies along the southeast side of the bay of Zoltoi. Beginning a short distance beyond Zoltoi sands, the harems are situated on the boulder beach at the foot of cliffs which rise to the height of 20 or 30 feet, topped by grass-grown sand dunes. This cliff breaks down later on in a long rocky slope, which shades into a slope of lava rocks in place, and again into a long cinder slope which rises to the plateau of the parade grounds above. On the westward side this cinder slope is abruptly terminated in perpendicular cliffs. The harems are scattered about among the rocks and massed along the foot of the cinder slope.

Among the sand dunes at the top of the cliff and all along the cinder slope to its top were many idle bulls. By using care and stones it was possible to make a way through these bulls, and thus get a view of the harems as they lay massed at the foot of the slope.

One or two bulls with single cows were just in the rear of the regular harems. These were evidently idle bulls that had stolen cows. The idle bulls were mostly asleep. When disturbed they lunged at one another as though to take revenge for being disturbed.

An idle bull was seen to seize a pup and carry it several yards up the slope. The master of the harem to which it belonged started after him and made him drop it. The pup walked about in a bewildered sort of a way, but would probably get back to the harem. Six dead pups were seen scattered along the slope well up among the idle bulls. They had probably been carried away by the bulls or crushed in their struggles while straying among them.<sup>1</sup> One lone pup was seen to wander up the hill in the wake of a flock of bachelors. The cows pay no attention to the pups, but let them stray where they please.

It is more and more evident that the seals have little fear of man when he is not in motion or is moving in a stooped position. When you lie down they can not tell you from the rocks. When you stand up against the sky line and move about they are confused and afraid.

#### ARDIGUEN ROOKERY.

On Ardiguen one unlucky yearling male is seen to invade a harem and get routed out by the hoarse and furious old bull. The young bachelors seem to be a little slimmer than the cows of the same size, but it is hard to distinguish them. Even the cows strike at the young bull. "One doesn't know boys," they seem to say. The

<sup>1</sup> Later observations seem to point to the fact that these were pups, sick from *Ucinaria*, which had crawled out of the harems to die.



yearling is afraid to go off alone, though every bull he comes near chases him and bellows at him. It may be that the young male was born in this rookery and instinct brings him back to the spot. He is fast learning that it is a place where he is not wanted.

A big, greenish-backed female in the harem in the head of Ardiguén tries to run away, but the bull seizes her by the neck and beats her nose against the rock till it bleeds. He dragged her back into the harem by main force. She bites him in the neck, but has to submit. Sex equality is not the rule here. She remonstrates and the bull scolds. The cows and bulls seem to converse mouth to mouth.

The breeding ground<sup>1</sup> on which the above observations were made consists of a small group of isolated harems, 27 in all, this season, containing 652 cows, as counted by Mr. Townsend on July 13, which lie in a particularly favorable location for observation. The harems are scattered along the rocky beach for a distance of several hundred yards. Near the southern extremity a gully leads up and back to the level of the hauling ground of Reef rookery. In the gully itself and on the flat about its mouth are a number of harems. At the side of the gully toward Gorbatch the cliff rises to a considerable height and overhangs these harems, affording a view at close range without disturbing the animals.

Pups and cows seem to be present on this rookery in equal numbers. The pups are podding back from the harems in the massed portion of the slope.

On the level above the slope lies a bull which has been dead for some time. He is too far decomposed to permit of examination as to the cause of death.

#### GORBATCH.

A few half bulls and bachelors are on the level parade ground above the cinder slope. In early times the space used to be covered with them crossing over and back between the Reef and Gorbatch. They are seldom seen to cross now.

Whole harems of seals are to be seen stretched out sleeping. Some lie on their backs with their flippers folded up. Others lie on their bellies with their flippers folded under them. Still others with their flippers stretched out on either side and behind. They have as many attitudes as a dog on a hot day. Occasionally a cow or a bull is to be seen asleep, sitting up with head thrown back and nose in the air. Others hang limply over rocks, with heads hanging down.

The idle bulls are a fine lot. The younger bulls are grizzled on the back of the neck. In another stage they are black with brownish edgings. The oldest bulls show the brownish mane, or even the whole body a buffalo color. Occasionally one has a shade of warm yellow.

The cows are all shades of dove color, mouse color, dark brown, silvery gray, and warm brown. There is much less variation in size among them than among the bulls.

#### DR. STEJNEGER'S NOTES ON KITOVI ROOKERY.

Beginning at photographic station 12, at the boundary line between Lukanin and Kitovi rookery, Mr. Lucas and myself spent the day in counting the cows by harems around to Kitovi Point. Beyond the point it was found impracticable to

<sup>1</sup>From the frequency of our subsequent observations on this territory a separate name was afterwards given to it—Ardiguén, the Aleut name for "a pile of stones." This name is here used in substitution for the local name the "Shde."

count the cows, and the 14 harems in this space were estimated on the basis of the harems in which the cows were counted, giving a total of 243 cows. One hundred and sixty-eight harems were found by actual count to have 2,909 cows. The total of the rookery would therefore be 182 harems with 3,152 cows. Following is the detailed count by harems:

*The actual count on Kitori rookery.*

25	85	14	30	8	25	60	30	3	4	7	15	10	48
2	11	24	21	2	12	10	1	17	32	13	30	1	10
3	1	2	12	3	35	2	17	72	16	30	3	4	25
6	2	55	25	2	45	21	7	12	11	20	7	18	9
36	6	1	51	16	58	25	6	60	24	3	30	19	14
1	1	12	20	1	24	5	20	25	12	15	21	9	2
17	4	13	20	25	14	9	20	3	1	10	15	2	24
7	2	2	10	5	50	10	10	4	3	2	40	35	3
4	21	51	3	7	12	9	36	20	14	6	23	47	43
16	16	30	6	34	14	5	25	2	13	2	1	46	3
20	4	60	30	30	1	20	4	15	18	20	10	1	15
35	17	15	1	20	1	39	11	1	18	25	10	17	17

Total cows (counted).....	2,909
Total harems.....	168
Average size of harems.....	17.3

In the rear of the rookery 53 old bulls without harems were counted. There were in addition 30 males which might be classed as half bulls, mostly 5-year-olds.

Two dead pups were observed; one on a flat rock near the water and some distance from any harem. It was wet, and had probably been drowned. The other was lying among the cows of a very large harem (60 cows), and, judging from the treatment another newly born pup received from these cows, it seems probable that the dead one was killed by them. The newly born pup was roughly shaken by 2 cows. At one time the cows had the little thing above the ground, each holding an end, and both trying to pull it to pieces. It afterwards got away and toddled off. No dead pups were observed on the bluffs or slopes behind the rookery.

The rookery seems to be at its fullest seasonal capacity. Nearly all the cows have pups. Two were seen with placenta attached, showing recent birth. The mother of one of these made an effort to bite off the umbilical cord. Some wet cows were seen, and some were going into the water. Young bulls were trying to intercept these, and pursued them a short distance in water. Some cows were noticed teasing bulls. Two bulls were seen to copulate. One young bull (5 years?) held a single cow on a path at some distance above the rookery. It is apparent that were old bulls lacking there are plenty of young bulls ready to take their places.

One young bull was seen with patch of skin 4 by 6 or 8 inches torn off the flank. In front of the isolated rock pile—photo station 14½—were many bones of pups and a number of dried bodies.

Fighting was very common in the rookery, some old bulls being very vicious. One old bull with a single cow had his jaw injured so that left canine projected forward. Another bull also with a single cow had an injured jaw.

Compared with Mr. True's count on July 8-10, 1895, it appears that there are to-day 512 more cows on this rookery, and 28 more harems, while the number of cows

<sup>1</sup> To this must be added the 14 estimated harems, bringing the total up to 3,152 cows, and 182 harems.

per harem averages nearly the same (a little over 17). It is probable that this does not necessarily indicate an increase in the number of cows. Mr. Townsend states in the report of 1895 (pp. 30, 34) that the usual number of seals had not appeared at the customary time of commencing the photographic work—about July 10, the date at which the count was made—and that “a correction is to be applied for a moderate number of females not on the rookeries at the time.” I was myself present early in June, 1895, and the season was backward<sup>1</sup> and the females later than usual in arriving. On June 25 I found scarcely 3 females to every bull that had landed. That the conditions were different at the time Mr. True made his count is also evident from the fact that he “found the percentage of young to be 62 on July 9,” while to-day it is 90 to 100.

#### JULY 14.

Dr. Jordan, Dr. Stejneger, and Mr. Lucas counted the Zapadni rookeries and Tolstoi, going over in the whaleboat of the *Albatross*. Professor Thompson and Mr. Macoun photographed the rookeries, as did also Mr. Townsend. Colonel Murray counted harems on Reef and Gorbatch.

The weather was fair; the sky overcast with light clouds and haze in the morning; gentle westerly breezes; some fog in the afternoon when the wind shifted to the north; temperature, 43; barometer, 30.

#### ZAPADNI ROOKERY.

There are three distinct patches of rookery ground which go under the name Zapadni. Usually two divisions are all that are noted, Lower and Upper Zapadni, the latter including the two patches that extend along the shore of English Bay. It seems best that each section of this great breeding ground have a separate name, and accordingly we have called the larger section Zapadni, the section immediately to the south of Southwest Bay, Little Zapadni, and the lower portion Zapadni Reef.

Zapadni is by far the largest of the three sections. Beginning where the cliffs break down just below Zapadni Head, it extends along the convex shore to the sands of Southwest Bay. Back of the usual abrupt shingle beach the breeding ground extends up a very gradual slope, broken by many rocky ridges with intervening gullies, and occasional basin-like flat sandy areas.

On account of the great irregularity and width of the area occupied by the seals it was difficult to make a count of this rookery. The count was made from the water, in the whaleboat, by Dr. Stejneger and Mr. Lucas, assisted by Dr. Jordan. Afterwards an attempt was made to verify the figures from the rear of the rookery on land, but it was found impossible to do anything on account of the broken ground and the presence of many idle bulls. The figures for this rookery are necessarily therefore only approximate. Only harems were counted, no count of the cows being possible.

The total number of harems counted in Zapadni rookery was 583. The rookery ground nearly enough resembles that of Kitovi to make the average size of harem for the latter rookery applicable here. This would give to Zapadni of St. Paul a total of 10,085 breeding cows.

<sup>1</sup>The ice hung about the islands till late May. Passes had to be cut for the seals to haul through.

Many idle bulls were seen along the water front, and the slope back of the harems was full of them. A complete count of these bulls was not attempted. Fifty were noted in a single gully. In another gully 43 were counted. The number on the whole seemed nearly equal to the number of occupied bulls. The bulls were very active and savage. Some were seen fighting in the water. A bull was seen standing with his weight on one flipper across an opening between two rocks. He must have had astonishing strength in his carpal bones.

Many straggling bulls with small harems of one and two cows lie inland at the back of the rookery. These must be stolen cows. Fresh arriving cows are taken into the harems near the water. One wet cow was seen in one of the water-front harems. She had probably just landed.

A bull was seen to steal a cow and carry her back at least 15 yards, fighting off the owner of the cow and another bull. Another bull was seen to seize a cow in a similar manner and carry her back to the harem from which she was trying to escape. Still another cow was seen to be carried a distance of 20 yards. Her pup was left behind. The harem from which she was taken originally contained two cows. While the bull was fighting to regain possession of the stolen cow, another bull attempted to steal the remaining one. The second attempt was unsuccessful, and the bull would probably have regained the first cow if he could have carried on the two battles at once.

The cows and bulls seem to be very active to day.

Numerous pieces of excrement were seen at the back of the rookery on ground occupied by idle and half bulls.

The pups were numerous. Five dead ones were counted—probably trampled to death. Pups are less liable to be trampled upon on the rocks than on the sand. The seals seem to get around more surely on the rocks than on flat areas, or rather they probably go more slowly and exercise greater care.

The bachelors haul out in a runway near the middle of the rookery, and small bands were seen in the rear of the rookery. The great hauling ground for this rookery is, however, at the angle of Southwest Bay sand beach. Here there was a large pod of bachelors.

#### LITTLE ZAPADNI ROOKERY.

A sand beach of about 300 yards in length separates Zapadni proper from the next section of breeding ground known as Little Zapadni. It resembles, in form and character of surface, Zapadni itself, but the slope is a little more steep, and there are no gullies or sand flats. The whole slope is thickly set with angular bowlders.

This rookery could only be counted from the boat, but the opportunities for seeing the whole ground were good. The total number of harems counted was 210, containing 2,400 cows. The seals are not so thick here as on Zapadni, and the harems are smaller. The conditions more nearly correspond to those on the Lagoon.

The hauling ground of Little Zapadni is at the angle where the bluff slope of this rookery joins the reef or rocky spit on which the final section of rookery ground on the north shore of English Bay is located.

#### ZAPADNI REEF ROOKERY.

This section, called Zapadni Reef, is just like the Lagoon in its formation. A rocky spit cuts off what was once a lagoon, now dried up. The harems are strung



along this reef in seven patches of varying sizes with vacant intervening spaces. There were last year two additional patches forming the extremities of this breeding ground. These have disappeared, showing a positive shrinkage. The total number of harems was 176, with 2,256 cows. The count here was very accurate, as the entire width of the rookery was visible from the water.

Following is the detailed count by harems:

*Count of Zapadai Reef.*

3	5	1	5	1	9	29	22	29	2	20	6	2	7	17
9	5	3	2	34	43	7	16	9	11	51	16	2	3	1
14	24	15	2	13	1	1	16	15	2	26	2	16	25	8
69(5)	5	10	28	2	5	1	6	1	37	11	6	11	13	20
2	18	12	18	1	43	1	7	10	45	1	9	7	16	35
17	15	13	18	2	17	20	21	6	35	3	22	4	3	43
2	1	1	14	18	15	25	1	16	10	7	32	30	7	10
18	10	1	1	1	1	1	2	11	9	16	6	9	21	11
7	7	14	34	3	1	9	1	20	9	36	14	8	9	25
49	10	24	5	15	17	11	3	5	8	1	54(6)	9	20	5
20	27	1	2	23	3	5	1	1	21	17	12	3	3	1
7	17	18	15	50(3)										

Total cows.....	2,256
Total harems.....	176
Average size of harem.....	12.8

At the terminus of Zapadni Reef is a large hauling ground for this and probably for the greater part of the bachelors from Little Zapadni, known as English Bay. At the foot of English Bay and about midway between Zapadni Reef and Tolstoi, is the hauling ground on the sandy slope of Middle Hill. The seals cross the sands of English Bay and climb up, lying among the bowlders near the summit of the hill. This is probably a hauling ground frequented by bachelors from all the rookeries about English Bay.

#### TOLSTOI ROOKERY.

In the afternoon Tolstoi rookery was counted. This rookery lies in three well-defined areas. Beginning at the angle of the shingle beach with the sands of English Bay a great wedge-shaped mass of seals occupies a sand flat extending back to the edge of a rocky slope and running for a considerable distance parallel with the shore. Rising from the rear of this is a steep slope of great extent covered with large angular bowlders. Above and back of this slope is the great hauling ground of the rookery, to reach which the bachelors have to haul out on the English Bay sand beach and pass around the end, coming in at the rear. This slope is bounded to the westward by a steep ridge which comes down to the water's edge, and beyond which the harems lie along the shingle beach at the foot of the perpendicular cliffs.

On the sand flat of Tolstoi the seals are more closely massed than on any other rookery seen; they swarm like bees. The bulls among them are rampant and savage, continually fighting. No doubt many pups are crushed on this space.

On account of the massed condition of the seals on the lower part of Tolstoi only the harems could be counted. This was done from the whaleboat, and the number on the sand flat and the area of rocky slope behind it was found to be 389. Applying to this the average harem of Kitovi, which is low for this rookery, we have 6,729 cows.



Under the cliffs in the part of the rookery near Tolstoi Head the cows and harems were counted from the boat and afterwards more accurately from the cliff above. There was found a total of 108 harems, with 1,498 cows, an average of 13.8. This sort of rookery ground corresponds to that on Little Zapadni, Lagoon, and Zapadni Reef, and the average harem runs about the same size. Following is a detailed count by harems made by Mr. Lucas from the bluff behind:

*The count of the cliff portion of Tolstoi.*

27	2	36	53	41	4	15	12	8	9	13	18
11	7	7	1	11	18	15	1	20	1	33	1
23	24	22	1	22	33	21	28	45	31	5	1
18	19	23	12	2	2	1	1	4	15	4	9
12	14	9	7	17	8	5	7	1	8	1	54
9	1	8	11	27	21	19	11	9	24	33	3
23	6	19	18	10	20	5	2	2	9	15	3
18	22	11	4	11	28	16	7	11	28	16	7
4	1	17	2	7	1	21	16	1	11	14	25
Total cows .....											1,498
Total harems .....											108
Average size of harems .....											13.8

There is a great excess of idle bulls on the main part of Tolstoi rookery, the rookery itself having diminished. Mr. Townsend has very appropriately said: "Our rookeries are crowded with surplus male seals, useless for any purpose except to make sole leather." There were only 19 idle bulls on the section at the foot of the cliffs, but there was hardly room for more. Behind the main part of the rookery were many savage idle bulls. They prevented us from reaching the crosses painted up last year, none of which are reached by the seal masses this year.

The thinning out of this rookery since last year is evident, whether compared with maps or photographs, and the greatest reduction is shown at the northern end toward the sand beach.

About 100 bachelors were hauled up in the rear of the rookery; another hundred were hauled up on Middle Hill, and a third lay between the hill and the water.

The sand flat is literally black with pups. The pups are also thick on the side of the cliff. It is surprising up what cliffs the seals will climb to reach coveted places. They are to be found located on apparently inaccessible shelves far up the cliff. The females on the sandy area are as densely massed as they can be. The bulls can be counted, but not the cows. The bulls are quarrelsome, stepping on the pups and plunging about through the harems on the slope of the hill more recklessly than on any other rookery. Two dead pups were seen.

Where a rookery can be more or less definitely extended inland, or up a hillside, there is room for idle bulls to accumulate about the rear. Where the rookery is hemmed in by a cliff and is incapable of extension there are few idle bulls, as all cows are appropriated by the two or three lines of bulls between the cliff and the water.—(Lucas.)

A young bull was seen to dodge and fight his way past three harems, whose bulls pitched into him. He was bitten on shoulder and hip, but succeeded in reaching an elevated position in the rear of the harems.

## ARDIGUEN.

Mr. Clark visited Ardignen rookery and mapped out certain harems for special observation, making the following notes:

The seven harems so designated are known in order as A, B, C, D, E, F, and G. The first three are located on the level ground at the mouth of the gully. The others follow in order below.

A contains an active bull, not very old, with 7 cows. One is a large gray cow with a greenish tint in her coat, due probably to sea water. The bull is now talking reassuringly to the cows who were alarmed when first approached. He has a severe wound at the angle of his left fore flipper with the body. There are 4 pups in harem A. A pod of 16 pups are playing on the rocks between A and B. There are 3 more on the rocks above A.

B is a larger harem. It contains 24 sleepy cows. There are 9 pups in the harem, 3 below and 21 playing between this harem and C. The bull in B is larger and browner than the one in A.

C is a big harem on the flat rocks. The big black bull is very uneasy about a young 2-year-old bachelor whom A and B drove into his circle at the time of our first visit to this spot, on the 13th, and which is apparently hanging about.

Every time the big bull gets his eyes on the bachelor he dashes after him, but his attention is soon taken up with one or another of his many cows and the young fellow settles down in a different place in the harem. It is extremely difficult for me to pick him out among the cows, but the bull has no such difficulty. The cows snap listlessly at him and he is in a restless state most of the time, but seems unwilling to get away.

There are 42 cows in harem C, with perhaps another cow hidden. The bull has been taking a nap; he wakes with a roar and the little bachelor crawls over the cows, who snap at him. When the bull is quiet, the bachelor is also. The 2-year-old crawls into the upper part of harem D and the cows all bite at him till he perches on a flat rock alone out of their reach.

There are about 25 pups asleep in C. Some are nursing. D contains a big brown bull with a long mane; 30 cows are with him and about 25 pups are scattered among them. Thirty-four pups form a pod between D and F, next to E.

E has 10 cows and is a younger bull of domineering disposition. Nine pups are asleep, nursing or scratching their ears, in E.

F contains a big bull with 4 cows, nearly out of sight, as is also G opposite him with 16 cows. Four pups are about F and 20 about G, also 1 lone cow in the rocks asleep. A cow tries to leave G and go to sea; the bull seizes and carries her back bodily.

*Summary of the typical harems on Ardignen.*

Harem.	Cows.	Pups.
A.....	7	23
B.....	24	36
C.....	42	25
D.....	30	25
E.....	10	9
F.....	4	4
G.....	16	20
Isolated pod.....		34
Total.....	133	176

Some of the pups<sup>1</sup> must have come up from the rocks below.

## JULY 15.

Dr. Jordan, Dr. Stejneger, Professor Thompson, Mr. Lucas, Mr. Clark, and Captain Moser and Mr. Parmenter, of the *Albatross*, accompanied Treasury Agent Crowley on the drive from the Reef. During the forenoon Dr. Jordan and Mr. Clark

<sup>1</sup>When the count of live pups came to be made later on, it was found that the disproportion between cows and pups was due to the absence of the former at sea.

visited Ardignen. Mr. Townsend photographed Polovina rookeries and Colonel Murray counted harems. Mr. Townsend made a count of the cows under Polovina cliffs. Dr. Jordan visited Lukanin in the afternoon.

#### THE DRIVE FROM REEF HAULING GROUND.

We left the village at 2 o'clock in the morning. It was then light enough to make one's way without difficulty. After a few minutes' walk we reached Zoltoi sands, a beach about one-fourth of a mile from the village, at the angle of which the bachelors from Gorbatch rookery haul out to reach the rocky slope above. The drivers ran in quickly between the seals and the sea and soon had the animals rounded up in a large pod. From a similar hauling ground on the shore just across the neck of the peninsula another pod was in like manner rounded up. The two pods combined were left in charge of three men to be driven across the sands to the village killing ground, a few hundred yards beyond.

We then proceeded to the extreme point of the Reef peninsula. The hauling ground of Reef rookery lies in the rear of the breeding ground and has four well-marked runways connecting it with the sea, on which no harems are located. A line of idle bulls keeps clear a considerable space between the hauling ground and the rookery. From the head of the various runways and in the intervening space pods of sleeping bachelors were rounded up, the Aleuts passing between the idle bulls and the bachelors and turning the latter up the bank to the flat parade-ground back of the hauling ground. Here the pods were all united in one large group and the drive started on its way. It was 3 o'clock when we reached the point and by 3.30 the drive was in motion.

After passing over a short space of ground, scattered at wide intervals with irregular boulders and having a gentle slope, the drive came into the level grassy plain of the parade ground. Here the herd, which numbered about 1,500 bachelors, was separated into two parts for greater ease and safety in driving. While one pod was allowed to rest the other was driven slowly forward in the direction of the village. Three men were now assigned to each pod and the rest of the drivers allowed to return to the village to make ready for the killing. We followed the first herd.

Over the green turf of the parade ground the drive moved along quietly and without difficulty. The drivers took their positions one on each flank to repress any lateral movements and the third brought up the rear. There was no noise or confusion. In general the seals were allowed to take their own time and go at their own pace. Those in the advance acted as leaders and the rest of the flock followed naturally after them. At the beginning the seals showed some reluctance in leaving their hauling grounds and made ineffectual attempts to break away. But after the drive got under way they moved forward apparently as a matter of course. When the leaders showed an inclination to take a wrong course the men on the flank simply stood up and raised a hand, which was sufficient to turn them back into the way. For the most part the men kept out of sight of the seals.

The seals on the drive do not keep up a continuous motion. They take ten or a dozen steps and then sit down like dogs to rest and pant, resuming their way when they find that their companions have gone on. The leaders set the example, and as they are rested by the time the rear members of the herd have come to a standstill, they move on and are ready to stop by the time the rear guard have started.

The result is that some part of the herd is moving all the time and the progression is continuous.

There is a tendency on the part of the young seals to go faster than the older ones, of which a large number were included. By a gradual shifting process the old fellows fell to the rear and on several occasions pods of from a dozen to twenty were cut off and allowed to return to the sea.

All the seals, and especially the larger ones, showed signs of fatigue. They appeared to be hot and excited, and a cloud of steam rose constantly from the moving animals. This steam had a strong musky smell. When the herd stopped, individual seals would often sprawl out on the ground, raising their hind flippers and waving them fan-like evidently in an effort to cool off. After resting a moment the seals were ready to move on, apparently refreshed. Continuous exertion is evidently hard on them, but they quickly recover from exhaustion. As soon as the flock comes to rest after a few moments' breathing they begin to bite one another and push in an unconcerned fashion until they are reminded by the absence of their companions that they must keep moving.

The seals were not urged forward, but were allowed to take their own time. When the herd was brought to rest for a few minutes, the rear man started them on by clapping his hands or by rattling a stick on a rock. Our presence evidently urged the seals and made the drive really harder than it would ordinarily have been. The Aleuts seem to have a way of handling the seals that they understand.

A short distance brought us to the end of the grassy plain and into an area of ground filled with embedded bowlders. These were for the most part flat and worn smooth. It looked like hard ground for the seals, but in reality they seem to get over it better than the flat ground. On the flat there was constant crowding, while here the rocks kept the seals apart. Besides the animals are more familiar with the rocky ground, their breeding rookeries, with few exceptions, being on the rocky beaches.

After passing over a slight ridge where the passageway became narrowed by projecting cliffs and where there was a good deal of crowding and scrambling, the drive left the boulder-strewn path and passed into a valley overgrown with tall Elymus grass and lying between rows of sand dunes, also grass grown. The seals seemed to be refreshed by the moisture of the grass, which was wet with dew and rain.

This grassy plain led into the top of the boulder-set slope above Zoltoi sands, from which the earlier seals were driven. The seals passed down this slope without difficulty and came into the level sand flat. Here the first really hard work of the drive began. The seals seemed to find their greatest difficulty in walking on the yielding sand. Their flippers take hold of the rocks like rubber, but slip back in the sand. No rocks prevented the animals from crowding. They stepped on each other's flippers, became much excited, and seemed generally worried.

But in a few minutes the sands were passed and the herd emerged into the grass-grown killing ground. As soon as the seals came to a standstill, they seemed to forget their troubles immediately. They began biting, snarling, and blowing at one another as though nothing had happened. They were at once turned into the little lake beside the killing ground to cool off and were then herded up on the bank to rest before their turn came to be killed.

It was five minutes after 5 when the first herd reached the killing ground. The second arrived three-quarters of an hour afterwards, having taken more time on the way.



## THE KILLING.

Killing was already begun when we reached the ground. The Zoltoi seals, which had come in about 3 o'clock, having rested in the meantime, were killed first.

The larger pods of seals were in turn separated into smaller ones containing from 20 to 50 each. These were driven up one after another and the killable ones culled out by clubbing them on the head. Those too small or too large to kill were allowed to escape and were driven into the water. Some of these, released on the eastern side of the peninsula early in the killing, had already made the circuit of the Reef and were again hauled out on Zoltoi in time to be included in the second herd driven in.

The blow with the club on the head renders the seal instantly unconscious, and before the animal recovers it is bled by being stuck to the heart. The skin is at once taken off and thrown upon the grass to cool, the carcasses being left to rot on the field. The killing is under the immediate direction of the agent of the company and the native chief and in the presence of the Treasury agent. By a judicious division of the labor the various processes connected with the killing and skinning of the seals go on at once, and in a few minutes after the last seal is clubbed the skinning is completed.

The total number driven this morning was 1,919, of which number 1,070 were rejected and 849 killed. Of the rejected seals 522 were too small and 548 too large to furnish skins of the requisite grade.

From what has been said of the carcass-strewn roadways of the drives and the terrible effects of over-exertion on the seals, we were prepared to see greater evidence of exhaustion and to see the animals drop by the wayside to be killed and skinned there. Not a seal died by the way, and in half an hour the herd had apparently entirely recovered from the effects of the drive.

The morning, however, was favorable for driving, the fog continuing and shutting out the sun. It is when the sun shines or the morning proves close and warm that the seals suffer. The sun seldom appears during June and July (the average for these months being less than a full day of sunshine in ten years), when the driving is done, and little difficulty is experienced.

## ZOLTOI SANDS.

On passing Zoltoi Sands on our way to the Reef at 11 o'clock, about 300 bachelor seals, yearlings and wigged 4 and 5 year olds, were found hauled out and sleeping on the sands and under the edge of the bluff, from which early this morning everything was driven up to the killing ground. The rejected seals must have already swam around the Reef and back to Zoltoi Cove, for they were turned off on the eastern side of the neck.

Two half bulls, each with a cow, have taken up their places at the angle of the cliff where the Zoltoi bachelors haul out. They hold their own pretty well. The cows are small and have no pups. One of these must be killed to determine whether or not they are virgins. This class of seals we have not yet been able to find. There are 2 other half bulls, each with a little cow of the same description, up on Zoltoi sands, at the edge of the sleeping bachelors. The bulls act like true bulls, holding their ground and keeping the others off fairly well. The cows seem very affectionate. But both cows and bulls are more timorous than grown animals are.



The male seals find it very hard to land on the sandy beach, the wet sand slipping back under their flippers. Hence they prefer the rocky beaches. They get on better among the rocks, their flippers clinging to the rocks like rubber.

Half bulls and idle bulls are sleeping under the lee of the sand dunes at the top of the cliffs just past Zoltoi sands. One has to be careful not to step on them.

One half bull sleeping near the head of a rocky slide, up which the animals climb with great difficulty, is badly seared at our approach and on suddenly waking falls over the cliff into the harem below. He is badly handled before he reaches the sea.

#### GORBATCH.

Another case of what might be called "assisted emigration" was witnessed from the slope of Gorbatch. A half bull frightened fled to the sea through the harems. The first bull whose premises he invaded attacked him and pitched him down the rocks to the next one, and this bull passed him on to the next, and so on, until he finally reached the sea, scarred and torn.

The injuries likely to be inflicted on the half bulls in the drives is probably much less than that produced by being thus handled and chewed by the adult bulls. The ability to survive this sort of treatment is probably the passport to their obtaining a place on the rookery.

A harem of 17 cows is stampeded in the confusion created by the escape of the half bull, and most of them run into the water. The bull rushes in and seizes one, carrying her back. One cow comes back of her own accord to the 4 which remained with the pups. Eleven swim off in the water. At a distance of about 30 rods they turn, and in a few moments are swimming about offshore. They appear to enjoy the exercise. The bull returns, wet and panting, very greatly excited. Before leaving we saw another cow come back, and on our return home two hours later the entire harem was found to have returned.

Fourteen harems were counted in the first section of Gorbatch under the cliffs. There are 24 more on the rocky slope to the first break; 18 to next reef, and 10 more to the square green rock called Old John's Rock. There are 33 harems to the smooth rocky slope. Probably 6 are invisible in the part of the slope under the cliff. Forty harems occupy the space to the angle of the cinder slope. To this point there are 45 surplus bulls in the rear above, and 20 more on the beach line below. There are 15 harems beyond to the first break; 65 up to the projecting Gorbatch Point; 30 to the rock where the sea lions sleep; 37 along the western side of the basaltic columns to the end of the rookery.

For Gorbatch rookery, therefore, we have a total of 302 harems. Applying to it the average of Kitovi, we have a total of 5,224 cows.

An albino bull lies on the edge of the parade ground near the last large break in Gorbatch. He should be looked for next year; he is rather above the size of the ordinary half bull, clay colored, with pale flippers. He has a cut in his side.

Two large harems, numbering together 66 cows, occupied a flat bench together away from neighbors. There are 66 pups in the two harems. In general it seems as if there was 1 pup for each cow, though pups are being born all the time in the different harems.<sup>1</sup>

<sup>1</sup>During July, 1897, this same space was occupied for a time by a single harem of 150 cows, which afterwards broke up into a number of smaller harems.

The only "massed" portion of Gorbatch is along the edge of the cinder slope. There are several large groups that extend wedge-shaped up the slope. Townsend's map is very close to present facts on Gorbatch.

#### REEF PARADE GROUND.

Above the cinder slope of Gorbatch is a level plateau known as the "parade ground," which gradually slopes toward the eastern shore of Reef peninsula and extends back to the hauling ground of Reef rookery. The highest part of this plateau is bare, but toward the eastward it is covered with a thick growth of grass. In earlier years it was kept entirely bare by the herds of wandering bachelors. To-day it is deserted.

In order to settle the question of how long it would take territory of this kind to become grass-grown, a space which was bare in 1892 was marked off with stone cairns by Messrs. Stanley-Brown, Townsend, and Macoun. The space so set off is now covered with seal grass (*Glyceria angustata*), like the regions about it. Saxifrage, artemesia, and segina are also growing in it.

#### ARDIGUEN.

At 3.30 a. m., while on the way to the drive, the typical harems on Ardiguén were visited. Two instances of copulation were seen at this time. The animals were as active as in the daytime. Of the pod of 38 pups 26 still remained. The harems had the same number as in the afternoon.

In the afternoon a second visit was made. Two half bulls were on the rocks above harem A. Harem B lay on a space about 36 by 30 feet. This would give 45 square feet each, no account being taken of space about them. They could all be crowded into 480 square feet, if all were as closely packed as some are. This would give an area of 20 square feet each, or with pups, 10 square feet. This, however, would not occur naturally, and 23 square feet may be taken as a maximum in close masses, as True has estimated.

If B covers 36 by 30, A to G cover 108 by 72, or 58 square feet for each cow; with bulls and pups, 24 square feet each. This is above the average for rookeries under the cliffs, as 23 is a maximum in massed rookeries. True's estimate is not very far from correct, if rookeries could be measured.

#### LUKANIN ROOKERY.

On Lukanin was seen a little cow, apparently a 2 year-old, slender, young looking, silvery gray in color, with features of a yearling. She was in a harem alone with a young bull well up from the shore and near no others. There was no pup. She may be a virgin. According to Mr. Townsend, Mr. Stanley-Brown, and others, the silvery gray ones are lately in from the water; the brown ones are those who have been in long enough to become sunburned.<sup>1</sup>

A little pup was found walking away alone well above the harems, going slowly but steadily, as if it knew its way. It went some 15 rods, and was still going when last

<sup>1</sup> Further observation showed that the silvery cows were young. The newly arrived adult is more olive-tinted than the sunburned cow, but is not silvery.

seen. Some idle bulls noticed it but did not touch it. Probably a lost pup. It paid no attention to us.

One bull with one lower canine bent horizontal and one lost was seen on Kitovi. He had no cows. This is the same bull mentioned by Mr. Lucas at the time of the count on the 13th.

#### JULY 16.

Dr. Stejneger, Mr. Lucas, Professor Thompson, Mr. Macoun, and Mr. Townsend went to Northeast Point on the *Albatross*. Dr. Stejneger and Mr. Lucas counted cows and harems on the scattered portions of the rookery. Mr. Townsend, Professor Thompson, and Mr. Macoun photographed the rookery. In the afternoon Dr. Jordan and Mr. Clark counted harems on the Reef. Colonel Murray counted bulls on the Zapadni rookeries and Tolstoi.

The weather was fair; cloudy, with occasional glimpses of the sun; westerly winds. Thermometer, 47; barometer, 30.20.

#### NORTHEAST POINT ROOKERIES.

Northeast Point is by far the largest rookery on the islands. For convenience it has been divided into two rookeries and the tip of the Point is taken as the point of division. The area to the south and east of the point is designated as Morjovi (of the walrus); that to the west of the point Vostochni (eastern).

Beginning at the eastern side of the peninsula, at a point a little northeast of Webster House, the harems lie scattered along the shingle beach in a narrow belt, which widens into a group of considerable size across a projecting rocky point. A little bay with a sand beach intervenes and forms a break. The harems are resumed along the sides of Sea Lion Neck, a narrow spit running to the southeast and having a sea-lion rookery on its tip. The groups are small and scattered. There is a break made by the sandy beach of what is called Walrus Bight. Beyond this lies a wedge-shaped, densely massed group of harems on the flat back from the shore. A hauling ground follows this, and beyond it are scattered patches of seals to the tip of Northeast Point itself. This is Morjovi rookery.

From this point the harems extend along the shingle beach to the angle of Hutchinson Hill, on the flat area at the base of which they are again densely massed. On either side of the massed portion are bachelor runways. The rookery continues to occupy the rocky beach with occasional breaks and outcroppings of the harems of the flat above until just opposite Cross Hill and the beginning of the great sand beach leading down to "North Shore," as it is called. This section is called Vostochni rookery.

#### NOTES OF DR. STEJNEGER AND MR. LUCAS.

The first patch just south of Sea Lion Neck was counted and found to contain 87 harems with 967 cows, an average of 11.25 per harem. There were 12 idle bulls in the rear of this patch.

On the south side of Sea Lion Neck are 8 harems with 87 cows. On the north side are 17 harems with 140 cows. Four idle bulls are counted here.

The crowded mass beyond Walrus Bight can not be counted, nor can any between here and the break beyond Hutchinson Hill. The harems can not be approached

sufficiently near to count from land, and from the water only those on the shingle beach can be seen, while those on the flat above can only be guessed at.

On the western side counting was begun at the most southern patch, and was done from the whaleboat. The first patch contains 47 harems and 527 cows, an average of 11.21 per harem. Few idle bulls are noted here. The second patch contains 104 harems, 1,366 cows, an average of 13.13 per harem. Twenty idle bulls are counted. The third patch contains 73 harems, 994 cows, an average of 13. There are no idle bulls.

The extreme southern patch of seals indicated on Townsend's map has entirely disappeared. These are the only portions of the rookery that can be counted.

It is interesting to note the recurrence of the averages, 11-13 cows to the harem on some breeding areas, and about 17 in others. When harems occupy the narrow fringe of rocky beach the smaller average holds true, while the larger average holds where the harems have no opportunity to spread over a wider area.

On Sea Lion Neck were 2 dead seal pups among the harems. Many pup bones were seen in the rear of the breeding grounds, representing deaths of former years. Among the bachelors hauled up just north of the Neck was 1 dead pup, with the hair worn completely off the lower part of the back, and 1 live pup, both near together, and a considerable distance from the breeding grounds. They were probably brought there by the bachelors. On the sandy beach just south of the southernmost patch of breeding seals on the east side 9 dead pups were counted in the uppermost wave of the recent gale. In the same place were 11 dead sea-lion pups, and 14 more lay in a similar position on the south side of Sea Lion Neck. All the dead pups were fresh (except 1 sea-lion pup), and apparently died at the same time. From their position and appearance one would naturally suppose them to have been drowned in some recent gale,<sup>1</sup> probably the one of July 10, which blew from the northeast. On the western side 1 dead pup was seen at the posterior line of the hauling ground to the south of Hutchinson Hill, with its placenta still attached. Another pup very badly bitten and torn was seen still walking about, although apparently quite sick.

A dead seal was found on the beach just north of Sea Lion Neck, only a few feet from photographing station 6. It appeared to be a rather large yearling just getting its permanent teeth, but was too much decomposed to make it possible to ascertain sex or cause of death.

In the patches on the western side excessive fighting was going on among the bulls, and the females were consequently highly excited and nervous. Many cows were cut; many bulls were also torn and bleeding. The animals seem insensible to pain and pay no attention to their wounds.

The total number of cows and harems which could be counted on Northeast Point rookeries was 336 harems, 4,032 cows; an average of 12 per harem. Only the scattering and unmassed portions were counted. The character of the ground is in these cases very similar to that in the Lagoon and Zapadni Reef, and the average is practically the same.

<sup>1</sup>This is not probable. More likely both sea-lion pups and seal pups were the victims of *Uncinaria*, as they were evidently washed from the rookery on the tip of Sea Lion Neck, which is sandy and well adapted to the development of the worm.



## ARDIGUEN.

Harem A had 7 cows; B, 29; 1 afterwards proves to be the young male noticed at our first visit to this point; the bull is still after him. Roused up by our approach the bull seeks to drive him out. The bachelor finally goes into the next harem and works his way down to the water. Harem C has 43 cows, E has 25, and F has 16. There are other harems below, but they seem to have a fair proportion of pups at hand. But for these five harems, which contain 110 cows, there are 132 pups in sight. Thirty-eight of them are playing in a group above the highest harem.

## THE BIRTH OF A PUP.

While counting the harems a cow gave birth to a pup very close at hand. Attention was first called to the event by a copious discharge of water from the cow, which ran down the rocky slope. The hind flippers of the pup were seen first. The cow was very uneasy, changing her position frequently, but chiefly keeping a sitting posture. In about two minutes, and apparently with no very great effort, the little fellow was born hind flippers first, evidently not the usual way. The mother quickly turned herself about, tearing off the cord and freeing the little fellow from his covering. She nosed over him, but made no attempt to lick or otherwise dry the pup, which almost immediately began wriggling about. The mother bleated over it like a sheep and seemed very much excited. A cow near by reached over, but was snapped at savagely by the newly made mother. The old bull came by and sniffed at the little fellow with a mild show of interest. The pup was on a slippery, slanting rock, and every movement it made caused it to slip down. The mother took hold of it by the neck, just as a cat would take her kitten, and dragged it up to her side. She would draw its head up to the teat, but it was some time before any very definite attempt was made to nurse. Later on it did so, as the mother seemed very anxious it should. She finally moved up to a dry place and drew the pup up after her. A neighboring pup coming by was driven off by the mother.

In another harem a cow was seen to pick up a pup by the back of the neck and carry it clear across the harem. She laid it down and apparently paid no more attention to it, though the little thing remained near her.

One cow in harem A seemed to have a cough. Every few minutes she would be doubled up with a fit of coughing.

## ZOLTOI.

On the rocks at the angle of Zoltoi Sands there is a half bull very badly cut about the breast and across the shoulder: the skin is much swollen, and the animal seems to be badly injured.<sup>1</sup> Another bull has a number of bad shoulder cuts. Still another drags his hind flippers as if injured in the back. This bull was killed for examination and found to have the pelvis crushed.

This point seems to be a sort of hospital for the derelicts of Gorbatch. Their wounds, as far as evident on the surface, are the result of fights. They have probably been whipped and driven out of the breeding grounds.

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<sup>1</sup> This bull was afterwards found dead and the skeleton taken for museum purposes.



A count of the bulls on Reef rookery was made. One harem of 2 cows is seen about midway between Ardiguen and the end of the point. It is in an isolated position, no other harems being within 40 yards, and properly belongs to Ardiguen. The bull is seen to copulate; the cow bites him. He keeps up a constant growling and puffing. When over, he turns and roars. Then both bull and cow plunge into the water and swim away in opposite directions, leaving the other cow and the pod of 6 pups. They do not return while we remain, but are swimming still, in dolphin fashion, after ten minutes. This is doubtless a young bull. There are 6 pups in the harem, but only 2 cows; the others must be at sea. On visiting the harem twenty minutes later the bull was found to have returned to the beach, but at sight of us he once more took to the sea.

#### REEF ROOKERY.

One harem, the first of Reef rookery, lies isolated on the west side of the point. It contains 12 cows.

The first patch of seals on Reef rookery has shrunk well away from the double cross mark, 40 feet at least. It begins at the point and is bounded by a bachelor runway on the east. There are 52 bulls with harems. The harems are moderately massed on coarse, irregular blocks of rock.

The second patch, a merely arbitrary division, has 31 harems. There are many idle bulls on the outskirts, and their breath, as they puff at each other, is suffocating. Eighteen harems are in the space between this and a second runway, marked by a single cross at the head. No harems are within 40 feet of the cross, however, the space being full of cantankerous, idle bulls. A bull steals the only cow from a neighboring harem and adds her to his already large harem.

There are 38 harems to a triangular green rock, and 36 harems to the stump at the point where the line of harems widens into a wedge-shaped mass. This mass contains 80 harems and is bounded by a third bachelor runway, in which there is a pond of foul-smelling water. This great mass of seals, the densest seen, reaches well up to the cross marking the terminus of last year. The ground is black with pups. Small harems, evidently the result of capture, lie on the outskirts.

Back of the central portion of Reef rookery is the hauling ground. The runway containing the pond is the one most frequented by the bachelors of Reef rookery. There are at its head to-day 500 half bulls, to say nothing of bachelors, although it was only yesterday that everything was driven up. These half bulls will increase the horde of idle bulls of next year.

Beyond the first pond there is a still larger lot of seals. One isolated harem is located under the cross painted by Mr. Townsend. Several others are near it, but the main rookery does not come within 20 feet of the cross. The great patch can not be counted from any point.

Then comes another runway, and in it another pond nearly dried up. In the great patch terminated by this runway the harems can only be estimated. There are probably 100 families in all. This estimate is verified by a still later view at a point beyond. The wedge of seals falls 60 feet short of the cross painted last year.

One bull stands guard over a dead cow and a live pup at some distance outside the line of harems. It can not be determined whether the pup belongs to the dead cow or not. The bull is with difficulty driven away from the cow. The pup goes off

in the direction of the harems. The cow has a hole in her side, but has been too long dead to make it possible to determine the cause of death.

Small harems are located behind the regular mass, and these mark the outline of the mass of last year. One has 2 small cows; another has 3. The cows are small, silvery, and slim. There are no pups. One cow from the harem of 2 gets away and joins the harem of 3, much to the surprise of the bull to whom she comes. The remaining cow is lonesome and tries to get away. These are apparently virgin two-year olds, and seem very small by the side of the big black bull. The runaway cow soon makes herself at home in the new harem.

There is an enormous number of idle bulls and half bulls. The interests of the herd demand that their number be reduced. The idle bulls simply tear each other, steal females, and trample on the pups. Those nearest the rookeries crowd upon them and are in turn crowded upon by those behind.

About 40 bulls are counted on the flat ground in the next wedge. The shingle beach chops off here so steeply, that all the harems can not be counted. There are probably 35 more out of sight.

Next comes a flat at the angle of the parade ground, and the seals grow fewer and the space narrower.

Twenty-five harems are counted to the angle of the point opposite Sivuteh Rock, and 25 more are located along the parade-ground front to the castle-like pile of rocks. The shingle beach here everywhere falls off too steeply to admit of counting from above. Twenty harems are therefore estimated for those out of sight, and later observations from the sand dunes at the extreme northern end, giving a lengthwise view of the beach, shows the estimate to be about right. There are 43 harems from the rock pile to the end of the rookery. Adding together the various patches counted on the Reef we have a total of 504 harems for this rookery, and applying the average of Kitovi the number of cows would be 8,719.

A battle royal between a bull with 1 cow and another from a large harem is witnessed at the edge of the parade ground. One bull is badly cut; meanwhile his cow runs away and the attacking bull goes after her.

Three other idle bulls attacked the defeated and deserted one and handled him very roughly. The cow has brought up in a distant harem and is lost to all three. In their fighting the bulls show a tendency to clinch when the fighting becomes too hot. At close range they push one another like centers in opposing foot-ball teams.

No dead pups are visible on Reef rookery. Of live pups there seems to be about three for every four cows. Cows step on pups in getting around, the pups paying no attention.

#### GORBATCH.

From the brow of the cliffs overlooking Gorbach 3 cows are seen perched on an almost inaccessible ledge. Their pups are trying to reach them, climbing up the slippery slope time after time, only to fall back to the bottom. The cows do not seem to care whether the pups get up or not, though they call them at intervals.

Two cows have a fight because one abuses the pup of the other which gets in her way. One pup tries for ten minutes to get across the slippery ridge. When almost successful a cow snaps at him, he loses his balance, and slides to the bottom. His mother has been bleating to him across the ridge, but shows no disposition to help and no alarm at his mishap.

JULY 17.

Dr. Stejneger and Mr. Lucas returned from Northeast Point. The forenoon was spent in the dissection of the cow from Zoltoi and in office work. In the afternoon Dr. Jordan and Mr. Macoun visited the Reef, and with a glass counted harems on Sivutch Rock.

## DISSECTION OF A THREE-YEAR-OLD COW.

In the rear of the rookeries have been seen of late a number of small harems, containing each a single small cow. This morning two similar harems are located at the angle of Zoltoi Sands. As a step toward determining the question whether these are virgin females, one of the cows on Zoltoi was this morning shot by Mr. Chichester for dissection.

The specimen was chosen as being apparently less than average size, light in color, and consorting alone with one of the smaller bulls away from the regular breeding grounds. She had no pup.

The following measurements were taken: Neck, 1 foot 6 inches; length to root of tail, 4 feet 3 inches; girth around posterior nipples, 1 foot 9 inches; girth around anterior nipples, 2 feet 2½ inches; girth of shoulders, 2 feet 9 inches. Weight, 73 pounds.

In examining external characters the vagina was seen to be distended, its lining walls thickened, fleshy, and wrinkled. The nipples were dark in color, and moderately protuberant; the subcutaneous layer of fat abundant.

The mammary glands contained a very little milk: were functionally well developed; their tissue, nearly an inch thick in the region between the posterior nipples, was found to thin out gradually anteriorly, the tissue extending from the pubic symphysis to within about 8 inches beyond the front of the anterior nipples, and the posterior glands on both sides merging together in one continuous sheet. The upper edge of the gland was in line of the upper axil, and along the median side of the body.

In the bicornuate uterus the right horn was thickened and dilated to about half the size of one's fist. The ovaries were smooth, about the size of a walnut, the right exhibiting a single scar. The left showed one large and several small granular follicles. The scar showed that the animal had bred once. No rupture was evident on the left side, but the follicle was ready for rupture.

The animal was therefore not a virgin, but apparently a young cow which had lost her pup, and, having no further interest on the rookery, had gone to sea, and in landing had taken up with the young bull on Zoltoi.

## ZOLTOI SANDS.

In some conditions of weather the bachelors lie on the flat sand at Zoltoi, but not often. There are, however, always hundreds of them hauled up on the stony southeast edge of the sands. They haul out at the angle of the bluff and then go straight up to the boulder-strewn slope where the sand is firm over the underlying blocks of lava. The seals find it very hard to walk on sand at all, or to creep up from the sea directly on the sand beaches. They slip back at every step. It is not easy for a man to walk over these sands. But at the angle of Zoltoi Bluff, where the sands are beaten hard

and flat, the landing is easy. Here the seals come and go all the time, and the bluff above the sand is a favorite location for them.

A bull and cow, which seem to be the same as were seen this morning when the young cow was shot, are now out in the sea, a rod from the shore. They come ashore together and the bull drives a bachelor away. It is evidently the same pair. The male has a big ent in the side. At 4 p. m., on our return, both are gone again.

## SIVUTCH ROCK.

With a glass from the rock pile back of the Reef one can make out about 27<sup>1</sup> harems of moderate size scattered along the beach of the concave western shore of Sivutch islet. About 150 bachelors are hauled up on the north end. The bulk of them seem small. No drives are made from this island, though occasional killings are made there in the early spring, the first bachelors usually hauling out there.

## ARDIGUEN.

Harem A had 7 cows; B, 19; C, 29 only; D, 27. The young bachelor is apparently gone. Harem E has 9 cows; F, 6; G, 9. One cow in D is wet. The cows are asleep in lazy attitudes, but they waken occasionally and fight sleepily.

The young bachelor has evidently returned. He is driven out of B into D by the angry bull. Wherever he goes the cows are in a turmoil and bite at him. He is now among the pups at the bottom of D. Passes a noisy cow, who strikes at him; tramples on pups of F and goes on dragging his hind legs over pups and upsetting them. He can be traced down to H, where he goes reluctantly.<sup>2</sup>

The bull calf paddles down to the harem at the very foot slowly and reluctantly, trampling all the pups he can: they recover themselves rapidly.

At a distance beyond harem C there is a big black bull, with a cow and pup, evidently a new harem, which we may call X.

The old cow with the green fur, now silvery, formerly in A, is now in charge of an idle bull a rod higher up. We may call this harem Y.

## JULY 18.

The day was spent on board the *Albatross* dredging 6 miles off Zapadni Head. The weather was very rough. Heavy rain fell during the whole day. Dr. Stejneger remained on board the vessel, it being arranged that the *Albatross* should sail in the night for Unalaska to take coal and steam for the Commander Islands. Mr. Townsend also remained to accompany the vessel to Unalaska, where he will remain until August 10, getting information among the officers of the sealing vessels which are now coming in to fit up for the Bering Sea cruise.

## JULY 19.

Dr. Jordan and Mr. Clark visited Gorbatch rookery. Weather very disagreeable, with alternate fog and rain, southeasterly winds. Thermometer 42; barometer 30.20.

<sup>1</sup> Inspection of this island in August, 1896, showed the rookery to be much larger, and in 1897 a count made from a boat showed 102 harems.

<sup>2</sup> This may have been a yearling cow. In 1897 a young cow of this sort was seen to shift about among the harems under Lukauin Cliff for about 10 days, always avoiding the attentions of the bulls, and consequently apparently attacked by them.



## GORBATCH.

Under the cliffs of Gorbatch rookery a half bull about 10 feet from shore is seen copulating with a little cow. The cow's head is under water two-thirds of the time. She rests on the rocks in shallow water. Another bull tries to interfere and disturbs the copulating, which is resumed after the intruder is driven off. The cow is half drowned and both animals are repeatedly rolled over by the surf.

A cow goes out to sea; her bull remonstrates and follows her into the water neck deep, but she gets away. He chases her under the water.

Two seals on a rock snatch at a sea bird which skims over them in its flight.

Some of the natives have the absurd notion that the shrinkage from Townsend's crosses is due to the fact that the white crosses scare them. On a cairn of stones where Captain Moser placed a white flag while making hydrographic observations, a half bull is now perched close to the flag, of which he seems very proud. It marks his castle, as it were.

Cows in the rain move out of the puddles and perch upon rocks in all sorts of attitudes. A favorite position when rain is falling is to sit up like a dog with the head thrown far back. A dead half bull at Zoltoi lies on the beach, badly cut about the breast and flippers.

## ARDIGUEN.

This rookery was visited about 4 p. m. The weather is cold and rainy. Harem A has moved up 15 feet nearer the rocks and has 7 cows, his original number. Another bull from behind is located in his former place, but has lost the cow he had stolen the other day from A's harem. We have designated him as Y. There is no difficulty in recognizing the cow by the peculiar color of her neck, though now that she is dry this is not very marked.

Harem B has only 10 cows; C, 23, spread out and climbing on the rocks, probably because of the muddy condition of the harem, due to the rain. Harem X has 1 cow and 2 pups. D's harem is much spread out with 15 cows. Harem B has 3; F, 17; G, 2.

Pups are still being born, red placentas are lying about. The cows are much more scattered, probably to avoid mud.

## JULY 20.

Dr. Jordan and Mr. Clark visited Gorbatch and Reef in the forenoon and Lukanin in the afternoon. Mr. Lucas made a count of Lukanin rookery.

Weather cloudy, with thick fog at times; strong southeasterly winds. Thermometer, 44; barometer, 30.40.

A semi-albino half bull, 5 years old, is to-day on Zoltoi sands with some 40 others, nearly all 5-year-olds, some 4, some younger.

Six single cow harems lie at the back of the massed portion of Gorbatch, where not more than two were to be seen yesterday. It is probable that the idle bulls succeed later on in establishing many of these harems. A bull was seen to enter a harem and carry off a cow a distance of 20 feet, holding her against two other idle bulls which attacked him. He kept the cow for a few minutes, but she escaped and got back into the harem to which she belonged. This seems to be the regular process by which the small harems in the rear grow.



## ARDIGUEN.

The harems on Ardiguén were visited at 5 o'clock to-day. A heavy wind, with driving fog, was blowing across the Reef. With the exception of the harems on the flat the seals were protected from its effects. The following is the count of the harems: A, 4; B, 6; C, 25; D, 14; E, 3; F, 17; Y, 0; X, 1.

The cow with the peculiarly marked neck is gone. This is the first time she has been missed since the 13th, when she had evidently just arrived. A wet cow is seen to land and make her way up the slide taking her place in C. She calls and is plainly hunting for her pup.

For the 73 cows now visible in the typical harems there are 192 pups. Of course they may come up from the harems below, and yet these show a fair percentage of pups.<sup>1</sup>

## MR. LUCAS'S NOTES ON LUKANIN.

A count of the cows in 59 harems on Lukanin gave a total of 848 cows, an average of 14.3 to a harem. For the rest of the rookery only harems could be counted. Eighty-eight additional harems were found. Estimating these on the basis of those counted, they would represent 1,167 cows, or for the entire rookery 2,015. But an unusual number of cows are coming and going, and it is evident that the population of the rookery is breaking up, though the original harems are still clearly marked by the presence of the bulls. The average of Kitovi rookery, which Lukanin resembles in many respects, is therefore a safer one to apply, and this would give a total of 2,543 cows for the 147 harems of Lukanin.

Five dead pups were seen on Lukanin, one with placenta attached: all probably trampled while young. Saw a few fresh placentas lying about, and two or three newly born pups. Two pups were bitten, probably by cows. A pup was seen born. Its mother was a silvery gray cow. Silver-gray cows are young; adult cows are brownish. Pups podding and nursing. A wet cow hunts for her pup and finds it, but makes it wait until she is dry before she lets it nurse. Cows coming and going in spite of strong surf. The customary number of idle and half bulls back of rookery. Harems seem to be disintegrating.

Nine harems were counted as follows: 18, 10, 11, 33, 20, 13, 23, 13, 11; a total of 151 cows in an area of about 102 by 80 feet. This would give space of 27½ feet to each animal, including pups. This is a fairly dense patch of harems, not nearly so dense as the massed areas, but above the average of the rocky ground.

A lone cow is teasing a young half bull in the surf. One bull seen with injured jaw, one front canine broken and bent forward. Females crane their necks and look at you with sleepy curiosity. Seals are not much alarmed at man. They soon lose their sense of fear when you have passed.

The drives do not run close to any rookery and do not alarm the harems. Killable seals stay away from the rookeries on their special hauling grounds.

A big bull copulating occupies four minutes. Another cow elings to him admiringly. The bull growls a good deal, and keeps his mouth open nearly all the

<sup>1</sup> Later observations showed that at no time were more than half of the cows out at one time, and at this date in the breeding season the number present was considerably less than half, as shown by the investigations of 1897.

time. The cow creeps off and the bull sits down, mouth open, and fans himself with one flipper. Then he rolls over and fans himself with both flippers. A pup begins to play with the moving flippers.

In their fights the bulls strike for the most part at the base of the fore flipper. Nearly every old bull has scars there.

#### JULY 21.

Dr. Jordan and Mr. Clark visited the Reef and Gorbatch in the morning, and went with Mr. Lucas to Tolstoi in the afternoon.

Weather fair, with light clouds; southeasterly breezes. Thermometer, 44; barometer, 30.48.

#### ZOLTOI.

At the angle of Zoltoi sands with the rocky cliff, which seems to be a sort of receiving hospital for injured bulls, a large number of wounded animals are constantly to be seen hanging about the edge of the water. Some of them are terribly cut up. A number of these invalids have been killed and dissected, and the results are recorded by Mr. Lucas in the chapter on the mortality of seals.

There are 150 half bulls hauled out on the slope at Zoltoi; there are only two or three killable seals among them. These half bulls have probably been driven several times already, and will undoubtedly appear in the next drive.

There is a prehistoric pile of bones on the rock plateau above Zoltoi. The bones contain skulls of bulls and seals of all ages; there are the bones of sea lions and all kinds of birds, foxes, etc. This pile of bones was photographed in 1892 by the British commission to illustrate the myth of the "carcass-strewn" driveways. As a matter of fact the Reef drive does not pass within a hundred yards of the spot. The skeleton of a seal buried in the sand looks surprisingly like the imprint of bones found in the rock at Roblar, near Paso Robles, Cal. These were supposed by some to be the bones of prehistoric man. They may have been the bones of a seal or sea lion.

Looking over Townsend's photographs of Reef rookery for 1892 and 1895, one can see plainly a large falling off at the later date on all the massed portions. When we compare photographs for 1894 and 1895 for Reef we do not find the difference so striking.

#### ARDIGUEN.

Harem A has moved well up under the lee of the cliff, with but 1 cow. Y remains in the old position of A, but with no cow.

Harem B has 5 cows; C, 30. Harem X has 6 cows and is growing right along. Harem D has 14 cows; 2 of them show by their wet coats that they have just come from the water. The bull belonging to E is gone; 7 cows lie about the old position; F has 5 cows; G, 15, lying about asleep. The bull of E is seen lying down below G fast asleep; seems considerably cut. There is a wet cow climbing up to C. A pup ejects a quantity of cream-colored excrement.

## MR. LUCAS'S NOTES.

## ARDIGUEN.

At 11 o'clock 2 cows come out of the water and come directly up the gully to harems, where they arrive at 11.5. One cow ascends a rock and seems in no hurry to find her pup; the other looks about and calls loudly; walks over one end of a mass of 30 pups; turns about so as to face them; lingers, then goes over to outlying pups and noses some of them; snaps at them; comes back to the bunch of 30; noses and snaps over them as they wake up. At 11.17 she finds a pup which she recognizes and allows to nurse; clears away enough pups to make room and sits up and dozes; appears tired and sleepy. The pup nurses the wet cow, shifting from nipple to nipple on the left side.

About 150 young bulls from 3 to 5 years old are to the south of Zoltoi Sands.

Two dead pups on Gorbateh; cow lies with her nose immediately above 1, which has lost patches of fur; pups podding, about 60 in a solid mass and 15 others near.

Two fresh placentas are seen in harems where two or three pups have already turned quite gray. At southern end of Gorbateh is a pup with placenta attached. In some harems cows are coming and going from the sea. They do not seem to go direct, but tarry here and there as they go, working from harem to harem.

Pups are seen to defecate on the ground, but the excrement is quickly trampled up and rendered unrecognizable. The same is true of the excrement of the cows. There is no lack of excrement, however, either on the breeding grounds or on the hauling grounds.

## TOLSTOI.

In afternoon I recounted Tolstoi bluffs in company with Dr. Jordan and Mr. Clark.

*Count by harems.*

4	11	20	6	7	15	26	8	14	9	23	22
5	26	1	20	7	1	12	10	13	11	6	18
1	9	7	5	4	2	26	10	12	1	22	9
18	3	9	10	5	9	13	17	7	24	2	1
22	7	1	2	17	10	4	11	1	23	3	7
2	19	4	5	14	1	10	1	7	17	18	6
10	2	7	22	6	7	4	7	3	6	11	6
2	14	1	7	7	7	4	18	3	3	6	5
1	7	4	3	8	9	7	4	7	3		

Harems, 114; cows, 954; average, 8.3.

Harems, 108; cows, 1,498; average, 13.94 (July 11, 1896).

Harems, 113; cows, 1,539; average, 13 + (Townsend, July 11, 1895).

Harems, 107; cows, 1,624; average, 15 (True, July 11, 1895).

## DR. JORDAN'S NOTES.

## TOLSTOI SAND FLAT.

Pups are podding and swarming like bees around the mass of the harems. Two recently born pups are seen. There are 5 dead ones. Three of the dead pups are on the sand. Under the cliffs at the headland a young dead pup was seen alone near an idle bull. Two small dead pups are seen in a harem.

The cows have their own way, anyhow, and go whither they please finally. Those sitting on the rocks, fanning themselves after coming out of the water, look amazingly

like lizards. Bulls and cows both weep a great deal, keeping up a steady lachrymal flow, making a dark stain behind and below the eye.

A bull is seen copulating on Tolstoi. The cow is in an awkward position and he is apparently unsuccessful within half an hour.

A bull and cow about to copulate near a newly born pup threaten to crush it. The mother drags away the pup, which is not more than a few hours old, having the placenta, still red, attached. The cow finally gets her pup into a safe place.

The cows move their pups as a cat does her kittens—by the nape of the neck. An attempt to carry a wandering pup that way proved dangerous. The skin on the neck was not loose enough and the pup's sharp teeth are too ready to bite. It is not wise to attempt to pick up a lively pup in that way.

The bulls patiently and indifferently father all the pups attached to their harems. Most ignore the presence of the little fellows. The cows are apparently never jealous and like to be in a crowd.

Pups have the temper of the old bulls and are fierce enough. They cry like children. A stray pup is exceedingly cross when touched.

#### JULY 22.

Mr. Lucas visited the typical harems on the Reef slide, Ardignen, in the forenoon, and in the afternoon went with Dr. Jordan to Kitovi rookery. Colonel Murray counted the harems on Lagoon rookery. Mr. Macoun photographed Reef rookery.

A dense fog prevailed during the forenoon, clearing away at noon; wind still from the southeast; thermometer, 44; barometer, 30.56.

Colonel Murray reported 115 harems as the result of his count of Lagoon rookery, made from a boat. The original count was 120. It is likely that he omitted to count some of the harems toward the back or landward side.

#### KITOVI.

A cow all alone with a pup was seen some rods above Kitovi. She must have landed and borne her pup alone, finding no harem. She is 100 yards south of the rookery. She is much alarmed by our approach, but stays by the pup, which is still very young. The placenta lies near it. She runs away at last, leaving her pup. A big rotting sea-lion carcass lies near by.

A little pup was found wandering off behind the rookery. He was starving and nearly dead. He was killed. Even half-starved he was very tenacious of life, and revived three times after clubbing.

Much so-called teasing of bulls by the cows is the result of the bull's effort to stop the cow from doing something she wants to do. This teasing on the water's edge means that the cow either wishes to leave the water to seek her harem or wishes to go to sea, and is being prevented by the bull, who places himself in her way. She bites him on the neck and breast, sometimes in the mouth. It does not show that the cow is in heat or that the bull lacks virility; at least it is susceptible in many cases of an easier and more rational solution. In nearly every instance the cow finally gets away to the sea or to her harem above.

On Ardignen a female leaves her own harem and starts for the water. She is intercepted and held by the bull in an adjacent harem. After a little interviewing and smelling she is allowed to escape. A cow in a near harem is restless and seems to wish to leave, but is prevented by the bull.



A cow at Lukain Point tries to get to the water and is pursued a long way by her own bull, then right and left by four other bulls, the last one on the water's edge. She remonstrates and explains, biting at them. One nearly breaks her neck. The cliff is dangerously high. She dare not drop off the cliff into the water. Cows in the harem bite at her. She finally escapes by making a long detour, but has to stop frequently to rest. Cows returning do not seem to have the same difficulty.

When a cow wishes to take to the water her own bull remonstrates with her. Then the bulls through whose domains she goes try to detain her. In the end, however, she has her own way. Often the bulls come to blows—that is, to blowing their strong, musky breath at each other, like rival journalists. Cows often seem to forget what they started out for and go back to the harem. The purposelessness of action is very characteristic of harem life.

When cows come in from the water they seem hampered by their wet coats, and are discouragingly deliberate about hunting up their pups. It makes one tired to watch them, they are in so little of a hurry. It is said that they do not let their pups nurse, even if they find them, before they get dry. Cows have, however, been seen to nurse their pups almost immediately after finding them, and while quite wet. Two cows come out of the water apparently with some idea of where their pups are. They call and two pups come, and after being smelled over are accepted. One nurses the wet mother, the other is made to wait.—(Mr. Lucas.)

The bachelors are full of curiosity, coming to look at us if we sit down. Four-year-olds swim all about the edge of the rookeries like whales, at home in the water though despised on land.

There is need of a manual for the guidance of young bulls. They land from the sea on the domain of the idle bull and are lucky if they escape scalped. The same thing happens if they get into the breeding ground.

Cows are near-sighted. They do not notice one at all unless he is above the level or moving. An exception to this seems to be when a seal comes to the surface of the water to breathe. Then the animal seems to catch sight of the person walking or standing on the shore even at a considerable distance. It will make a quick dive and hasten off through the water, soon, however, coming to the surface, gazing curiously at the object of alarm. The seal's senses are less acute than those of many other animals. It has too few enemies to make accuracy of sense perception necessary.

The sun comes out hot and every hind flipper on the rookery goes like a fan. The day is unusually clear and hot for St. Paul. Such a day as this is unfavorable for driving, and yesterday it was necessary to turn a thousand seals back into the sea and discontinue the killing, because of the untimely appearance of the sun. To make the seals exert themselves in such weather or undergo any unusual excitement would be disastrous.

#### JULY 23.

Mr. Lucas and Professor Thompson went early to Polovina to witness the drive, and afterwards to inspect the rookeries. Dr. Jordan and Mr. Clark also visited the same rookeries later in the day.

Weather cloudy; wind from north, changing to northwest. Thermometer 44; barometer 30.44.

## MR. LUCAS'S NOTES.

## THE KILLING AT POLOVINA.

At the drive 585 seals were killed and skinned; 344 were rejected because too small and 313 because too large. The percentage of small ones was greater than in the Reef drive, of the total drive of 1,242 only 47.14 per cent being killed.

The drive was a very short and easy one, over smooth, grassy, rolling country, but the seals seemed very excitable and much exhausted. The excitable condition seemed also characteristic of the seals on the rookery. One could scarcely approach them without causing great commotion.

On the killing ground the rejected seals could scarcely be driven away. After leaving, they loitered along, lying down and fanning themselves. Some of them went round the pond; the majority went in and stayed some time. Coming out, they rested, going to the rise above beach and again resting before going into the water. They seemed much afraid of being separated; if one moved off, others would rush after. One seemed to urge on the other, and they move more rapidly in bands than when single or in twos and threes. Going down the beach to the sea they strung out in a long line, the leader being usually a small seal whose light weight enabled him to move faster. The larger seals sat down from time to time, but did not like to be left behind. As soon as they entered the water they lay down in it. In a few moments they swam off in a long curve toward their hauling grounds, some going out a mile or so before turning.

One yearling gets away with a fractured skull and will die; one fell near the killers and was clubbed; a third was found dead later on. The injured ones are small seals that have been struck by accident. It is impossible to avoid accidents of this sort, notwithstanding the care the clubbers exercise, for the seals crowd together in a compact mass. However, the proportion of such accidents is small, and the vitality of the animals is extraordinary.

At the killing twenty stomachs were examined and found to be empty, except for some mucus and bile. Two contained a little fresh blood.

## NOTES OF DR. JORDAN AND MR. CLARK.

## POLOVINA.

At the point where the sand beach joins with the rocks 8 dead pups were counted near together in the first three harems. The bulls seemed very savage, and from the appearance of the pups one might easily suppose that they had been trampled in the sand.

The greatest number of dead pups seen on the rookeries have been on these sandy beaches. On the rocks the examples are not numerous. Perhaps the pups are smothered in dust as well as crushed, and the smothering does not happen on the rocks. Nine more dead pups and 1 dead cow were noted on the flat slope above. Some of these might have been crushed by the idle bulls, which were numerous.

While looking for dead pups a big bull is seen to lunge and fall with his breast on a pup. It wriggles off. A smaller one would have been crushed flat. Some of the dead are at a distance back of the harems, and may have wandered there and died of starvation. One pup was found with his head crushed and covered with pus, almost dead. It was killed. The pup's head might have been bitten by a bull. A fresh placenta was seen, showing that pups are still being born.

## LITTLE POLOVINA.

Little Polovina is a pretty little rookery, but not easily counted, as there is no place from which it can be looked down upon, and it spreads out over an irregular rocky slope. It might spread out indefinitely along its rocky reef, like Lagoon or Zapadni Reef. There are 45 harems in the rookery. The bulls seem very fierce and the cows restless here, as at the main rookery.

Behind the rookery are many idle bulls. One bull left his harem of 5 or 6 cows to attack an idle bull lying near, and his harem stampeded into the next bull's flock. He looked back and saw what had happened, paused a moment, and then went with still greater vigor after the idle bull, as if to be revenged. He returned later with a torn eye to the place where his harem had been, but while we remained he did not regain any part of his flock.

## POLOVINA CLIFFS.

An attempt was made to count pups in the patches between Little Polovina and the main rookery, but with no great success, as it was not possible to get near enough to the harems to see all the pups in the crevices of the rocks without stampeding the cows. Many of them took to the water as it was, despite the restraining efforts of the frantic bulls.

There were many illustrations of the fact that when a cow wants to go to the water the bull can not in the long run stop her, though he may try to do so and succeed for a time. A wet cow is seen fighting to get past a wet bull at the water's edge. The efforts of cows to get past bulls to the water have certainly been wrongly interpreted when regarded as the teasing of listless and impotent bulls.

In the next patch or gully 27 pups are counted. Two are in a little cave alone with a single cow. Are these twins? It is not evident how the cow and pups could have reached the place. On crossing over to the other side, however, a small hole, just large enough for a seal to crawl through, is found leading down to the shelf below, where the rest of the harem is. One pup lies dead under a slide of sand and rocks; a very young one. There are 30 pups in the next section; 110 in the next; 18 in the next. Then there is a break; 23 pups follow; then 57, one dead in the sand. In the next section 112 are counted; then 79; one young one is trampled in the dust.

The sections counted extend to the first little point and break north of Polovina Point. There are over 900 pups, but the count is by no means complete.

On the 15th of July Mr. Townsend counted the cows in these sections and found 1,268 in 86 harems. Evidently we have not found all the pups.<sup>1</sup>

At the southern end of the cliffs is a wet cow, just in from the sea, with bloody shot holes in her back below the shoulders, the shot apparently having passed through. The cow had just come out of the water, and the fresh blood is streaming down her back. Another cow in the same harem showed a fresh wound on her back, probably the result of a bite; it might be the wound of a spear. The cow with the two holes was undoubtedly shot,<sup>2</sup> the buckshot penetrating the skin at one side and coming out at the other.

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<sup>1</sup> When the count of live pups was made on this section, by actually driving up and counting the animals, 2,496 were found.

<sup>2</sup> Others which had been shot at the same time were found at Morjovi, July 25.

## POLOVINA ROOKERIES.

The Polovina rookeries show some decrease from the conditions of last year. The decrease in hauling-ground area is more marked. The space at present occupied is but a fraction of the former area. It is almost impossible to count the harems on the main part of Polovina, but Colonel Murray reports finding 138 harems on the 15th, and, so far as we can judge to-day, this is about right, though at this time the harems are beginning to be demoralized.

The maximum extension of the breeding area on this rookery is still pretty well defined by the position of the idle bulls. Of these there are nearly enough to fill the old grounds, but the scarcity of females leaves two-fifths of them without harems. This thinning out of cows indicates a falling off much greater than the mere reduction of rookery space on the map can exhibit, because not only is less space occupied, but this less space is more thinly occupied.

The rookeries are fullest about July 15. Then each harem has its characteristic form and position. When cows are many and the grounds level, various harems run together in a mass. Each bull at first tries to control his own cows and round them up; but later on this can not be done, and finally two or three bulls rest on the edge of the mass, holding the cows in common.

After a while the wandering of the pup attracts the mother away from the harem. Impregnated cows have no further interest in the bull and follow the pups or go into the water, and the harems grow vague in their lines of demarkation. This is more or less true by July 18, when one-fourth, perhaps one-third, of the cows only are ever present.

The attractiveness of the bulls cuts no figure in building up harems. The bull does no courting, nor does he make any effort to please the cows. The position he holds is, in the first place, the reward of his force and pugnacity; but the size of the harem is determined by the advantage of the position and with reference to the place of landing of the cows. He can not leave this position to secure cows, without being supplanted. He must wait for them to come to him. All bulls seem to be alike to the cows, but the cows like certain places, and the more so if their pups are there. When the pups are podded, the cows scatter about and the rookery spreads.

As a rookery declines, the masses break up into individual harems, rounded up by the bulls, and the breaks between the harems become larger. This makes a count by space occupied a thing very untrustworthy. On rocky ground, among lava blocks and gullies, the scattered arrangement is universal, and probably has always been so, as no massed arrangement is possible under the rough cliffs of St. Paul. On Polovina cliffs and Kitovi little harems may be seen stowed away in all sorts of queer corners.

DEAD PUPS.<sup>1</sup>

On the way home three dead pups, not in a condition to be examined, were found on the beach approaching Lukanin Rookery, but a very long way distant from the harems. These pups could hardly have wandered there, and were probably dead pups washed over from Lukanin by the high surf, as they seem to have been dead for some time. They do not appear emaciated.

<sup>1</sup>This whole subject of the death of pups must be reviewed in the light of the fuller investigations of 1897.



An effort will be made to make a more definite study of the causes of death among pups. Several causes seem to be apparent on the surface. A certain number of pups are found at a long distance back of the harems. They do not show any marks of violence, and lie prone upon the sand as though they had lain down exhausted and died. Their emaciated condition points to starvation. They have wandered off and become lost. One pup on Polovina was found one-fourth of a mile away from the rookery, evidently starved. Another was seen on the hauling ground, weak and plainly starving. The number that thus stray is, however, not large.

Another cause of death is the trampling of fighting bulls. The crushed appearance of some of the little fellows and the position in which they lie point to this as the cause. It is not an easy thing to kill a pup, for of the hundreds seen to be run over and stepped upon by the bulls in their luges about through the harems, no pup has yet been seen to be killed or even seriously wounded. A pup physically weak, injured in some way, or taken in some peculiar position might, however, be easily crushed.

After the sandy beaches, the next most important place to find dead pups is along the line of the outer harems. This is the ground which is fought over by the harem bulls and the idle ones attempting to steal cows. The case of the dying pup with the crushed head and the pus oozing out seems to indicate a bite by a bull or cow as the cause of death in a limited number of cases.

The pups as a whole are a very lively, healthy, and vigorous lot of little animals. They climb over the rocks, play with each other in their fashion, and are not at all delicately constituted. No weaklings are to be seen among them. Their instincts seem to lead them to work up the slopes and away from the water, so that drowning must be an exceptional cause of mortality.

Killable seals do not lie close to or behind the rookeries. Therefore it is not true that in making the drives the breeding seals are disturbed. Behind most of the rookeries are from two to four series of idle bulls, 20 or 30 feet apart, quarrelsome, immovable, and dangerous. Outside of these there are usually as many series of half bulls who will drive a little but stand their ground more or less. Along the water's edge there is a similar arrangement, but the idle bulls and the wet bulls are closer together. Tolstoi, Zapadni, Reef, and Polovina, as well as other rookeries lying on slopes or with parade grounds behind, are fringed with these idle bulls, which some early writers took for sentinels. These often perch on huge rocks or sleep in clefts or volcanic craters, wherever they find a suitable place, but they are in no sense sentinels. They merely spend their time in sleeping and watching the rookery life below, in which they would like to take a part but dare not.

#### THE CENSUS OF THE ROOKERIES.

The estimate of harems made to-day on Polovina rookeries gives us the data with which to complete our census of the breeding herd for the present season for St. Paul. On all the rookeries the harems have been counted except Vostochni and Morjovi. These have been in part counted and in part estimated. For Tolstoi and Polovina Cliffs, Kitovi, Lagoon, Little Zapadni, Zapadni Reef, and Ardignen cows as well as harems have been counted. As all the breeding grounds on which cows have been

counted are of the scattered boulder beach sort, it has seemed that the average harem of Kitovi rookery, which is the largest consecutive breeding ground counted, is most nearly typical of the rookeries as a whole, and for those on which only harems have been counted this average is used in estimating the population of cows. This census is tentative and approximate only, but it seems to fit the conditions of the period known as the height of the season.

*Estimate of cows for St. Paul Island.*

Rookery.	Date.	Basis.	Harems.	Cows.
Kitovi.....	July 13	Count of both.....	182	3,153
Lukanin.....	July 20	Count of harems.....	147	2,543
Lagoon.....	July 13	Count of both.....	120	1,474
Tolstoi (main).....	July 14	Count of harems.....	389	6,729
Tolstoi (cliffs).....	.....do.....	Count of both.....	108	1,498
Zapadni.....	.....do.....	Count of harems.....	583	10,085
Little Zapadni.....	.....do.....	Count of both.....	210	2,400
Zapadni Reef.....	.....do.....	.....do.....	176	2,256
Gorbatch.....	July 16	Count of harems.....	302	5,224
Ardiguen.....	July 13	Count of both.....	27	550
Reef.....	July 16	Count of harems.....	504	8,719
Sivutch <sup>1</sup> Rock.....	.....do.....	.....do.....	27	467
Polovina (main).....	July 23	.....do.....	138	2,387
Polovina (cliffs).....	July 15	Count of both.....	86	1,268
Polovina (Little).....	July 23	Count of harems.....	45	779
Northeast Point (west side).....	July 16	Count of both.....	224	2,887
Do.....	.....do.....	Estimated.....	751	12,992
Northeast Point (east side).....	July 16	Count of both.....	112	1,194
Do.....	.....do.....	Estimated.....	181	3,134
Total.....			4,312	69,738

<sup>1</sup> Altered to 67 harems and 1,090 cows by count and inspection of August 12

**JULY 24.**

Dr. Jordon and Mr. Macoun went to Northeast Point in the buckboard.

Mr. Lucas visited Gorbatch in the morning and Kitovi in the afternoon. Mr. Clark visited Ardiguen.

Weather foggy, with glimpses of the sun at intervals; westerly breezes. Thermometer 44, barometer 30.54.

**ARDIGUEN.**

Harem A has still his 4 cows under the bank. Harem X has none, and maintains A's old position. Y, who had 6 cows at the last enumeration, has none to-day, but lies beside his rock with 2 pups. B has only 4 cows; C, 19. D has apparently 32, but part of them may belong to E, who seems to have been thrown out of his position and lies behind D. F has 15 cows. The number of pups still remains undiminished, but they are lower down the slide. A pod of 25 are down on the rocks so close to the water that the spray is breaking over them this afternoon. They were evidently there to meet the cows returning from the water.

It is significant that the cow first noted with the greenish tinge on the neck is present again to-day, having been present on July 19, but absent on July 20. She has been absent four or five days, doubtless at sea.

**MR. LUCAS'S NOTES ON GORBATCH.**

On Gorbatch a small fresh-looking seal, probably a yearling male, wanders about the harems; females snap at him and he moves off. There are 7 dead pups on the slope back of the rookery. They have probably strayed and starved.

Young and idle bulls are lying about everywhere, and are a nuisance, as one must be careful not to tread on them. Bachelors of various sizes lie about at low tide in beds of kelp. The day is alternate sun, fog, and sunshine; the seals sleep soundly, and when the sun comes out fan with their hind flippers. Three idle bulls are having a battle. They bite, wrestle, and push, this last seeming to be the decisive point. If a bull gets pushed he gives up and runs.

The seals urinate and defecate on rookeries, and the placenta decay. No notice is taken of the smell by the seals.

Events in harem life are slow, and one may watch for a long time without seeing anything in particular occur.

Do the testes of the males lie in the body when the animals are not rutting? Do they retract after copulation, or do they continue down during the season?<sup>1</sup>

Seals have a poor memory; they start to do one thing, then go off and do something else. A cow starts to seek her pup, stops to scratch and rest; by and by remembers the pup and begins calling and hunting again.

A cow comes out of water and goes to rear; calls loudly; a pup comes; they smell each other and the pup proceeds to nurse. This smelling seems to constitute the recognition between mother and pup. Another wet cow drives off various pups which approach, but shows no desire to find her own.

On Kitovi, a yearling is seen playing in a pod of pups: he appears to be spending the afternoon with them. The bull takes no notice of him. One pup has been bitten on the rump and is bloody. A wet female deliberately bites two wet pups and shakes them; makes no effort to find her own.

A bachelor blunders into the rookery and is expelled with great vigor; the last bull into whose clutches he falls is so excited that he loses his balance and falls 10 or 15 feet from the cliff into the sea.

A female comes out of the water calling and hunts about; a pup goes to meet her, but before it catches up the cow goes to another part of the rookery, sits down, and dries herself. After half an hour she calls again; the pup comes bleating; they smell each other and he proves acceptable and nurses. The pup in hunting is stupid. It climbs over large stones instead of going around them. Other females snap at it as it goes along.

#### DR. JORDAN'S NOTES.

On the way to Northeast Point I took, for museum purposes, the skin of a yearling bachelor accidentally killed in the recent drive at Polovina. A pod of 20 yearlings were seen in pond at the killing ground, where they took refuge after the drive on the 23d and have remained since.

#### VOSTOCHNI ROOKERY.

Hutchinson Hill, at Northeast Point, looking north, compared with Mr. Macoun's photograph of July 22, 1892, shows an evident falling off. The general line of massing in that year went back two or three yards farther southeast and was less broken into individual harems. Six small harems are now above the mass. Then there were 5

<sup>1</sup>See later observations in October, showing that they are under control of the animal and are withdrawn at will into the body.

large and 4 small ones. The rookery does not now go more than two-fifths of the distance from the shore to Townsend's cross of last year. Distant patches also seem smaller and do not extend up to the bank. Twenty bulls are now visible in one part of the mass where 30 were shown in 1892. There were 23 idle bulls in sight in 1892, where there are now some 30; but this is not worth much. The chief change is in the thinness and narrowness of the entire mass.

In another view from a photograph of 1892 a line from point to point would cut off 40 harems and 600 seals from the mass. At the present time the mass falls 40 feet short of this line, and only 5 small isolated harems on the rocks above would be cut off. Along the seashore no great change is evident, but from the sand all harems are gone. One-third of the whole great mass west of the foot of Hutchinson Hill is gone.

Looking north there is less change visible. Nine bulls are to-day about equidistant in a straight line running obliquely across the sands from the foot of Hutchinson Hill toward the east, but all are idle except 2. In the photograph of 1892 there is shown a similar line of bulls in the sandy tract, all occupied and in the very midst of the rookery, 10 to 20 feet west of its outer edge.

About 200 harems are west of Hutchinson Hill; 200 more in the large patches south of it. All the rookery masses are everywhere 30 to 50 feet short of Townsend's crosses.

One old bull, far above the others on the slope of Hutchinson Hill, had two cows which were stampeded. One got away to the harem below. The bull followed the second one down the hill, seized her, and finally succeeded in getting her back. Meanwhile he roared and fairly wept, his voice telling as plainly as could be his feelings. Another bull attacked him and the rescued cow ran away to join the other in the large harem below, leaving the old fellow alone and swearing. He climbs back to his rock disconsolate. When a bull chases another bull, or a man, he goes only about 10 feet and then looks back instinctively to see what has become of his cows. Then the object of pursuit can get away.

There is an enormous mass of seals under Hutchinson Hill, the largest on the island. Vostochni is a noble rookery, though far short of its former greatness.

#### A WOUNDED BULL.

One 5-year old bull, blind of one eye and hurt in the other, is ordered killed. Before he can be secured 3 other bulls attack him and nearly kill him. Nowhere has been seen such a ferocious lot of idle bulls, some of them old and brown. Fierce quarrels are in progress all along the rookery line.

The blind bull is probably 6 years old instead of 5. He is a noble fellow, but badly used and getting thin. His left eye is nearly gone on account of a cataract-like thickening. Right eye entirely gone. On closer examination the eyes are found to have been destroyed by buckshot. We find more buckshot under the skin. The skin is taken for museum purposes. The coarse gray wigs have little of sealskin beauty, but the brown and black ones are handsome.

There is great commotion on the rookery when we move about, but no attention is paid to the shooting of the bull, and when we are quiet all the idle bulls settle down to watch us and fan themselves in the sunshine.



The autopsies of seals of all ages and grades show splendid visceral health. The only wounds are on the head, breast, and especially at the edge of the fore flipper. In the latter place all old bulls show scars. When the seals fight they aim to strike low at the angle of the fore flipper, as if knowing it to be a weak spot.

#### THE EFFECT OF DISTURBANCE.

One of the bulls that tried to kill the one we shot now lolls quietly 30 feet away, while the skinning is going on. He looks on with sleepy interest, no longer afraid, as we are not moving, nor angry, as we do not invade his grounds. He soon goes to sleep beside us.

If we killed a hundred bulls and skinned them on the spot the others would not pay any attention. It is only our movements they fear. They have a nervous dread of quick movements, whether of other bulls or of men. The old bulls are made angry, the young ones afraid. The bachelors on hauling ground, in the rear of the rookeries, when alarmed rush to the rookeries, as they did when pups. This causes many of them to get out and roughly handled, for the old bulls soon show them they are not wanted.

The bull is much quicker to detect the nature of the intruder than the cow, which fears man chiefly when he is moving. A bachelor seal can often be surprised when asleep, and the surprise is sometimes mutual, as a big fellow starts up unexpectedly from behind a rock and dashes away in great haste. If it is an old bull that is surprised he will plunge at you, but before he has gone 10 feet he will turn about to see what his cows are doing. Then you can get away, for after he has once looked back he goes no farther. He will turn from an intruder to intercept the flight of his cows. This he does by snorting, growling, blowing out his musky breath, by seizing the cow and bending her neck backward to the ground, or by seizing her by the back and tossing her over his head. The cows are afraid to leave when the bull exhorts in this way, and during the period when the harems are well defined the cows are more afraid of the bull than of any intruder; but after July 20, when the cows have become impregnated, their fear of the bull passes away and the older ones do as they please, running away when frightened. Later on the young cows also become more independent. When a cow wants to go and the bull interposes she bites him in the neck. For the most part he takes it patiently enough, though sometimes the fur comes away with the cow's sharp teeth.

#### THE SEA-LION ROOKERIES.

North of Hutchinson Hill is a mighty hauling ground, with thousands of bachelors still on it. Once across the whole end of the island was an immense parade ground. A huge sea lion is seen asleep on the rocks with a drove of bachelors about him.

From the hauling ground and leading to the water is a great neutral belt of beach line, similar to that occupied by harems, but left open to the passing bachelors.

About 20 sea-lion pups are lying on a rocky shelf close to the sea, where the surf breaks over them. About 10 dead ones are cast up on the beach. Adult sea lions are more shy and the pups more defenseless than seal pups. Bulls as well as cows take to the water when disturbed and stay there bellowing, the cow much like that of a bull seal, but the tone is flatter, and the pups with very heavy flat voices. The sea-lion pups soon grow calm. There is considerable variation in their size. Two or three of the largest ones are twice as big as the smaller ones.

Thirty other sea-lion pups are seen on another rocky shelf. They are very heavily built and have long noses. One has several bad cuts. They swim rather clumsily yet. The sea-lion cows lie out in the surf and bellow and groan. They are usually together in groups of three or four.

The sea-lion rookery of the west side was also visited. A bull and 9 cows plunge into the water on sight of us. They swim about bellowing with fear. The pups, as large as yearling seals, remain on the rocks and bleat. Their color is a rich brown; that of the adults a rich creamy white. The pups are shiny, with rolls of fat under the skin, and lie huddled on the rocks where the spray breaks.

One element at least in the extinction of the great Sivuteh (*Eumetopias stelleri*) is the superfluity of bulls, that fight with tremendous force. Behind the two sea-lion rookeries were some 12 dead pups, nearly as large as yearling seals, high on the rocks. Jacob Kochuten says that they were killed by fighting bulls, which must be the case.<sup>1</sup> Three of them were crushed under great stones weighing 50 to 100 pounds each, "kicked up by bulls," according to Jacob. Certainly they were not thrown on them by the surf. Two or three others had bled pools of blood from their noses, which points to crushing rather than drowning as a cause of death.<sup>2</sup>

One Sivuteh pup recently dead seems emaciated, as though it had starved to death. Its skin is saved for museum purposes.

#### MORJOVI ROOKERY.

Up to a certain point in polygamy, the less bulls the more pups. The wise breeder would not turn a herd of 100 fighting bulls into a herd of 100 cows.

I go to the windward side of 500 sleeping bachelors and not far away. So long as I go quietly they pay no attention. I do not believe much in the acuteness of their sense of smell. If a man does not move, they care no more for him than for a sea lion. I sit down on a log within two rods of the harems and the cows pay no attention to me. The bull was much disturbed by my approach, but lies down and pants. The half bulls and idle bulls pant loudly on the drives, but the bulls always pant, even while going about their domestic duties.

Three water bulls come up behind me out of curiosity. These water bulls are very inquisitive. But no one is alarmed while I remain quiet, though on the windward side. It is the rushing of the half bulls into the harems that causes most of the commotion. The old bulls promptly collar them and throw them out.

One stray pup among the bachelors is cut in the rump, as though bitten. He is growing poor, but is sturdy and quarrelsome and wants no nonsense. I have to leave him to starve. A dead seal pup lies beside two dead sea-lion pups, far from any rookery. Probably tossed up by the surf after death.

Seven more dead pups are on the sand beach further on, with 2 more sea-lion pups and a half bull. All have probably been washed in by the surf from the neighboring harems. Three small dead pups were seen on the slope of Hutchinson Hill. One lay among the bachelors not emaciated. One dead pup was seen at the edge of the harems to the north of the Hill.

<sup>1</sup> It remains yet to be determined whether these dead pups were not killed by the worm, *Uncinaria*. This sea-lion rookery occupies a sandy area in part. The pups here were too long dead in 1897 to determine the cause of death.

<sup>2</sup> Bleeding at the nose may be caused by *Uncinaria*.

## SEA LION NECK.

Sea Lion Neck is a rocky reef with a few harems on either side. At its tip are 3 huge sea-lion bulls. Five sea-lion cows are swimming in the water. One bull goes in and one sits on a rock and looks at me. The third sleeps behind. One female lands. Several pups are on the rocks and in the surf. The female sea lion seems larger than the bull seal, but she is slimmer. The bull is immense, as large as a horse. The females come near the shore to see the pups. These huge cream-white beasts are very interesting. Eight more dead sea-lion pups are seen. There seems to be a very great waste among them. The pups are far from the sea on the back of the reef. All are rotting. One or two are emaciated; the rest not. Two or three are in the surf below the high tide. I do not see more than 20 live pups on the rookery. Ten more are near the rookery itself; with them are 1 male and 2 female sea lions.

The mother sea lions seem alarmed, but ineffective. The living pups are now on the rocks close to the water; some are in the water. But all of the dead ones lie on a tract of ground discolored by excrement, evidently the original rookery. Four emaciated male pups are skinned and saved as specimens. Evidently, from the waste of its pups, the Sivutch is not long for this earth.

The sandy beach below Walrus Bight is strewn with bones of whale, walrus, and sea lions, seals and mighty animals. It makes one sick to see this evidence of waste of splendid marine life. Why not let the walrus and sea lions alone? We shall never see their like again.

## THE BLUE FOX.

A little blue fox comes within a rod of me and circles about me as I stand still. He is a jolly little knave. He goes twice around, each time a little nearer, the third time coming near enough to snap several times at my shoe. I sit so as to prevent him from grabbing my leg, which he would prefer, but dares not touch. He circles around several times more, then lies down behind me, biting again at my shoe, which he finds hard. When I move away and sit down he circles around again, and seemed pained and disappointed when I finally leave. No other animal has such a cold, calculating, selfish eye as the fox.

North of Sea Lion Neck is a densely crowded mass of seals on a low slope strewn with very large bowlders. It is full of quarreling bulls and surrounded by several lines of idle bulls. It is a fine rookery which has evidently seen better days. It is very hard to inspect, except around the edges. There are no cliffs, and an easy descent leads to the reef of huge bowlders which constitutes the seashore. There is a noble hauling ground around it. The ground is black with pups and mossy with bull wigs above the brown cows. Five hundred square feet close by has 56 seals in all; 12 cows, 2 bulls, and 42 pups—9 feet each; but this is closer than the average. This great patch is thicker behind and on the edges than on the middle.

## THE SEA LIONS.

South of Sea Lion Neck 2 dead pups are seen in the sand among bachelors. Three have been washed up on the beach, with 5 dead sea-lion pups. These are some

of the lot from which Professor Thompson took skulls. One is fresh enough to skin. One dead female fur seal with unborn pup has been washed up with them. On examination she is found to have been shot through the back. Six young sea lions, 1 yearling male seal, and 4 seal pups have been washed up at the south end of the beach. Nine more dead sea-lion pups are counted; 2 or 3 have starved to death, the rest drowned. The starved pups can be distinguished by the absence of fat. They are the only ones not too rotten to examine. There are 5 more dead pups by this sea-lion rookery, big enough now to swim well. The sea-lion pups learn to swim in the great rollers. About 20 young ones are bleating "b-â-â-â," not "b-â-â-â" like the seals. Finally the whole rookery stampedes to the sea. The male sea lion is four times the size of the female. His girth about the shoulders is enormous. He has a face like that of a St. Bernard dog. He seems more gentle but less quick than the bull seal and has vastly greater strength.

A stampede of sea lions is worse than one of seals, but they do not get away so quickly. The whole herd, large and small, is now in the sea together, roaring, leaping dolphin-fashion, quite like the seals, the young not so well. They open the mouth very wide when bellowing. Their mouths larger than those of seals; jaws and teeth stronger. The natives save the large intestines of the sea lion to make water-tight uppers for their shoes. The sea lions go south in the winter. Their pups are born earlier than the seal pups, in the latter part of May.

Natives say that the sea lions fight much worse than bull seals. Ten to 20 cows each is the size of the harems, and they have the same general habits as the fur seals. In their fights they cut gashes in each other a foot long. The sea-lion bulls are said to go away after the middle of July. They have not gone yet.

#### THE SHOT SEAL.

A fresh cow floated in to-day on the beach below Sea Lion Neck and was skinned by the guard. She had been lately killed by buckshot, there being bloody shot holes in the neck. Evidently pirates are already abroad. The carcass was examined and the cow found to be lean and in milk, but not much milk evident. She seemed to be an old cow, from what I could tell by the ovaries, which were somewhat injured by the rude dissection of the skinner. I find shot holes through the œsophagus, in one side and out the other; also a shot hole through the glottis and one in the pericardium. The heart was full of clotted blood. The stomach was empty. The flesh was perfectly fresh, not more than a day or so dead. The cow died near the shore and was washed up on the beach. She was perhaps shot at some distance away and became worn out by long swimming. The skin was salted and taken in evidence of poaching in July from some quarter.

#### JULY 25.

Mr. Clark, Mr. Lucas, and Professor Thompson witnessed the killing on the village grounds. Dr. Jordan returned from Northeast Point. Mr. Macoun photographed Kitovi and Lukanin rookeries. In the afternoon Mr. Lucas and Professor Thompson visited Tolstoi.

Weather was foggy in the forenoon with occasional glimpses of the sun; westerly winds; thermometer 44; barometer 30.62.



## MR. CLARK'S NOTES.

The drive this morning was from Zoltoi Sands, the Reef, Kitovi, and Lukanin. The seals from Zoltoi Sands were already sufficiently rested by 4 o'clock, so that killing began at that time.

Upwards of 500 were killed at the edge of the ground on which the former killings took place. The rejected ones went back to the sea on the east side. In the first pod turned off was a cow, the mate of the one shot on Zoltoi Sands a day or two ago. She is said to be the first female seen in a drive the present season. She caused the clubbers considerable trouble, being very fierce and unmanageable.

At 7 o'clock work was suspended for breakfast and the various pods of the seals were driven into the lake to cool off and then rounded up on the shore to rest. After breakfast the scene of the killing was changed to a point nearer the lake to shorten the distance, the weather having turned out warm. The escaping pods were now allowed to return to the sea at the village angle of Zoltoi Sands. Later on another shift was made to the shore of the lake. Some of the pods went off to Zoltoi, but most of them swam the length of the lake and crossing the neck entered the sea at the cove in front of the lagoon.

Some of the yearlings, of which there was an unusual number, were examined to ascertain whether or not the yearling females herded with the yearling males, but all were found to be males.

Two seals were found with shot; one contained ordinary buckshot and the other two irregular slugs each as large as two grains of buckshot. Agent Crowley turned over 13 buckshot which had been taken from the seals at the Northeast Point killing on the 21st instant.

The seals seemed more irritable and fierce this morning than at the former killings. The percentage of little fellows was very much greater, and these, while showing all the fierceness of the older ones, had less appreciation of necessity of getting away, and were therefore harder to manage. One little fellow seemed determined not to be driven off. He remained through the killing of two pods and fought all the time. He then ran back to the herd and was brought up a third time with just as much fight in him as ever. Finally he forgot himself long enough to get out of range.

Frequently these yearlings would return several rods, leaving the escaping pod and taking up their places among the dead. They are quite as difficult to handle as the half bulls. One little fellow seemed bound to remain on the killing ground, and when one of the clubbers took him by a hind flipper and threw him several yards into the row of dead carcasses he immediately started back, but in the meantime part of the pod had been worked off and he turned back and went off with the escaping ones.

One yearling received a blow on the nose while the killing was going on at the lake shore. After a good deal of hesitation he entered the water, but came swimming back to the point from which he started as though dazed. His nose was bleeding and it was thought it might be necessary to kill him. But when it was finally decided to do so he turned sharply about and swam off to join his companions as if nothing had happened.

A half bull was stunned by a blow on the nose and lay apparently dead for a few minutes, then recovered and seemed willing to fight it out. He was with difficulty

forced into the water, his nose bleeding profusely. The seal's nose in his weak spot. A slight blow there produces great discomfiture for the time being.

Numerous escaping seals showed bloody marks, but it was blood from the noses of their dead companions. Several were seen to be struck accidentally with the clubs. But the number did not exceed a dozen in a killing of over 1,600, and aside from those instances noted none of the injuries were serious. A seal too old to kill was seen in one of the escaping batches having a blind eye, evidently one of the "moon-eyes" referred to by Elliott. His blindness did not impair his ability to fight, and the fact that he could not see on one side of his head enabled him to very effectively stampede the clubbers.

The drive from Lukanin showed a marked excess of yearlings. In the earlier drives these yearlings do not appear, and in the later drives Lukanin sends in an overwhelming majority of them.

The following is a tally of a number of typical pods of escaping seals, distinguishing between large and small. The large ones were half bulls over 4 years of age; the small ones were mostly yearlings with some 2-year-olds.

A number of pods from Zoltoi rau as follows:

Big.	Little.	Big.	Little.	Big.	Little.	Big.	Little.	Big.	Little.
18	2	9	1	13	2	9	1	9	1
17	0	15	3	18	0	10	1	19	1
15	2	18	0	15	0	12	0	10	1
20	0	21	0	14	0	9	0	16	6
26	2								

A number from the Lukanin, as follows:

Big.	Little.	Big.	Little.	Big.	Little.	Big.	Little.	Big.	Little.
18	15	5	2	8	9	5	20	5	25
8	5	3	15	11	5	7	12	6	28
9	30	12	12	7	12	10	9	9	19

Beyond this point it could not be clearly distinguished from what point the particular pods were drawn, as they had all been turned into the lake to cool and had become mixed. But it is safe to say that when the pods got to running again, as below, they were from Lukanin:

Big.	Little.	Big.	Little.	Big.	Little.	Big.	Little.	Big.	Little.
3	36	2	32	7	20	3	33	0	59
8	20	7	33	4	16	11	19	6	35
10	16	7	7	1	17	7	22	3	23
6	18	11	9	5	20	0	30	4	23
22	11	7	10	1	23	4	21	2	23
2	23	2	31	7	21	1	27	3	23
0	15								

These specimen pods will be sufficient to show the general proportion of those rejected on the killing grounds. There were rejected 1,008 big and 1,177 little seals; 1,630 all told were killed. The total drive therefore numbered 3,815 animals. These were driven up without the loss of a single one, as an examination of the driveway showed.

## DR. JORDAN'S NOTES: NORTHEAST POINT.

Another cow was washed on shore this morning near Sea Lion Neck. This one had been dead somewhat longer than the preceding. She was very fat and had a large unborn pup. A number of buckshot holes in the back and sides show the cause of death. This skin was salted and retained in evidence of poaching.

A little pod of yearlings swam about together all day in Webster Lake. They slept on its banks at night. These young males seem to enjoy life greatly. To the carcasses of the thousands of their kind on the banks of the lake they pay no attention.

Three cormorants and 7 little anks, each with a quill over his ear, its root near the glassy unintelligent eye, sat silently together on the rocks and let me approach them within 15 feet, when all but 2 of the cormorants flew away. I left these in peace, having no grudge against them.

Coming home I watched a pod of yearlings turn from the drive into the village cove; they go slowly until in deep water, then string out in long procession, dolphin-like. They are from Zoltoi Reef and Lukanin, but all turn to the left around Spilki and pay no attention to the neighboring Lagoon rookery. They are out of sight in about four minutes, the distance being about half a mile.

## THE DIFFICULTY OF MAKING A CENSUS.

It is evidently impossible to make an accurate census of the seals on St. Paul Island, because, on the great rookeries, as the Reef, Gorbatch, Tolstoi, and Zapadni, one can neither estimate nor count the cows. Nor can one do it at Polovina, because there is no point of view where the whole rookery is visible. Even the bulls can be only roughly estimated. On Northeast Point there are long strips which can not well be seen from the land, and the surf and the great distance from St. Paul village preclude a survey from the sea. Besides, the two great masses, one on the slope of Hutchinson Hill (Vostochni) and the other on Walrus Bight (Morjovi), are so situated that even the bulls can only be counted approximately.

At the time of our first enumeration on Kitovi, Tolstoi, and the Lagoon, the rookeries were at their height, with more cows present than at any time since. But all were not in and no yearlings nor 2-years-olds had appeared. Nor am I sure that any have appeared since, unless yearling cows are among the bachelors. I have never seen one, and am not sure that I have seen a 2-year-old.

True's estimate was honestly and carefully made, but I believe it to be too low for the year. The rookeries in question were less dense than the average, with smaller harems, and more cows were absent than he thought. Besides, by enumerating them as present when they were not, he omitted the virgin cows. No count gets quite all the cows, not even on Tolstoi Bluff's, the most accessible. True's estimate has the value that he assigns to it; no more. There are not and never have been millions of cows, nor are they so reduced as to be measured by a few thousands. There may be 75,000 to 100,000.<sup>1</sup> Adding the still absent virgins there may be 120,000, but it is doubtful.

<sup>1</sup>This was on the supposition that at the time the cows were counted practically all were present.

As to the bachelors, such as were killable have been killed and counted, 30,000 in all. There are some 5,000 bulls in active service, half as many idle bulls 6 years old or more, and some 15,000, more or less, of half bulls, wiggling 4-year-olds, and wiggled 5-year-olds. Of these there are many specimens of splendid sealhood, robust and strong, besides a number of lean and poor ones, hurt somehow—ent by bulls, or with buckshot concealed in their bodies. Then there are yearlings and 2-year-olds, 30,000 or more altogether; no one can guess how many, as they come and go at will. As to the pups, there is one for each female thus far present on the rookeries. If exceptions exist, they will pass away in a few days, for there are no barren cows.

Perhaps the bachelors on Northeast Point do not roam back to the southern rookeries. If not, one can roughly estimate the proportion of cows on this great rookery by the known number of bachelors taken there. But this could not be absolute. About Kitovi and Lagoon few old bachelors stay. Tolstoi has very many and Lukanin more than its proportion compared with Kitovi. No drives are made from the Lagoon at all. It is almost exclusively a residence region.

#### JULY 27.

Heavy wind and rain all day yesterday made it impossible to get upon the rookeries.

Mr. Lucas and Professor Thompson attended the killing at Tolstoi this morning. Dr. Jordan visited Gorbateh rookery in the forenoon, and in company with Mr. Clark and Mr. Lucas went to Lukanin and Kitovi in the afternoon.

#### GORBATEH.

There is not much going on at Gorbateh rookery to-day. Many seals are in the sea and the water front is deserted. Pods of pups are paddling in sheltered pools of water out of reach of the surf. This is the first time the pups have been seen by us in the water. Many pups are asleep flat among the rocks. One dead pup, evidently crushed, is seen; it has the placenta attached.

A cow lies on the rock and calls her pup from below. She has a peculiar voice and the pup comes for some distance. He can not get up to her and she is too lazy to move. Though close to her she pays no attention to me. She seems to expect her pup to do what is impossible—climb up 10 feet of almost vertical rock. The pup's hair parts in the wet, showing the skin; it feels uncomfortable. The cow finally climbs down. When she gets down the bull makes a fuss. The wet weather makes him cross. He begins teasing another cow, but soon goes to sleep. The cows make their pups come to them. They hardly move an inch in search of them. The pup is allowed to nurse by the sleepy cow and he looks perfectly happy.

The white, half-albino 6-year-old bull is on the south end of Gorbateh close above the earlier harems. He has a family now. He is a beauty, evidently just beginning to feel his importance. It is a pleasure to see him on his first entrance into society. May his tribe increase. It braces up his courage amazingly to have 4 cows to look after, and it apparently does not make any difference to him that all the pups under his charge are black. Old bulls rarely touch the little bachelors that are not wiggled, but are very savage with the wiggled ones.

On the steep wet incline at the western end of Gorbateh the animals slip and slide about. When the bulls fight on the cinder slope they roll down it; even the



pups slide like the rest. No dead ones are to be seen. The pups about here are in lively pods. They are probably all born by this time, though one placenta is noticed which is apparently fresh.

Two sea lions are on the point now. Both are apparently bulls and fast asleep. The seals lie close by without paying any attention to them. Sea-lion excrement is abundant and chalky in color, like a mixture of plaster and water; this appearance probably due to the undigested shells of crabs.

The hind flipper of the seal often rests on the fore. It has separate toes connected by a membrane. The eye of the seal is one-third the length of muzzle, not far behind the cleft of the mouth. The mustache is twice as long as the muzzle.

Ten "harbor" seals (*Phoca vitulina*) of mottled white, with some young ones of darker color among them, lie on Gorbateh Point. As I look at them they take to the water. Their senses seem much more acute than those of the fur seals, and they drop off into the water and melt away like snowflakes when one looks at them.

#### THE LENGTH OF THE DRIVES.

The drive from Polovina to Stony Point, described by Stejneger and True last year, is the last long drive which has been made. The killings at Polovina are now made on the margin of a pond about one-fourth of a mile away from the hauling ground; those at Zapadni, near Lake Anton; those at Tolstoi, near Ice House Lake. At the Northeast Point killings are made at two places, one on the east side of Webster Lake, the other on the west side near Cross Hill. Seals from the Reef, Zoltoi, Kitovi, and Lukanin are killed on the village ground between Zoltoi and East Landing. The drive from the tip of the Reef is about a mile long, the longest on St. Paul Island; that from Lukanin three-fourths of a mile; Kitovi less; Zoltoi one-fourth of a mile. The drive from Staraya Artel on St. George is longer, over 2 miles, but it is over level ground, with ponds at intervals in which the animals can cool off. The hardest piece of driveway on St. Paul is that crossing Zoltoi Sands from the Reef. This is due to the softness of the sands. The rocks offer little difficulty to the movements of the seals, and the grassy stretches, which are easy going for them, make up the greater part of the driveways. No drives are made from the scanty hauling grounds of Lagoon rookery, or from Sivuteh Rock, or from beyond Zapadni Point.

#### LUKANIN.

Two little dead pups were seen on Lukanin, evidently crushed to death. Nine-tenths of the dead pups seen thus far have had the umbilical cord attached. They have been crushed soon after birth. Other instances of death, resulting from wandering among the bachelors and from drowning, have been rare up to date.

A single cow is located to-day with a bull at the southern end of Kitovi, where the lone and apparently starving pup was picked up two or three days ago by Mr. Clark. The pup was, at that time, carried to the nearest harem, in hope that it might find its way back to its mother. The mother has apparently found it and brought it back to the original place, for it looks like the same pup. The cow was first seen with her pup on shore alone. They were lying close to the water's edge. On the approach of Dr. Jordan the cow fled to the sea. He carried the pup back above reach of the surf. Before she came back the pup was found alone and supposed to be lost. It was carried some rods away to the nearest Kitovi harem. The mother has brought it

back, and in the meantime has been taken in charge by a beach master. A pup with sore eyelids, probably caused by the intrusion of sand, was also seen.

The harem system is now largely broken up. Pictures of the rookeries taken July 25 and after show nothing of the real extent of the rookeries in the breeding season, as the wandering of pups scatters the cows, and an increasing number of them are in the water, while many new ones have come to form harems around the idle bull. The cows can probably remain away longer now, as the pups become older.

This evening the guard reports 4 dead cows on shore of the breeding ground at Zapadni.

#### THE KILLING AT TOLSTOI.

Mr. Lucas witnessed a portion of the killing from Tolstoi rookery. In his estimation it would hardly be practicable to drive up smaller pods to the clubbers. Single seals are more courageous and fight worse than when in groups podded together. Large droves of seals are readily intimidated; nothing can be done with a single seal of any age when brought to bay.

One seal among the killed has the fat of orange color. Natives ascribe this to having fed on salmon. It may be due to having fed on crustacea. Dr. Voss, the island physician, thinks the coloration is due to biliary trouble or jaundice. Nothing was found in the animal's stomach.

Mr. Lucas examined a number of other stomachs at Tolstoi, but found nothing save thick mucus, in one case nearly a pint. Professor Thompson also opened a number with the same result. And yet excrement is to be seen scattered over the hauling grounds, appears on the drives, and is found in the large intestines of the seals killed.

#### THE WITHDRAWAL OF THE BULLS.

Old bulls are hauling out on Middle Hill and thereabouts. Some of them look pretty thin. They go back from the water and sleep in the sands and among the rocks. Tolstoi Sands seems to be a cemetery for old bulls, as many bones are to be found strewn about.

The guard has just brought down from Northeast Point the skins of 2 cows dead from buckshot wounds, noted on the 25th, on Morjovi near Sea Lion Neck. The 2 skins have been preserved as evidence of shooting in Bering Sea before August 1. These 2 skins, together with the wounded cow on Polovina, seen on July 23 with apparently 2 shot holes in her back, show pretty conclusively the presence of pelagic sealers even at this date. The wounded cow at Polovina was just out of the water. The two cows<sup>1</sup> at Northeast Point were found on the beach on the morning of July 24.

#### ARDIGUEN.

Harem B has 5 cows and many pups. Harem C has hauled back on the grass out of the muddy place where he belongs. There are 53 cows with him, evidently part of

<sup>1</sup>It may be noted that the schooner *Aurora*, seized later by the *Rush* for having shot skins on board, with unsealed guns and ammunition, was in Bering Sea at this time. She was released by the courts, it not being proved that the shot holes in the skins had been made by the crew of the vessel in question.

them A's. D lies alone below his place with 1 cow. Other cows are scattered along the muddy slide. A is asleep in his later place with 3 cows. E is gone altogether. He was found thrown out of his position on July 21. F is in his place with 8 cows. G is asleep away below; 9 cows are scattered about where he belongs. X has no cows and is above A's old place. Y is gone altogether, unless a lone bull on the edge of the cliff is he. The green-necked cow with her pup is with A. It is not known whether she has been absent since the 20th, when she was last seen. Two wet cows come in slowly and creep up the slide, bleating very loudly, shaking their heads. There is nothing going on at the water front. The few wet bulls are inactive.

A cow selects a pup from D and repels 2 others. A large pup comes from above down the wet slide to meet the mother, and they crawl slowly up to D. Other pups look anxiously at each wet cow.

#### JULY 28.

Professor Thompson, Mr. Lucas, and Colonel Murray went to St. George on the *Corwin* to make further investigation of the rookeries there. Mr. Macoun photographed Polovina rookery. Dr. Jordan visited Gorbatch and the Reef.

#### GORBATCH.

A wet cow came in from the sea; her pup comes down to the lowest rock to meet her. She sees me and goes right back into the water, leaving her hungry, crying pup at the water's edge. A bull which seems young plunges into the water after the cow, but he is not to be the master of the household. A pup is dead on the rocks above the harem. It has a broken scalp with pus oozing out. Perhaps this pup belonged to the cow shot some days ago on Zoltoi Sands while consorting with a half bull. The harem is located only a short distance from this point.

The cow which deserted her pup a few minutes ago bleats in the water, and the pup answers, but will not go into the water. I retire and the cow comes in, going high up on the rocks with her pup. When one passes a harem now the brown, rusty cows leave for the water and the bull offers little resistance. It is chiefly the silvery cows that remain.

There are more than 50 pups paddling to day near the green-striped bowlder that looks like a watermelon. This is the place where pups were noticed in the water yesterday for the first time.

#### NATURAL CAUSES OF MORTALITY.

The mortality from natural causes in 1,000 pups probably cannot exceed:<sup>1</sup>

- (a) One killed by cows (overestimated).
- (b) One killed or led off by foxes (overestimated).
- (c) Eight from being crushed to death by bulls while very young; this has caused half the deaths so far.
- (d) Two from being drowned.

<sup>1</sup> We allow the following notes on pup mortality to stand as written. It illustrates the difference between qualitative and quantitative work. No actual count was then possible. A later count showed that 70 to 80 in a thousand have been trampled while young, the other causes being all of trifling importance. (This foot note, made in 1896, must be again revised and corrected in light of the discovery of the parasitic worm in 1897.)

(c) Three from starvation due to straying.

(f) Two from being carried off by bachelors.

Estimate of 17 in all in 1,000, or 1.7 per cent.

One pup has been seen with sore eyes, but this can hardly be considered a cause of mortality. Not more than 1 in 50 die naturally, which is certainly a high estimate up to date.

#### ZOLTOI.

The white semi albino half bull which has been seen on Zoltoi and which is out this morning is not the same as the white 6-year-old at Gorbatch; but both are beauties. The Zoltoi bull is a 5-year-old. He is not nearly so white as the other. He is rather yellowish gray over dusky under fur. The 5-year-olds generally seem to be getting lean. They are much larger and less plump than 4-year-olds. They have smaller heads. Five years seems to be the "hobbledehoy" age with them. Four-year-olds look like 3-year olds, except for their incipient bristles.

Two wounded 5-year-olds are out on Zoltoi; one with a shoulder out of joint, another with an injured back. Another 4-year-old in rather feeble condition is blind in one eye.

Buckshot will probably be found to be the cause of injury in many such cases. The drives rarely or never produce such injuries, and injuries from falls are very few. Accidental wounds by the clubs on the killing grounds are also very rare. Wounds in fights with other bulls are mainly on the shoulders, breast, and head. Of the injured bulls and half bulls that lie about the sands at Zoltoi and Polavina probably 10 are injured by buckshot to 1 that is seriously hurt by fighting or by falling or by driving. The cuts of the bulls are rarely more than skin deep and seem to heal quickly. Buckshot breaks the bones and tears the viscera.

The bull with the injured back is ordered shot for museum purposes. He is about 10 years old. Examination shows a large unhealed hernia before the right hip. Jacob Kochuten says that he has been bitten.

#### THE WITHDRAWAL OF THE BULLS.

The tired old bulls are already beginning to pull out on the beaches, having finally given up hope of getting on the rookeries. They may be seen on Zoltoi Sands and on Lukanin and Polavina sand beaches. We are told that many of them will die before the season is over. They will go to sleep on the sand and simply not wake up. The sand will drift over them as they lie.<sup>1</sup>

In the afternoon Dr. Jordan visited the salt house and saw the process of curing the skins. The skins are first taken to the salt house and spread out in tiers one above another with salt shoveled over them. After about five or six days they are taken out and examined for places where the salt did not take effect. They are resalted, the order of the skins being reversed. After ten or twelve days they are again taken out

<sup>1</sup> It is evident that these bulls were those which had done duty on the rookeries and withdrawn at or near the close of the season. They had probably already been to the sea to feed. They were seen in increasing numbers throughout the rest of the season. The idle bulls which temporarily took their places on the breeding grounds also joined them later in the season. These were in no sense animals which had withdrawn to die. They recovered their wonted condition, and were to be seen by the thousand on English Bay, North Shore, and Lukanin beaches until the end of October.



and tied in bundles of 2 skins each, ready for shipment to San Francisco, where they are repacked in barrels for shipment to London.

Mr. Macoun reported to-night that pups were seen by him playing in sheltered pools of water at Polovina rookery to-day. The time of going into the water is probably not dependent upon the age of the pup, except perhaps in the case of the few that act as leaders. When these have tried the water doubtless pups of all ages within sight follow their example. At least the pods seem to contain little fellows as well as big ones.

MR. LUCAS'S NOTES FROM ST. GEORGE ISLAND.

I made a short visit to North rookery with Professor Thompson. It has spread considerably, the extension backward and uphill being noticeable. Pups in two places are playing in the water. This is in advance of St. Paul.<sup>1</sup>

One fresh placenta is seen.

Are the bulls darker colored here than on St. Paul?

The harem that contained 135 cows on July 9 now has only a moderate number. Some distance inland and up the hill is a new harem with a considerable number of cows. A bull in an adjoining harem who had only a few cows at the earlier date has now a full share.

There seem to be several small fresh cows among the others. Are these the virgin cows, or merely undersized?<sup>2</sup>

JULY 29.

Dr. Jordan visited Zoltoi and the Reef in the morning, and in the afternoon with Mr. Macoun and Mr. Clark went to Tolstoi.

The strong southwest gale continues with great surf. The air seems warmer than usual, and it is difficult to see because of the blinding mist.

ZOLTOI.

On Zoltoi numerous instances of excrement were noted. The normal excrement of the bachelors is yellow, firm in texture, with no evident composition. One bull, perhaps an old one, voided liquid yellowish excrement. It is ill scented, abundant with many nematode worms 1 to 3 inches long. The worms are preserved in formalin. Some examples of excrement have dark clayey colors, no texture.

The surf is breaking very high on the beach of Gorbatch, where the pups were swimming yesterday. None of the pups are in the water to-day. The seals seem to be simply putting in their time till the storm is over.

ARDIGUEN.

The bull in harem A is asleep on the flat rock. There are two cows and a large pod of pups about them, rolling and biting one another in the neck and flippers. B has 13 scattered cows. A "water bull" (Z) has come up and tried to establish

<sup>1</sup>See notes for St. Paul of to-day, both by Dr. Jordan and Mr. Macoun. The coincidence is interesting.

<sup>2</sup>See observations on St. Paul, which culminated on August 1 in proving these small cows to be virgin 2-year-olds.

himself, having apparently observed the disappearance of E. D is indifferent and half asleep down toward F, with whom he has a wordy discussion. D has 8 cows, and they squabble a good deal. A's green-necked cow is down in D.<sup>1</sup> The water bull remains for a time in E, where there are 3 cows. D is near him and attempts to drive him out, but both seem very sleepy. Twenty-eight cows are with C, who is pretty active. X is behind him with none. Y is well back, with 1 cow. Another bull well behind Y has 1 cow. Y is very fierce. F is active and has 9 cows. E is gone. Two weeks ago Z would have been skinned alive if he dared enter the harems as he does. He tries again to go up to C, who uses strong language. A is pretty lean. C makes a heavy lunge into a pod of pups and stands on the flipper of one, which pulls and pulls and can not get away until the bull moves.

#### REEF.

Six little cows in a harem at the rear of Reef rookery stampede. In a short while they come back to the bull in a body. A stray pup is seen among the bachelors in the runway near by. He is very fierce. I carry him back toward the harem. He tries to follow me away. When touched he bites savagely. There is a single old cow in a harem with a young bull on the hauling ground. Perhaps the lost pup is hers.

The wedge-shaped patch of seals is now far beyond Townsend's crosses, within 150 feet of the limit shown by Macoun's photograph of 1892. There has been a great spreading backward on the rookery within a few days. Many bulls which at first were idle now have harems. These harems are evidently formed from late-coming cows, mostly young ones.

A bull near the hauling ground has a single cow. In these outer harems, which are large, there are few pups, but some of the cows seem old. Perhaps the pups are podded farther back. Still there are many idle bulls, and they are fierce.

The household life in the great patches is different from what it is under the cliffs. Very few wet cows are here, and not nearly so many silvery ones. It will be some time yet before these pups learn to swim, they are so far from the sea.

The patch north of the dry pond is now about even with the cross. There are hundreds of pups around the stone on which the cross is painted. There is no sign of virgins here. There are as many pups as cows, if not more. The bulls are very quarrelsome. The cows seem wilder here, and there are more single harems along the edge of the bachelors with whom the cows are more mixed up. When the bachelors stampede, however, the cows always fall behind under the influence of the bull.

Evidently the cows in the rookeries most visited—Gorbateh, Lukanin, and Kitovi—are less wild than the others. Those along the west side of the parade ground are very wild, because not near the drive and almost never visited.

Three starved pups lie on the hauling ground. A stray pup is among the bachelors. The bachelors tend to hug the edge of the rookery, much to the annoyance of the observer. It takes an Aleut or an old bull to keep them off.

There is a good deal of fighting going on. There are some splendid 5-year-olds here. There is a big dead bull lying on the ground occupied by the idle bulls. He has been long dead.

<sup>1</sup>She was present on the 19th; absent on the 20th; present on the 21st and again on the 27th.

An old bull snarls at a pup and rolls him over endwise. The pup seems to stand it well enough. It is wonderful how tough they are.

Nothing resembling virgins are yet seen except in the harem of 6 cows first mentioned. This bull finally loses all his cows but one. She is broad headed, like a yearling bachelor. One of the fleeing cows is taken in charge by another bull. Her owner tries to regain her, but can not.

## TOLSTOI.

Tolstoi rookery was inspected this afternoon for dead pups. This is the rookery upon which the dead pups of 1892 were recorded by Mr. Macoun.

The rookery lies in part upon a sandy area of considerable extent back from the water's edge and in part on ledges of rocks under steep cliffs. It was on the sandy part that the great mortality was noted. Above the sandy stretch there are many harems located upon the long rocky slope covered with large bowlders.

When the rookery was first visited this year the harems were closely packed along the edge of the water and under the edge of the rocky slope, leaving much of the sand bare. At the point where the mass was thickest a cliff forming a projecting angle of the slope juts into the sandy tract. From this angle to the sand beach was a great wedge-shaped mass around which the bachelors hauled to get in behind. From this mass most of the harems now to be found above have come, though a part of them have come up over the rocky cliff at accessible points. When the rookery was first seen the entire upper space was covered and held by idle bulls.

## DEAD PUPS.

As in 1892, so to day, this rookery shows the largest number of dead pups on St. Paul, and it shows its excess of mortality about this jutting cliff and on the sandy beach at the point where the greatest mass of seals was located.<sup>1</sup> This area of sand is now covered black with pups, and scattered over it are a large number of dead pups flattened out or partially covered with sand. With a glass from a position just above the green cliff and near one of Mr. Townsend's crosses 88 dead pups are counted. It is possible that a number are hidden among the masses of living pups, as in many cases they are playing about and over their dead companions. One hundred would probably be a fairer estimate.<sup>2</sup>

At the angle before spoken of where the seals were thickest, and where a great amount of fighting was going on at the time the rookery was first visited, there are between 20 and 25 dead pups to be seen within a small area. The rest are scattered over the length of the sandy tract. The angle here resembles very much a similar angle at Polovina, where 8 dead pups were counted in 2 harems. When we consider the great mass of pups at this point on Tolstoi, numbering many thousands, as compared with other rookeries, the percentage of dead pups, placing the number at 100, is not

<sup>1</sup> See account of the formation of this mass of seals in notes of 1897 for last week in June. The seals massed against this jutting rocky point as the nearest way to reach the slope behind, up which the harems spread.

<sup>2</sup> When these pups were counted later on, the number was found to aggregate 1,495. This shows how it came that from mere casual observations the great mortality of pups was unnoticed or underestimated in earlier years.

remarkable. Mr. Macom points out the spot where he to-day counts 25 dead pups as the place where the great mass of dead pups, estimated by him at over 4,000, was seen in 1892.

So far as could be made out with the glass, no other cause of death than that already noted in similar places on other rookeries can be discovered, namely, crushing under foot by fighting bulls. The pups seem small at a distance, but may be partially concealed by the sand. They show a uniformly flattened appearance and are not curled up. They seem to have died about the same time, or to have been dead about the same length of time. Their appearance seems to indicate that they died in the height of the season. In many cases the fur is worn off in patches.

Mr. Macom remarks that the mortality is not so great to-day as it was in 1892, but his observations of that year were made somewhat later and under more favorable conditions. In his opinion, not starvation, but some epidemic, was the cause of death in 1892. He agrees that 200 would probably cover the dead pups to day on Tolstoi Sands.

#### MR. LUCAS'S NOTES.

On East rookery of St. George, the hauling grounds and breeding grounds are now but a mere fraction of the space formerly occupied. The character of the ground and the vegetation shows that within very recent times—say five or six years—the rookery covered twice the area and the hauling ground ten times the present area.

There are some idle bulls about, mostly young, and many bachelors. Old bulls are hauled out on the beach at various points. The harems are small, the rookeries sparsely populated.

Little East and Great East rookeries were once continuous; now they are separated by a considerable space, and East contains 135 harems and Little East 40.

One fresh placenta seen at the water's edge.

#### JULY 30.

Dr. Jordan and Mr. Clark visited Gorbateh and Reef rookeries in the afternoon. Mr. Macom visited Lukamin.

The day was cloudy and foggy; southwesterly winds. Thermometer 46; barometer 30.45.

#### ZOLTOL.

An old bull with a broken flipper, which lay in the "hospital" at the angle of Zoltoi Sands, was killed. He was going about on three legs, holding up the injured flipper like a dog would its paw.

#### THE COLORATION OF THE COWS.

There does not seem to be much truth in the current idea that the light-colored cows are recent arrivals and the brown ones those which have been out long enough to get sunburned. It seemed plausible enough when we first landed on St. George, but there are more of these silvery ones now on the rookeries than there have been at any time this season. The season is now far enough advanced to make it possible to assert that all the adult breeding cows are on the rookeries or else have gone to sea after having given birth to their pups. It seems almost certain that the lighter



or silvery colors are those of the young females. In a harem of a dozen cows here on Gorbatch about half the number are these light-colored cows, probably 3 year-olds. The pups have all been born some time, and are as big as any seen on the rookeries. Two other cows in this same harem are wet. They are looking for their pups. One cow is uniformly dark in color. The other shows distinctly her light silvery color. There can be no question that these cows, when dry, will one be brown and the other silvery. Again, these light cows have been seen to enter the water and have been watched as they swam about, their white bellies and throats being noticeable as they whirled in the water. In the case of the brown cows, just as soon as they are dipped they show dark all over.

#### GORBATCH.

Beyond the harem just referred to on Gorbatch, near Zoltoi, a dead cow was seen under the cliff apparently wedged between two stones. With considerable difficulty and after a lively fight with the neighboring bulls the body of the cow was reached. It did not seem likely that she had been crushed. It was, however, with difficulty that she was withdrawn from the crevice, and it may be that the heavy surf of the past few days has shifted the rocks and wedged her in. As she was dragged along the blood oozed out of her nose. Her skin on a superficial examination did not disclose any shot marks, though the bleeding would seem to indicate some internal wound. Between the shoulders on her back was a scar, quite fresh, where the skin had been cut out in a round patch about the size of a silver dollar. There did not seem to be any wound beneath, but as the cow had been dragged some distance by the skin of the neck the wound might not have shown. She had not been long dead. The body seemed very plump if not swollen, indicating that perhaps it contained an unborn pup. The nipples were moderately swollen and the vagina somewhat dilated. The details of her condition will be given later after dissection.

#### REEF.

Five dead pups were counted on the hauling ground of the Reef rookery, or rather in the runway between the masses of harems through which the bachelors pass in going up to the hauling ground. They did not show evidence of starving, and were probably trampled to death by the half bulls and the idle bulls of which the passageway is always full. Their bodies were flattened out.

The holostiaki, of which there are a great number on the hauling ground back of the Reef, are very playful, pulling one another around like dogs at play. Their actions resemble those of the pups in the pods about the harems, but they seem more playful and less in earnest than the pups. The pups play as though they were angry.

One old bull, a magnificent fellow, is badly injured in the back. He drags his hind flippers in a perfectly helpless manner. He is, however, very strong in his foreparts, and maintains himself against the half bulls and idle bulls that attack him while trying to get out of their reach.

Another old fellow with one of his fore flippers badly swollen was seen on the top of the slope of Gorbatch in a pod of bachelors. He carried his flipper in the air as a dog might a sore paw, getting along quite briskly on three flippers.

## ARDIGUEN.

The slide shows continual change. There are 58 cows up on the flat where the harems of B and C were located. Probably 35 of this number were in B's harem, but they stampede by way of C's harem, many of them going down over the cliff, but some of them almost immediately returning. On account of the stampede of the cows to the harems below it is difficult to determine the status of harems D, E, F, and G.

A young 6-year-old bull (Z), noted yesterday as trying to locate himself in the slide, is now up above D and seems very active. He greatly annoys the cows trying to return to harem C, dragging them back down the slide as they climb the slippery rocks. One cow has a particularly hard time. She bites him severely in the throat and on the back. The other bulls do not seem much inclined to tackle him. They are too lazy now.

A is still under the cliff in his position, but has 10 cows. One gets away and is taken up by an idle bull above. He keeps the cow for a few minutes in the position formerly occupied by X. X has left his place and lies by the rock where Y used to be. Y is down by the brow of the cliff, a little farther along than the position occupied by an idle bull, which has kept his position from the beginning.

In the harems now controlled by B there is a little brown animal, very small. She looks very much like what one would expect a virgin cow to be.

## STAMPEDES.

The question of the stampeding of harems and consequent injury to the female herd seems an absurdity. It frequently becomes necessary to go very close to the harems in order to get to desirable observation points. The cows show evidence of fright, but are, for the most part, held in check by the bulls, and as soon as the intruder has passed or comes to rest the seals settle down as if nothing had happened. If the fright is so great, as sometimes happens in these days since the harem system has relaxed, as to cause the cows to break away to the water, they are invariably found back in their places within a few hours, perhaps within a few minutes.

The killable seals do not come near the rookeries. There is a regularly graded buffer of idle and half-idle bulls on the water front, in the rear, and at each flank, which effectually prevents the crowding of the bachelors on the harem. Unfortunate individuals, impelled by fright, occasionally try to escape through the harems to the sea. But the injury is to the bachelor concerned and no general stampede can result. It certainly is not possible to-day for the bachelors to get near enough the harems to occasion any danger of stampeding the cows in getting them, and there is no reason to suppose that conditions are essentially different this year from what they have been in the past. It is generally conceded that there has always been a fringe of idle bulls about the rookeries, and the bachelors have been taken for years from their present hauling grounds, which are wholly distinct from the breeding grounds.

Later in the season a few stray cows whose pups are dead may take up with young bulls away from the rookeries proper. These may occasionally get into a drive. One such female appeared in the drive from Zoltoi on the 25th instant. But it is not likely that such cases occur frequently, never early in the season. A cow so driven is not hurt in the least. The cow from Zoltoi was found at a distance from the rookery. She was herding with the bachelors, probably because she had lost her pup.

## DEAD PUPS.

There is a dead pup on the rocks high up out of the way, in a position where it could not very well have been crushed. It has probably been injured and crawled up there to die. It is impossible to get near to examine it on account of the bulls.<sup>1</sup> Near by is another dead pup in much the same condition.

On Zoltoi cliffs are trails on which the bachelors come up and go down. There are others on the steep western slope of Gorbatch. It would be hard for a man to climb them. In getting down they sometimes drop in places 6 feet or more on jagged rocks. In no case do they seem to be hurt by such a jump.

## VIRGIN COWS.

There are many little harems apparently of virgins, with an occasional adult cow and pup, along the edge of the hauling ground on Reef rookery. These are in charge of 5 or 6 year old bulls. Two of these harems, each with a small cow, are in a position to be easily got at, and to-morrow an effort will be made to determine whether or not these are virgin cows. The bachelors seem to worry them, but the sex is uncertain yet. A harem containing several supposed virgins has some old cows in it twice as big as the little ones. A harem consisting of 1 cow is in the hauling ground, and the cow goes off, leaving the pup.

A bull is holding a little brown cow by main force and roughness. She bites him on the neck, and he has a great time holding her. She must be a virgin. The bull smells of her genitals. She is very small, not over 40 pounds in weight. She has a large head and eyes like a pup. She tries to run away, but comes back at every motion of the bull. The bull seizes her and holds her down by main force, watching her every movement, regardless of the observers 10 feet away. The cow hangs tightly to his neck. She runs toward us once, as if without fear. Perhaps all this is love making, but if so it is terribly harsh. Both bull and cow are getting tired. He fans himself with his hind flippers, voiding excrement. The little cow is probably coming in heat. Her nipples are very small. She has never had a pup, although in color she is like the old cows.

## STARAYA ARTEL.

Mr. Lucas visited Staraya Artel rookery, making the following notes: This rookery has spread out and thinned since our visit on July 9. The idle bulls have disappeared from the upper part, but there are many about the lower portion. Twenty old bulls were counted in one bunch. Many of the younger bulls seem to have secured cows, and the influx of these young animals is very perceptible. As nearly as can be counted there are now 75 harems. This is a larger number of harems than were found at the former count.

## NORTH ROOKERY.

At North rookery, where the harem of 135 cows was, there are now 9 harems, 2 of them back on the hill very far from the former solitary harem. Here, as on Staraya

<sup>1</sup>This pup was secured later with a fish hook on a bamboo pole.

Artel, the influx of young bulls is marked. The western part of this rookery now contains 55 harems. The count on July 9 gave 51 harems, 867 cows. The previous uncounted portion of the rookery contains 36 bulls with cows. Allowing for the thinning out of harems, this would make the former estimate of 2,700 cows not far from correct. Colonel Murray finds to day a total of 225 harems on North rookery.<sup>1</sup> He saw one bull copulating to-day. He also reports seeing a dead pup on East rookery, and Professor Thompson saw 2 pups, supposed to be drowned.

It is apparent that the mortality among pups at the present age is small unless they are drowned<sup>2</sup> by a heavy gale. They are tough enough to stand knocking about, and, moreover, have such fear of a bull that they keep out of his way.

Pups are crawling about the rocks and high up the cliffs. One lies dead at the foot of a cliff, where he has evidently fallen from above. Pups are playing freely in the water.

At the east end of North rookery are three harems which were not there when the first count was made. They are around young bulls. It is evident that with young bulls at the rear of every harem and at the water's edge there is little chance of cows escaping impregnation.

A bull was seen to act toward a seal among the bachelors as though it were a cow. A large patch of excrement was seen on the hauling ground, indicating a recent meal by some seal.

Bulls still take an interest in their harems and there is some quarreling. A number of cows frightened into the water were watched and found to return to a harem within a short time. The bulls below offered no opposition.

On the stones of the gully, and on the hillside just above, leading to the eastern hauling ground of North rookery are many gray lichens. Ten years ago thousands of seals clambered over these stones to the hill above, and some still climb there. The spaces between the stones are filled with the characteristic slime of the hauling ground, black and slippery. The lichens are growing and the grass covers the ground, which has not been worn bare this year, although some seals climb up daily and lie about at all times.

#### JULY 31.

Dr. Jordan visited Gorbatch in the morning, and in the afternoon, in company with Dr. Voss, Mr. Stanley-Brown, and Mr. Clark, made experiments with a view to identifying the virgin females.

Weather clear; wind from southeast, with heavy surf; thermometer 46; barometer 30.55.

#### GORBATCH ROOKERY.

The dead cow on the Zoltai end of Gorbatch was skinned. She contained an unborn pup and had been bitten in the small of the back, probably by a bull. This bite was the cause of death. She had probably been wedged among the rocks by the surf.

<sup>1</sup> A count of harems at this date, after many of the regular harem masters are gone, and when the young half bulls and idle bulls are entering the breeding grounds, is manifestly misleading. The division of the single harem of 135 cows into 9 harems shows how the idle bulls have increased the harems.

<sup>2</sup> See later observations. Very few pups are drowned in the surf, even of the severest gales.



The old bull seen yesterday on Gorbach cinder slope with his fore flipper "in a sling" was found this morning out on Zoltoi Sands. He was ordered shot. The shoulder was out of joint and the whole flipper badly inflamed and sensitive.

#### REEF ROOKERY.

The two single harems noted on the Reef rookery last night were readily found this afternoon. One cow was in charge of a splendid old black bull, full of fight, the other in charge of a fine-looking young gray bull of probably 6 years. The first bull mentioned had a number of cows yesterday afternoon. They seemed to be in greater part virgins. Some were old cows, however. None had pups. On approach they all stampeded into a neighboring harem except one. This remaining cow was the one found to-day. This was the same harem from which on Thursday afternoon Dr. Jordan observed 6 young-looking cows decamp in a body, returning half an hour later.

#### THE VIRGIN COWS.

It was decided to shoot the little cows. Jacob Kochuten said that the one in charge of the big black bull was a holostiak. She was standing close to the bull, who was watching the man with the rifle. The instant the shot was fired the bull dropped his nose to the cow's head as though he was conscious of some injury to her, though she made no sound. He fondled over her, paying no further attention to us, until we undertook to get the body. It took fully half an hour for the four of us to get the cow away. The bull was fight all over. No blow on the body produced any effect except to enrage him more and more, nor could he be enticed far enough away from the dead body to permit anyone to reach it. Finally a well-directed blow in the mouth with a stone knocked his lower canines loose and stunned him sufficiently to make him yield for a moment, and the cow was secured. He returned to the spot as soon as he recovered himself, but appeared to realize that there was nothing more to fight for.

The other cow was shot in the same way, but her bull, probably never as yet master of a harem, deserted her immediately when pressed. Both animals shot were found to be females which had not yet given birth to pups. They were carried to the level of the parade ground above, skinned and dissected by Dr. Otto Voss, resident physician of the North American Commercial Company.

#### RECORD OF DISSECTION.

The cows proved to be virgin females, coming in heat. This probably accounted for the eagerness with which they were held by the bulls and for the absence of effort on their part to escape. One of the cows was of the usual light color, silvery underneath. The other was dark brownish, like an old cow, with only a lighter shade of brown under the throat. This should settle the question as to whether the difference in coloration is due to length of time out of water. It also shows that age is not the sole determining factor. The difference must be due to individual variation.

The little brown cow belonged to the young gray bull. Her mammary glands were small and undistended, containing no trace of milk. Her weight was about 60 pounds. She was about to come in heat. The Graafian follicle was just rupturing. The cow had evidently never bred. The left ovary was apparently the one prepared to breed first. The two horns of the uterus were alike, neither yet fertilized. It is

probably accident that determines which horn shall be impregnated first, but after the first pup is born impregnation occurs each year in the unused horn. While the horn which has just borne the pup is recovering from gestation the other is made ready for impregnation.

The silvery cow belonged to the old black bull. The Graafian follicle showed no trace of rupture in the right ovary. The follicle in the left was about to rupture. The ovaries in this case were a little larger than in the first cow, but showed no trace of having yet been fertilized. This cow was somewhat fatter than the other and a little larger.

Secretions of the outer part of the vaginal tube in both cows proved acid; those of the uterus alkaline; mammary glands normally developed in both. No corpus luteum appeared in either ovary of either cow. Both stomachs were wholly empty except for a few nematode worms. The fat was yellow in its color. The intestines of both contained excrement.

#### THE YEARLING MALE.

Near by were two small seals in charge of a young half bull. The smaller one was shot and proved to be a yearling bull. It had all the appearances of a female, and Jacob said it was one. The bull showed it all the attention which could have been expected in the case of a cow. It showed tremendous tenacity of life; had to be shot twice in the head and neck, and yet had strength enough to bite and scream. If it had been in the sea it would probably have swam a mile, perhaps many miles, though from the loss of blood it must eventually have succumbed. It defied all of us, even after the second shot, and continued to fight till struck with a knife. It is simply impossible to believe that pelagic sealers do not lose a large percentage of those they shoot. No other animal shows the tenacity of life that a seal does, and no animal is more free from sickness or defective parts. When first shot the little yearling screamed like an angry pup.

The sacrifice of this yearling was valuable in showing how easy it is to be deceived. This animal was watched closely at a distance of not more than 10 feet by several persons, all of whom pronounced it a female as far as appearance went.

The yearling male is about the size of the 2-year-old female. Jacob and the other natives say they can tell the female by the sharper snout and narrower head. But while the head of one female killed seemed to bear out this view, the other most decidedly did not, and there was no essential difference between the head of the yearling and that of the female. There does not seem to be any characteristics that will surely determine the sex of the young animals other than those of the sexual organs themselves.

It is evident from our experience with this and other animals shot for scientific purposes that the suggestion that rifles should be substituted for clubs on the killing grounds is not a wise one. The amount of suffering would be greatly increased by such a change.<sup>1</sup>

<sup>1</sup> In 1897, while securing bulls for museum purposes, Jacob Kochuten shot a bull twelve times before he finally killed it. To require the natives to shoot the seals in the land killings would be nonsense.

## VIRGINS.

The animals we thought virgins are now certainly known to be such. The one we formerly shot on Zoltoi was an exception, a young cow which had lost her pup and had left the harem. Falling into the company of a young bull she hauled out on the sands. The virgins are probably not often impregnated in regularly formed harems. They seem not to be wanted in the regular harems; at least they shift about as if they did not feel at home. They are to be found chiefly at the back of the regular breeding ground and at the water's edge. Among them are a good many old cows,<sup>1</sup> probably drawn back by the movement of their pups, fertilization being over and the bulls having relaxed their watch.

It is not necessary to suppose that the virgins come up on the hauling grounds with the bachelors and then wander away to the bulls. These little harems in the rear are to be found behind all the rookeries.

## EXCREMENT.

A young bull in sex excitement with a cow voids much orange-colored excrement, and paddles his flipper in it till he is thoroughly soiled. There is excrement in abundance both on the rookeries and on the hauling grounds. This animal must have fed recently. On the rookeries the excrement is mostly soft and soon dries in the sand. On the hauling ground it is often cylindrical and of the consistency of putty. One of the little cows killed had a long cylindrical piece of excrement in the rectum; the other was filthy with soft greenish excrement.

## ARDIGUEN.

The slide was visited at 3 o'clock. One pup was observed just born, having the placenta still attached. The cow was fairly large, but of the whitish color of those supposed to be young. Doubtless she is a 3 year-old, with her first pup. She is in charge of a half bull lately come on the water front. There are other cows in the harem. A cow draws up the pup to her breast by the nape of the neck.

A large pod of pups are playing in the water. They seem to enjoy it greatly. Those entering the water are not confined to harems near shore. Wet ones are observed at the very top of the slide. One wet pup comes up to harem A. He waits a little and then goes back down the incline toward the water again. He is watched two-thirds of the way down. The wet pups are scattered all about in every pod of sleeping ones. They seem even smaller than their fellows, but probably this is because the water has smoothed down the fur.

A wet cow just in from the water is watched find her pup. She calls; three or four pups answer. The cow ceases to call; she makes no further effort. No pup comes to her within half an hour.

A mother lying near the large green rock awakens and calls. Her pup responds and comes to her. She is in a position which does not give the little fellow any chance. The cow fusses about, calling to the pup, who keeps up a response. Finally the little one is pushed off the rock and slides down 10 feet. The mother is alarmed and calls frantically. The pup comes to the foot of the rock and looks up, calling, but can not climb the rock. The mother calls repeatedly. Finally the pup makes a wide detour and gets up to the mother. She moves to a better place and the pup takes his dinner.

<sup>1</sup>Apparently cows that have lost their pups haul backward with the virgins.

The changes on the slide go on. A has 10 cows. B has 6 cows near him, and probably 4 more at some little distance are under his jurisdiction. The harems are all scattered out in irregular fashion. Among his 6 nearest cows are 3 little white-breasted cows with dove-colored backs. They look like virgins. The other cows are brown and larger.

The little cow, supposed to be a virgin last night, and which was on the crest of the slide, appears to be about halfway down in another harem. She is brown, but very small; the smallest cow seen. It is probable that the light color in the younger animals is a matter of individual variation. The case of the two virgins killed which showed the two distinct types of coloration bears this out. It may be that the lighter animals represent that class of pups which show the brown belly.

C has 19 cows. X is gone from Y's place. An idle bull from the rear has taken his position—the old position of A. Y is still by the cliff's edge. X is lying flat in the edge of C's harem, which is crowded down toward the cliff. D has 20 cows, but one can not be certain. The young half bull Z, seen to tease the cows trying to return from the slide to C's harem, lies sleeping in the place where we left him last night. There are 12 cows in the space formerly occupied by E, a different bull in charge. F and G can not be distinguished or counted with certainty.

#### THE CHARACTERISTICS OF THE FUR SEALS.

A fur seal has almost as much in common with the grizzly bear as with the true seal. It is roughly a grizzly bear with webbed feet flattened and oar-shaped. Except for its wonderful powers of swimming, its habits and appearance are that of a land animal. The elements determining its residence on the islands are the cold, moist, sunless weather, the ice cold water, and the absence of native population or of any creature on land powerful enough to be an enemy. Hence its choice of uninhabited islands. Its migrations are influenced by the encroachments of floating and coast ice, and its other movements by the need of food.

#### THE SLAUGHTER OF THE SEALS.

To kill the whole body of seals on the islands, as has been lately proposed, is, of course, no worse than to destroy the herd by pelagic sealing; for land protection is a farce if the female can not feed safely at sea. Nevertheless such action is a confession of impotency a great nation should never think of making.

The real interests of England are identical with ours, as are the real interests of the civilized world, and some method must be found to put an end to the indifference and jealousy which now prevents just or rational action. If the seal herd is to exist it can not be preyed upon by any nation. If it were true that the removal of bachelors diminished the herd it should be forbidden, like any other depredation. That it does not reduce the herd, is perfectly plain, and no one conversant with the facts has honestly denied it.

The white semi-albino 5-year-old<sup>1</sup> has been seen sleeping in the same spot on Zoltoi Bluffs for a week or more. Though several times driven off in the meantime he had invariably returned. This gives some idea of the length of time the older bachelors remain on shore.

<sup>1</sup>This animal was seen in the same place on one or two occasions in 1897.



## THE CENSUS FOR ST. GEORGE.

The fact that Colonel Murray's count of the harems on North rookery of St. George, as reported by Mr. Lucas, is 225, as against an estimate of 168 for July 9, leads us to conclude that for some reason our count of this island was too early to represent the state of these rookeries in the breeding season. A count of Zapadni rookery, also by Colonel Murray, increases the harems from 143 to 182, and on Staraya Artel from 59 to 75. A count made so late in July as these are not truly representative, as doubtless many of the harem bulls are already gone and their places taken by others. On the whole, however, we feel that this latter count may be more near the truth than our own, and we are inclined to substitute its results as to harems for our own, applying to the rookeries of St. George, as to those of St. Paul, the average harem of Kitovi rookery. This is 17.3 cows to the harem. It will be remembered that for the counted portion of North rookery, the largest on St. George, the average harem was found to be about 17 cows. The following, therefore, is the revised census of St. George Island:<sup>1</sup>

*Census of St. George Island.*

Rookery.	Harems.	Cows.
North .....	225	3,891
Little East .....	44	761
East .....	135	2,335
Zapadni .....	182	3,148
Staraya Artel .....	75	1,297
Total .....	661	11,432

## AUGUST 1.

Dr. Jordan went to Zapadni in a boat this morning to investigate the seals reported dead on the rookeries there. In the afternoon, with Dr. Voss, Judge Crowley, Mr. Adams, Mr. Macoun, Mr. Clark, and a force of natives, he visited Reef and Lukanin rookeries to determine whether the yearling males and females mix on the hauling grounds.

The day was bright, with no wind; the sea was unusually calm, with occasional drifting fog.

A great snow bank is still visible on the southern side of the hill between Lukanin and Little Zapadni rookeries, and furnishes a landmark by which vessels steer.

## THE KINDS OF ROOKERIES.

The Lagoon rookery is but an overflow from Tolstoi, as English Bay or Zapadni Reef is from Zapadni. The break between Tolstoi and Lagoon is larger, because on the south side of Tolstoi Head the vertical cliffs abut closely on the sea. There is not over 5 feet between the cliff and the high-tide mark, and often when the surf is running there is no space at all. On the west side of Tolstoi there is 30 to 60 feet under the cliffs, and this widens out northward to the broad concave slope of Tolstoi

<sup>1</sup>After the investigations of 1897 we are still more dissatisfied with the count of harems made at the close of July than with the early count. We have attempted in the complete revision of the census of 1896, which will be found in the notes for 1897, to arrive at a mean between the two.

Sands. The tip of Tolstoi is formed not of broken columns, but projecting wall-like dikes. The last harem is beside a grassy projecting wall, with a smooth slope on one side.

The preferred rookery ground is a gentle slope with large angular blocks of lava evenly strewn between with hard lava sand. From these sometimes run hard benches of broken lava, in which sand predominates over the rocks, as at Tolstoi.

The sandy places are generally avoided, but the concave flat of Tolstoi can not be wholly avoided. On this sand is washed down from above and becomes packed by the movement of the seals. In such places occur the greatest natural destruction of pups. Gentle rocky slopes, but more or less strewn with bowlders, are found at Zapadni, Little Zapadni, the Reef, under Hutchinson Hill, at Polovina, and Little Polovina. Other rookeries lie on the rounded, waterworn bowlder beaches, without hill slope behind. Such are Zapadni Reef, Lagoon, the greater part of Vostochni and Morjovi, and part of the Reef. Irregular rocky areas under cliffs, and not capable of much extension, are found on Kitovi, Lukanin, Tolstoi bluffs, part of Polovina, and much of Gorbateh. In the cliff portions and on the bowlder beaches the harems are well separated, having natural boundaries, and there is no crowding.

In the great masses, as at Vostochni and Reef, on rather level ground and among rocks, the harems are larger, partly confluent, and there is much more fighting among the bulls. All rookeries have a front of rounded bowlders except where the cliffs abut on deep water, as at Kitovi and Tolstoi bluffs. On Gorbateh the harems extend more or less up a steep, hard, smooth slope of lava gravel and sand.

Open sand beaches are never frequented by breeding bulls or cows, though bachelors and injured bulls like to sleep there. The regular places for the bachelors, however, are on the rocky edges, where the sand is packed firm. At Zapadni the former limits of the hauling grounds are clearly evident, as is their diminution, from the slow creeping green of the seal grass. The bachelors as they diminish tend to hug the rookery edge, and the ground first vacated is always that farthest from the rookery.

#### ZAPADNI ROOKERY.

The trip to Zapadni was made in a boat along the east side of the rookery. There is a dead hair seal on the rocks here. There is one harem on a rock in the sea.

The dead cows proved to be too rotten for examination, and the place was so thick with bulls that they could scarcely be approached. Another rotten cow is seen on the beach, but can not be examined. All these died at the same time as the shot cows at Morjovi, but the cause of death can not here be ascertained.

What seemed to be a dead pup lying on the rocks proved to be one asleep. It has been wet by the wash of the sea. The crevices of the rocks are filled with wet pups, who can only get out by swimming. They swim freely, some of them in rather deepish water. A drowned pup must be a rare occurrence, as they soon learn to swim. One was seen to leap in and swim about. It could not keep its head above the water, but splashed about a fourth of a minute, his head all the time under the water. Then it came back to the rock and climbed out. Another did the same thing. Another went out a few feet, head mostly above water, and circled back to where he started. He has learned to keep the nape down and the nose up.

There are not many virgin cows along the water front of Zapadni, but there are lots of wet cows. One wet cow, without doubt a virgin, is in charge of a wet water bull. The water is thick with swimming cows. There are 3 harems around Zapadni Point not seen by us before, containing 50 cows. Near them is a dead bull.

Zapadni Point or headland is made up of columns of lava, apparently not changed since they first cooled. We climb the west side of the cliff, 100 feet high, by the path the seals go up and down—no easy climb, and one impossible to any but a strong man.

Two cows and one pup lie dead together and rotting on western end of Zapadni in the last harem. Two other pups are found crushed on the rocks. There are too many bulls. A bull at the end of the rookery has 6 or 8 virgins waiting.

#### EXCREMENT.

Passing along the west side of Zapadni on foot yellowish excrement is seen on the hauling grounds; three instances of brown cylindrical excrement; still another of gray mash; another of translucent liquid excrement; two more of yellowish brown. All these are found within a distance of 6 rods. Idle bulls are seen with much soft excrement about them. Similar observations could be made anywhere, showing the falsity of the contention of the British commission of 1892, that no excrement is found on the rookeries or hauling grounds in August. It is abundant everywhere for the whole season.

A virgin is seen in charge of an old bull. No virgins are seen in the large harems near the sea. I see none in the rear of the middle portion of the rookery. Several virgins are in a harem behind the next cross.

Zapadni rookery has shrunk greatly, in one case 200 feet from one of Townsend's crosses, marked on a stone covered with green moss. This cross is near the middle of the length of the rookery. A bull stands on his hind feet on a pinnacle of rocks on which another cross is painted, looking over the top he looks exactly like a tall man in a fur coat stretched up at full length.

Pups by the thousands are lying on the smooth, hard sand. They like to sleep there, as do also the cows. Both like to be in a big bunch. Organized harems avoid these places, the bulls preferring the rocks.

A big dead pup lies among a crowd of bachelors; not starved; probably crushed. Bachelors are as likely to nurse a lost pup as a cow not its mother would be.

This is the warmest day of the season. Many seals are in the water; many asleep. The smell of the rookeries is suffocating.

A harem of virgins in charge of an old bull is located below the next cross to the north. Five or 6 virgins, with as many old cows, are in another harem well back. Another harem shows half virgins. These harems are in the last tier of harems near the hauling ground to the north.

#### THE RESERVE OF BULLS.

Many 3-year-olds at Zapadni evidently escaped killing. They haul out in small bunches at various inaccessible points. Many are on the headland.

Without doubt more 3-year-olds escape each year and grow wigs than there is needed for purposes of reproduction. These are by no means the smallest or weakest. They are at least average animals. Sometimes they escape because located in outlying

positions; sometimes because they are late arrivals. The killing closed this year on July 27, and is never continued later than the 1st of August. Those arriving after that time are exempt from driving, and as killable seals are found to the last, it is not unreasonable to suppose that some arrive after August 1 for the first time.

#### ZAPADNI GULLY.

There is a long shallow gulch in Zapadni, north of the middle part winding down to Southwest Bay. There are many virgins in the last 4 or 5 harems at the top with many regular cows among them. This long gulch is a concave sandy track where many pups gather and where many bulls fight. It was the scene of constant fighting at the time of the original counting of the rookery. Many dead pups are here. Ninety are counted trodden in the sand; mostly, but not all, small and rotten. Probably 120 could be found. There are no rocks to hide them. As I stand on the parapet above I can see over the whole space, but have no glass. One newly-born pup is in the gulch, and several pods of from 30 to 100 older pups are playing about. This Zapadni gully<sup>1</sup> is a place where pups are easily killed as well as easily seen. Very few dead pups are to be seen on Zapadni except on the sandy gully. The live ones pile up and sleep on the dead ones.

There are few wet cows here, so far from the sea. Virgin cows that can get away dash for the sea. One bull seizes a cow and brings her back. Forty of them are going down the canyon now like holostiaki.

I come over through the quarrelsome bulls to a green cliff over the gully, a better point of observation. I can see more dead pups here even than on Tolstoi. The conditions in the latter place are the same, but the sands are less concave and broader, with the side, not the end, open to the sea. There are 50 harems in Zapadni gully.

Three other dead pups are seen among the bachelors.

Where so few instincts are demanded as in the case of the seal they are necessarily very intense. Knowledge of place, of mother, of pup, of reproduction, of catching fish, of protection and retention of harem, are the principal things the seal has to know. These he knows automatically, each one as well as another.

Another dead cow and a dead bull lie rotting; and more dead pups are among the bachelors, 2 on the rocks. Doubtless there are more dead pups crushed among the rocks than appear. It is as easy to see into a grizzly bear's lair as into harems in the center of the great masses.

Two very little cows, probably virgins, are on the edge of harems among bachelors guarded by a half bull. Another is seen in the northernmost harem.

The 2 virgins and the half bull all take to the water. The bull tries to round them up in the sea; seizes one and tries to drag her ashore, but fails. The other tries to get ashore and he prevents her. There is no doubt that these cows are virgins. They are still rounded up in the water, though one cow keeps trying to get ashore. A little cow lies on the rocks wet. She dives into the sea out of sight. A bull tries to catch her. Another bull close by guards a cow with a pup and a virgin. The virgin gets away to sea. The virgin 2-year-olds are plainly visible everywhere, but there is nothing to be seen on Zapadni that looks like a yearling cow.

<sup>1</sup> When this gully was counted on August 14 more than 600 pups were found dead in it.



## THE EXPERIMENTAL PUP.

A strayed pup is found on Zapadni a long way from any harem, among the bachelors. It is a robust, healthy female, perhaps 3 weeks old, sleek and strong. It is taken home for purposes of experimentation in starvation, as it can not fail to starve to death where it is. The dead pups seen on the hauling ground among the bachelors are evidently astrays like this one, having wandered away and starved, or else been trampled upon by the half bulls and bachelors.

In counting dead pups experience shows that it is very difficult to distinguish surely the dead from the sleeping pups. They stretch out and assume in their sleep positions similar to those in which dead pups are seen, and not infrequently the pup you have decided to be dead will lift his head and go forth to play. At a long distance there is also liability of mistaking a black half-buried stone for a dead pup when half hidden in the sand. There are some of these among the dead pups on Tolstoi.

The drive from Zapadni is a very short one. The skins are brought to the village in boats. Killings at Zapadni are made only when the weather permits this to be done.

## DRIVES AND STAMPEDES.

Even if the treatment of holostiaki on the drives and killing grounds was needlessly cruel, as has been alleged, it would affect the increase or decrease of seals on the rookeries no more than the overdriving of street-car horses would affect the breeding of fine colts. An injured animal would merely recover or die. The voluntary racing and climbing the bachelors undertake for fun, for curiosity, or when alarmed far exceeds the strain I have seen any driven animal undergo. Where an animal gets its head crushed by a blow intended for another, as in the case of the yearling at Polovina, that is simply the end of the animal. If the animal is only temporarily stunned, it recovers and is none the worse.

Stampedes of the rookeries are carefully avoided by the people on the islands; but should they occur they are not necessarily serious or likely to be dangerous. The cows do not flee willingly, except late in the season. They do not injure pups, and the bulls devote all their time to preventing the escape of the cows and to rounding up the disorganized harems. As to the bulls, the man does not live who could stampede one in the height of the season. An old bull would not leave his place until his skull was broken. Nothing frightens him, and he is as incapable of fear as he is of hunger in the breeding season. This, however, is not true of those under 6 years of age, and those under 7 can be driven. The so-called impotent bulls are not so through sex exhaustion, but through broken bones, broken joints, hernia, or buckshot. It is to be doubted if the functions of life outlast those of virility. The bulls with virgin harems now are as fierce and virile as the beach masters were in the middle of July.

## GORBAT'CH ROOKERY.

From the tip of the slope of Gorbatch a group of young seals was rounded up which contained a number of young females, including the uppermost harem in charge of the white half-albino bull to which reference has been made (July 27).

By means of a slip noose fastened to a long pole in such a manner that it could be slipped over the head of the seal and then drawn taut, the men were able to draw

the small seals out, one by one, from the pod. The first two inspected proved to be females, virgins which had never had pups. The third, very closely resembling these, proved to be a holostiak. He evidently belonged to the flock of bachelors lying hauled out on the brow of the hill above this last outlying harem. The majority of the rest were 4-year-olds, distinguishable by reason of their incipient wigs. Among them were a number of females with pups. The rest of the pod was released. The holostiaki and the cows hastened down through the harems and did not stop till they reached the sea. The white bull went part way down and then turned about. He was the picture of outraged dignity. He seems perfectly dazed. Two half bulls are in his former place. It will be of interest to see whether he returns.

Apollon, the chief, and his men rounded up a pod of holostiaki from the hauling ground of Reef Rookery. There are some half bulls among the lot, but the majority are apparently yearlings. One by one they are noosed and drawn out of the lot. While two Aleuts with their clubs control the head of the seal, another seizes it by the hind flipper and turns it upon its back, thus permitting perfect identification as to the sex.

It is interesting to note that these little fellows fight with exactly the same spirit and determination as when they were on hand at the killing on the 25th. It is with the greatest difficulty that those examined can be induced to leave the ground. They persist in returning to the pod. The tenth animal examined proved to be an adult cow, and as she had evidently never borne a pup she was killed for dissection. She proved to be a barren cow, the only one so far definitely recorded.

One after another the little fellows are drawn off until 23 have been examined. They are all plainly holostiaki—yearlings. A few yet remain, but their size and the presence of the wig sufficiently indicate their sex, and they are released. It may safely be inferred that no virgin females are among the bachelors on the Reef.

#### THE BARREN FEMALE.

On examination the barren female showed the organs of reproduction in a rudimentary state. She could not possibly bear a pup; therefore, her presence among the bachelors meant nothing. She was to them no more than a male. The drive made was from the center of the hauling ground back of the main part of Reef rookery, and at a distance of not less than an eighth of a mile from any harem. The cow was associating with the holostiaki as though one of their number, and was not seen to be disturbed by them.

The following are the detailed notes of the dissection of the barren cow, conducted by Dr. Otto Voss and Dr. Jordan:

“From an examination of the teeth and skull she was found to be an adult cow, probably about 5 years of age. She was above medium length, but slender and of rather less than medium weight. The throat was very dark brown in color, rusty below as well as above. The mammae were found to be fairly large and to have undergone pathological fatty degeneration. The glandular structure was obliterated. The ovaries were found to be small, about one-fourth the size of those of the virgin 2-year-old cows recently examined. The fallopian tubes and uterus were similarly atrophied. The right ovary contained a small Graafian follicle and egg. The germinal spot was visible in the egg and not impregnated. There was evident no sign of impregnation or of capacity for impregnation. No signs of corpus luteum or

sears of previous impregnation were visible. The opening of bladder was so small as to require a probe to find it. There was no trace of hyperemia, the tissues being pale and bloodless."

#### STAMPEDING BACHELORS.

Returning from Reef Rookery, a bull was seen on Zoltoi Sands that dragged his hind flippers as though from an injured back. Jacob was sent to shoot him. But the bull ran around the eastern end of the crowd of sleeping bachelors and roused them up. When he found that Jacob was after him he straightened up and got out of the way as if nothing was the matter. By this time the whole crowd of about a thousand bachelors was in motion toward the edge of the cliff, being deterred from taking the usual runway to the sea by the presence of the crowd of men on the sands. The herd stretched out in a long, narrow line. When the first ones reached the edge of the cliff, which is about 15 feet high, those in advance turned back, but the crowd pressed on from behind and they began to drop one by one over the cliff in a way that seemed to indicate that the whole lot would eventually make the trip. The men were sent to turn them back. The fall was a severe one, but none of the score or more seals which went over showed evidence of injury; all swam off swiftly and strongly.

#### LUKANIN.

To make further test of the probable presence of virgin females among the holostiaki, we went to Lukanin Rookery, and the Aleuts rounded up another large pod of bachelors. The hauling ground of this rookery seems to be a favorite one for the yearlings, as a very large percentage of the seals in each drive from this rookery are of this class.

One by one the little yearlings were drawn off until 17 had been examined. All were bachelors. The rest in the pod were so evidently bachelors that further examination was discontinued. There is, therefore, nothing so far to show that the yearling females associate with the males on the hauling grounds, at least at this season.

To-day in looking over Lukanin sand beach, 25 bulls are seen to be hauled out where only 5 were counted on the 23d of July. These mark the withdrawal of the harem bulls from the breeding grounds.

To-day is unusually clear, and the outlines of the island can be seen distinctly. St. George is plainly visible. The smooth surface of the sea seems alive with seals far out.

#### EXPERIMENTAL PUPS.

On the way home from Lukanin, Dr. Jordan found in the grass, a third of a mile west of Lukanin Hill, a pup prematurely gray, half starved, and blind. He had evidently been there many days, as the grass about him was all beaten down. The pup was brought home and put in the box with the one from Zapadni. The big strong one examined him closely at first, smelling of him as if to see whether he knew him. After a little the pups began fighting, the blind one snapping at the other

#### SWIMMING OF THE PUPS.

After the examination of the yearlings, observations were made on the swimming pups under the cliff overlooking Lukanin. Many pups were at the edge of the water



learning to swim. No cows were with them. The little fellows began by dropping off the rocks into the water and then scrambling back again. On a second trial they would go a short distance, apparently having difficulty in keeping their heads above water or in getting them up when they wanted to breathe. They would always raise their heads with a gasp. In the course of two hours considerable progress seemed noticeable. Some of the little fellows were able to swim about 25 feet or more. After going this distance they would apparently turn in great haste to reach the shore, not stopping till they were out of the water. One could imagine they were just a little afraid. They would soon drop off into the water and try it again. Occasionally two or three would swim some distance down the beach, 10 or 12 feet out from the shore, to a large rock. Some returned by water, others came out on the rocks and remained there. These were evidently beginners. Others were swimming fearlessly.

The pups soon become accustomed to the water, and are to be seen playing with each other, biting and pulling one another about much as on the land. When one gets out on a rock another will attempt to push him off, or it may be that a big wave will push several of the pups off some flat rock, and the first one to recover his position will try to prevent the others from landing.

A little bachelor swims up to a pup out a rod or two in the water and takes him by the neck as if to duck him. The pup makes for shore, breaking away from the bachelor and raising his head gasping. Seeing the bachelor following, he climbs the rocks, not stopping till he is far up in the rookery. The bachelor swims out to other pups. There are other bachelors about, but neither they nor the cows seem to pay any attention to the pups. Cows from the water are passing out and in, shoving the pups out of their way as they go. There is nothing, beyond the interference noted, that resembles helping the pups learn to swim, and the bachelor's intention was evidently to have fun with the pups rather than to assist them.

A pup in the water was seen to take a long piece of kelp and swim away with it, soon dropping it. Another takes it up. This is what has given rise to the theory of the pups feeding on kelp. There is no apparent intention to eat. They simply play with the kelp as a dog would play with a stick.

#### COWS AND PUPS.

Many wet cows are coming out of the water at this point. One just in is calling. Three or four pups are hanging about her, but she snaps at them and pushes them away. They understand quickly enough that she is not their mother, and leave her. Though watched during the space of an hour, she does not get her pup. She presently stops calling. Perhaps her pup is one of those swimming and does not hear her. She is apparently content.

Another cow comes in and in two minutes her pup is nursing. The wetness of the cow has evidently nothing to do with the matter. If the pup turns up immediately and is anxious for it, he gets his dinner at once. If he is asleep or playing, his mother may or may not hunt him up, and she may prefer not to see him until she is dry. The pups she pushes away are simply not hers. Still another wet cow comes in. She finds her pup waiting for her at the water's edge, and it nurses immediately.

At the same time there are three cows almost dry, showing that they have been out of the water some time, which have no pups. One of them is calling lustily.



In company with three wet cows is a very little one, probably a virgin female, or possibly a yearling male. The little animal goes up and rests in the outermost harem. It is not noticed by the bull.

## YOUNG BULLS.

Many half bulls are invading the rookeries from the water. Five are seen within a short space. Some have harems of one or two cows each. Others try to intercept cows going to or coming from the water. They may round up virgins later on. The old bulls pay little attention now to these intruders.

A big bull comes in out of the water. As soon as he gets on the rocks he roars excitedly, making a bee line for the edge of the cliff and attacking a gray 6-year-old who is surrounded by a number of pups but no cows. After a brief fight he throws the gray fellow out, getting his eye laid open. Then he rushes at the bull on the right; returns and drives the gray fellow farther down. It looks as though the old fellow had had a harem there and the claim had been jumped while he was in the water.

## INJURED ANIMALS.

It has been suggested that the animals that lie stretched out full length are "injured in the lumbar region." The number of such animals must be very great. Within the range of the eye on this rookery there are 10 old bulls in harems lying at full length either on the back, the side, or the belly. Within the same space, without making a close count, there are 20 cows in the same position. While this position seems a favorite one, every other conceivable attitude is assumed by the sleeping animals. Many are seen lying on rocks with their heads hanging down.

## VIRGIN COWS.

In a harem under the cliff are 3 clean, fresh, little cows that are evidently virgins lately in from the water. One lies on her back. An inquisitive pup noses about her. She folds her flippers over her belly and does not even wake up. Another bites sharply at a pup. She has a different snap from a mother.

## ZAPADNI ROOKERY.

On St. George Mr. Lucas visited Zapadni rookery, making these notes:

The harems have moved a little uphill and decidedly away from the cliff. The majority of the cows are in one solid patch, but there are some straggling cows and harems from 100 to 150 yards back. There is no permanency to these latter harems, for the cows are nervous and the bulls chase them about so that now one bull and now another has the cows.

The pups have for the most part gone down the slope under the cliff, where they fairly swarm; some are in the water. On top of the hill is 1 pup recently dead, with the remains of 2 others eaten by the foxes.

There are still about 30 idle bulls around the upper part of rookery, most of them noisy and quarrelsome. Some of the bulls have mingled with the bachelors which struggle about the edges of the rookery or even enter it.

Zapadni shows the decrease of seals better than any other rookery and is most impressive, as from the hillside it can all be seen at a glance, making comparison

between present and past conditions easy. Hair and smooth stones cover the ground in places intermixed with vegetation, showing the former extent of the territory hauled over by the seals.

#### AUGUST 2.

Dr. Jordan and Mr. Clark visited Gorbatch and Reef rookeries in the afternoon.

#### GORBATCH ROOKERY.

Under the cliff at Gorbatch a bull is seen copulating. The cow lies with her breast on a stone. She is an old cow and is very patient. Another cow is biting at the bull's neck. The cow herself reaches up and bites him. The bull and cow roll off the stone, but are not parted. The cow tries to get away, bites him severely in the neck. The bull will not let her go and holds her quite successfully with his fore flippers. The cow is satisfied. The bull lies back with his nose in the air and seems to sleep. He is wet, but probably from the surf, which throws spray on him. The harem is on the rocks at the water's edge. There are 8 cows in the harem and 2 pups. Other pups play near by.

#### THE COLOR OF THE BULLS.

One big bull under the cliffs has more red in his coat than any other yet seen. It is noticeable that there is more diversity among the bulls as to color than is seen in the females. Some are creamy, others dark brown, this one reddish brown, some iron gray, some simply gray. One lying here looks as if he had dark rings across his gray back. He is fat and the rolls of blubber may give the ringlike appearance. Probably he has been out to sea to feed and has returned fat. He has evidently not suffered by fasting.<sup>1</sup>

#### PUPS.

Many pups are swimming to-day. There is no evidence that the cows are helping them to learn; in fact, none are near them. Cows going to and coming from the water pass them without notice. The holostiaki are here playing with the swimming pups as on Lukanin.

Five dead pups can be counted on the rocks below. A dead pup, a large one, is seen lying on a flat rock about 10 feet from the edge of one of the outer harems on Gorbatch. It is full and plump. After some difficulty it is got out and is found to be fresh. It was brought home for post-mortem examination.

The pup was dissected by Dr. Voss. He found the vena cava and one auricle of the heart burst, evidently under pressure. The internal organism of the pup seemed otherwise all right. Death doubtless resulted from crushing under the weight of a bull. After the accident the pup must have crawled up on the rock to die.

A pup is seen lying across the side of a sleeping cow. The pup's hind flippers are lapped over the cow's back. His head is down. He is taking his dinner under disadvantages, but he is getting it just the same.

A cow is up on a rock at some distance in the rear of the last harem. She is looking into a crevice in the rock and calling, evidently trying to get her pup out. There is a pod of sleeping pups in there.

<sup>1</sup>In 1897 it was observed that the younger bulls went and came from the water more or less regularly. They probably fed also.

Several virgin cows are grouped in small harems near the top of the rocky slope of Gorbateh. These small harems are evidently increasing from day to day.

The white bull driven up yesterday on the parade ground with his harem is back in his old position with one cow. The cow stampedes on our approach. The bull acts as though the world were a hard one, and as though he owed us a big grudge.

A young gray bull is fondling over a large pup which is lying on a small stone. A neighboring bull disturbs him. He returns and puts his nose down on the pup. Acts as though he would attempt copulation. The pup struggles out and runs away, the bull following. He is attacked by his neighbor, and, coming back, lies down by the stone.

#### THE CINDER SLOPE OF GORBATEH.

On the western slope of Gorbateh is a slide of smooth cinders which swarms with pups. The harems on this slide have gradually worked up the hill until the top ones are on the very brow of the parade ground. It is at the very top that the white bull is located. The slide is steep and the surface is hard. Any animal starting down is liable to slide to the very bottom, whether it will or not. A large number of half bulls have been seen to be thrown down here lately by the bulls. There are pups at every stage of the slide; but although there are hundreds of them about, none are seen dead, except one on a little angle, where it has evidently been crushed. It would be impossible for a bull to step on a pup here. He has to choose well his footing if he is not to slide off into the sea.

#### MOTHERS AND PUPS.

In a harem beside a stump of driftwood near the water's edge there is a newly born pup. The bull in the harem is greatly excited over something, acting as though he thought one of his cows was in heat. He follows her about until he has all the cows stirred up. When he comes near the little pup, the mother stands over it with an air of protection, lifting it out of the way of the bull, and fighting off the other cows. The fresh red placenta shows that the pup is only a few hours old. Finally the cow in which the bull is interested gets away to the water. Several others go, too. Then the bull quiets down.

One cow comes in wet from the sea. Before she is half way up the slide her pup meets her. He begins sucking as she stands waiting. In a few moments she starts on; the pup follows. She goes through a large pod of pups and lies down in the edge of them; the pup, which has followed her closely, settles down to nurse. In a few moments she turns over on the other side to give him a chance to complete his meal.

A cow on a rock at the water's edge which a moment ago was calling loudly for her pup has it with her now, nursing in that rather difficult location. The pup is wet. He has evidently been swimming, and so was right at hand to respond to his mother's call. Evidently the rule that the pups must wait until the mother is dry has many exceptions. The mother is dripping wet, and both she and the pup are drenched by the surf, which sends spray over the rock.

Another cow comes in and gets her pup at the foot of the slide. It follows her laboriously up the steep slope. She turns under a shelf of rock half way up and lets the little fellow feed.

A mother comes up the full length of the slide and lies down in a large pod of pups. She calls and the pup comes to her at once, getting up from among his sleeping companions at the sound of her call.

Other mothers are distributed about in various positions about the slide. Some are calling loudly and continuously for their pups without avail. Others are quietly resting. The pups are probably down at the foot of the slide swimming in the water. There is a little sheltered pool there with hundreds in it.

In a harem in a cleft about half way up the slide are two little mouse-colored cows, which seem to be virgins. The bull is very much interested in one of them.

#### ARDIGUEN.

The bull in harem A is still under the bank and has 4 cows, with possibly more out of sight. The green-coated cow is not in sight. B has 8 cows; C, 23. X is now in D's old place, and seems to control 18 cows; they are very much scattered. When last seen, X was in the outer edge of C's harem, on the flat. He has evidently fought his way down the slide or else has been thrown down by bulls B and C.

The water bull Z seems to be comfortably settled with three cows. It lends dignity even to an undersized bull to give him a harem to take care of. E has 9 cows; F has 5. There seems to be a bull in G's place—perhaps he is himself back—with 10 cows.

As we go round to the end of the Reef the cows in C and B are frightened and stampede down the slide. In ten minutes a half dozen are back on the flat. Doubtless all will be back in a short time. Y has disappeared.

#### REEF ROOKERY.

A wet cow is seen near Reef Point in a harem with two wounds on her left hip, which look as if made by a spear. Blood is oozing from them.

A few feet farther on is the smallest animal<sup>1</sup> not a pup yet seen. It comes out of a crevice in the rocks from among a flock of pups. It is no larger than many of the pups, but is slimmer, and the head looks different. This must be a yearling female. She goes slowly down the rocks and swims lazily out to sea. The bull in whose harem she was pays no more attention to her than to a pup.

Four or 5 virgin 2-year-olds are seen in small harems about Townsend's cross. In one of these single harems is a cow which evidently does not know what fear is. She lets us come within a few feet of the rock on which she sits. Her bull is very much excited, and is more fearful than she, but he has a little too much pride to desert her. If she would go, he would be glad to go with her. These little harems of virgins are to be seen all along the outer edge of the reef. There is no longer any mystery concerning the whereabouts of the virgin females.

It is to be noted that on the Reef, in every instance, the harems have extended out beyond Townsend's crosses, some of them even to the extent of 150 feet. But this plainly has nothing to do with the extent of the rookery in the breeding season. The cows are gradually working back from the beaches to the uplands.

The bull whose young cow was shot the other day seems to still linger near the scene. His lower teeth are in a bad shape, but not wholly lost.

<sup>1</sup> Later observations show this to have been a yearling cow, the first one seen.



On July 30 there was the severest surf of the season, and coming from the southwest it beat without restraint on Ardiguén, but no drowned pups are seen. When the surf breaks directly the pups withdraw. No "deadly surf nip" of any consequence has been seen, and certainly no dead pups as a result of it.

#### THE TRAMPLED PUP.

Dr. Voss supplies the following full record of the autopsy of the dead pup from Gorbateh: "The muscular system of the animal was intact; no evident wound was found on the head or under the skin. The stomach was full of milk; the heart full of venous blood; blood was found in pericardium from the ruptured vessels; the gall bladder was somewhat injured by pressure; there was some congestion of the lungs. Death evidently resulted from being stepped upon, the pressure bursting the right auricle at the entrance of the vena cava. The rupture of a blood vessel of the heart was the immediate cause of death."

The pup was found on a flat rock at the top of the rocky slope of Gorbateh, high above the sea. This examination shows that even the largest pups may sometimes be killed by the bulls. The little ones of a few days old, if stepped upon squarely, must die, although most of those we have seen under the feet of the bulls get up uninjured.

#### THE DEATH TRAPS.

The dead pups thus far have either been crushed by the bulls or starved as the result of straying, or else trampled by the bachelors. No other cause has been noted, and more than half of the dead pups have been small ones with the umbilical cord attached. The places of their death have been chiefly the sandy areas. The piling of stones in these flats and depressions would save a great many pups. They would receive protection in the crevices of the rocks, and the bulls would not be so likely to set their full weight upon them. It is at any rate to be noted that few, if any, dead pups are to be seen in the harems that lie on the loose bowlders of the water front and under the cliffs.

#### AUGUST 3.

Dr. Jordan and Mr. Clark visited Lukanin rookery in the afternoon.

Heavy rain fell during the forenoon, slackening somewhat at noon, but resuming again later in the afternoon. A heavy surf was coming in on Lukanin and Kitovi rookeries.

#### KITIVI AND LUKANIN.

The rookeries are wet and muddy. Each seal and pup, where possible, is perched on a rock to be out of the mud. A favorite attitude in the rain is for the animal to sit up dozing, with the head thrown back and the nose high in the air. All look uncomfortable, but not as though they suffered. A few seals are in the sea despite the high surf. No pups are trying the open water. This rookery is sheltered from the wind, but not from the surf, which is from the east. When a strong wind has been blowing from any direction for a few days a sort of return swell is started on the opposite side of the island. Many of the pups were huddled under rocks and overhanging edges of the cliffs.

## A DEAD PUP.

A freshly dead pup lay near the angle of the cliff; also a dead cow. The latter was found to be too rotten to handle. The pup had not been long dead. It was brought home for dissection, to determine cause of death. Dr. Voss reported on examination that there was a slight contusion of the liver, and the lungs were completely collapsed. The other organs of the pup were uninjured. A big bull had evidently squatted on the pup and crushed the breath out of it.

Under a corner of the cliff is a cavern extending in some 10 or 12 feet. This place is literally packed with pups trying to get away from the storm. It seems as if they must smother, so closely are they packed. The little fellows snarl and spit at the intruder like tomeats.

In trying to get the dead pup away, a live pup was encountered, which sat on a stone near by and refused to budge, growling, snapping, and in all respects acting on a smaller scale as the master of a harem might have acted. The pups evidently inherit the dispositions of their fathers.

The blind pup brought the other night from Lukanin, and kept in the box with the stray pup from Zapadni died to-day. He was nearly starved when found. The Zapadni pup is still vigorous.

## LAGOON.

It is evident that the seals prefer to sit up during the rain rather than to lie on the wet rocks. The showing of heads on the ridge of the Lagoon, as seen from the window of the company's house, is like the teeth of a saw. On ordinary days only the heads of a few old bulls can be made out at this distance, but to-day there are hundreds of upraised heads. The seals do not seem to take to the sea in very great numbers on rainy days.

## MR. LUCAS'S NOTES.

I visited north rookery of St. George. A strong southwest wind, with rain, is blowing. The bachelors were on land much as usual, but more wakeful and restless; the harems were about as full as usual. Many pups have worked down from the hillside to seek the shelter of the boulders.

The rain washes the rookery slopes in places and brings to light the bones of long-dead pups. Two fresh placentæ are seen, indicating that pups are still being born.

A stone on which a holostiak was seen lying was measured, the size being about that of the adult female. One animal sleeps comfortably on a stone 18 by 28 inches. Two have plenty of room on a stone 28 by 39 inches.

One 5-year-old bull wanders over the hill voiding excrement, which shows he must have fed quite recently.

## AUGUST 4.

Dr. Jordan and Mr. Clark walked to Tolstoi, then to Zapadni Reef, crossing the island to Lukanin Beach, and returning by way of that rookery.

The weather has cleared somewhat, but the southeast gale continues and a tremendous surf is breaking everywhere.

## THE FUR SEAL'S SENSE OF SMELL.

Much has been said about the fur seal's sense of smell. It is claimed that if you go on the windward side of a seal he will detect you at once and awake. We walked up on a bull from the windward side, approaching to within 10 feet without awakening him. After standing beside him for an instant he awakened, opened his eyes and looked at us sharply before he got out of the way. Whatever message his sense of smell conveyed to him, it was the sense of sight that he obeyed.

## TOLSTOI ROOKERY.

A dead bull was seen lying above one of the crosses in the area occupied by the idle bulls. The cause of death was not apparent, and the animal was too much decomposed for examination. We saw a large gray bull with a wound in the shoulder, from which pus was flowing. This and the wound on the head of the dying pup at Polovina are the only instances so far where wounds have shown evidence of suppuration.

There is a tendency on the part of the holostiaki on Tolstoi to stampede right down through the harems to the beach, and on the occasion of every visit to this rookery many half bulls are seen to make their way down the cliff and across the sands, in every case occasioning numerous disturbances in the harems. This rookery seems to be unfortunate in not having anywhere in its entire length a runway for the bachelors to haul out. They are forced to follow down to the angle of the sands, climb the hill, and work back to their hauling ground behind the hill slope of the rookery. It is possible that some of them work up through the rookery, but none have been noticed. If they tried this early in the season it is not wonderful that numerous pups are killed by the fights thus occasioned. Besides this, the harems tend to mass in a long tongue-like projection at the point about which bachelors must haul out. In going to the sea the bachelors try to avoid the long detour, and whenever they go into the harems there is constant disturbance.

Unless the holostiaki are in rapid motion, the remonstrance of a bull stops them. This is certainly true during the close breeding season. Now, however, many of the young fellows persist in going through the rookery regardless of the bulls, and are able to do so.

There are many virgin females in the outlying harems on the slope of Tolstoi. In approaching a rock for the purpose of getting a view of the dead-pup area a harem was stampeded, all the cows but one leaving the bull. She was evidently a virgin. Within a few yards two other bulls were guarding other virgins, one each. They apparently think more of them than of a whole harem of adult cows.

A pod of pups was closely approached. They growled lazily, but made no move to get away until an effort was made to touch them, then one snapped angrily at the outstretched hand, and the whole lot hurried off.

## ZAPADNI GULLY.

The gully at Zapadni, where the excessive mortality of pups was noted, is, like Tolstoi, a place where many bachelors try to make a short cut to the sea, and as the gully is narrow their passage results in great confusion and in the trampling of many pups. One might appropriately say that the gully at Zapadni, the sands of Tolstoi,

and the similar angle at Polovina are "death traps" for pups. At these points the greatest mortality of pups has been noted. It would be a good idea if in the winter time a lot of bowlders from the slope above Tolstoi could be rolled into the sand flat. The pups like to lie on the sand.<sup>1</sup> Were there bowlders scattered about on it the pups would be protected against the movements of the bulls.

#### DEAD PUPS IN WINDROWS.

A very heavy surf is breaking to day on Tolstoi sand beach, and scores of dead pups are being washed up. They lie in a windrow on the sands, while a mass of them is thrown up and sucked back by the waves. Many of the pups are hairless, and all are rotten, making dissection impossible. Most give external evidence of having been crushed. None are emaciated. Most, but not quite all, are very young. There are 185 in all on the beach. The sands along the beach are strewn with the bones of dead pups of other years. The pups have not been drowned. All give evidence of having been dead a long time. This has been our first heavy gale. The pups are evidently washed from the entire sea front of Tolstoi rookery. The southwest gale is blowing squarely into English Bay. It strikes the front of Tolstoi rookery at the headland, and the end of each wave sweeps the full length of the rookery front, washing out and carrying to the foot of the bar all the dead pups lying below high-water mark, finally throwing them on the sands.

This is certainly a new phase of the dead-pup question, for none of these pups are from those counted on the sand tract. This rookery must have a heavy percentage of dead pups. When the gale subsides it may be possible to pass between the harems and water and make further investigation of the condition of things.

In addition to those counted there are probably 50 more dead pups in the surf at the angle of the bay, all apparently in the same condition. One dead cow lies among the pups on the beach. She, too, has been washed in from some point on the rookery. She is too rotten for dissection.

All these pups have probably been crushed. Many show the umbilical cord still attached. One pup is seen with hair intact, but proves also to be rotten. At a little distance is a small female pup, which is fresh. On examination the pericardium is found suffused with arterial blood. The right auricle is ruptured. The pup is rather small and lean. The stomach is empty. The lungs are normal, but very little inflated. Probably an astray trampled in a rush of bachelors, for it lies in a place over which many of them pass in going to the water. All the dead pups seen, except the one examined, seem to have been dead from two to four weeks.<sup>2</sup>

#### THE SEAL'S SENSE OF SMELL.

In passing along the sand beach of English Bay opportunity was afforded for further testing the seal's power of scent. The beach was lined with sleeping bulls. Passing between them and the water brought us directly on the windward side.

<sup>1</sup>The investigations of 1897 show that in the presence of the dangerous parasitic worm which infests the sands these places become exceedingly fatal to the young pups.

<sup>2</sup>The phenomenon of dead pups here witnessed on the beach of English Bay is that which was noted by Tingle in 1886, and by Elliott in 1890, and erroneously charged to the effects of the "deadly surf nip." The pups were probably not closely inspected.



Most of them were passed at close range without being awakened. Some few of the bulls were startled, in most cases by the snorting of bulls nearer to us and awake. It is the noise and not the odor that first alarms them.

#### ZAPADNI REEF.

On the hauling ground of Zapadni Reef there were fully 2,000 yearling bachelors hauled out. They have been extending their hauling ground recently and have trampled down several rods of the grass-grown area. Along the stones were numbers of detached bachelors sleeping. On going up to one a cane was pushed gently against his nose without awakening him. Another was approached on the windward side and stroked for some time with a walking stick before he awoke. Two others were rubbed in the same way. They sleep very soundly. Later on 2 outlying bulls asleep on the sand were approached to within less than 10 feet on the windward side without awakening them. One of these was lying on his side, with his nose directly toward us. It was only when he opened his eyes that he took any alarm at our presence. While the sense of smell may help the seal some, there is nothing remarkable about it. None of its senses seem remarkably acute.

On the breeding ground, which fronts on English Bay, a tremendous surf was breaking. On going down to the water's edge in one of the bachelor runways a number of virgins in single harems were seen in charge of water bulls. One of these ran a little way into the water on our approach. The bull went after her, and a great were struck them and turned them over. He held her there during our stay, alternately on the rocks and submerged in the water.

#### LUKANIN BEACH.

The angle of Lukanin beach, where it might be expected that dead pups from Kitovi and Lukanin would be washed up, was visited on our return. None were found, and those seen there before had been washed away. There are, however, no sandy depressions on these rookeries, and few dead pups are to be expected.

A 4-year-old bull lies dead on the beach at the foot of the hauling ground on Lukanin, too far up to have been washed there by the surf. His fore flippers are badly swollen. On opening, one is found to be shot through with buckshot and broken. Maggots were seen on one flipper. A dead pup lies near by, probably an stray killed by the bachelors. It is too rotten for dissection.

A young holostiak lying at some distance alone wakened with difficulty, sits up, and seems ready to fight at first, but moves away languidly, voiding excrement of a thin, watery nature containing worms. The animal acts as though it were weak and sick.

#### REPORT OF MR. LUCAS FROM ST. GEORGE.

Strong southwest wind, but no rain. Seals are not obviously more abundant on North rookery than yesterday. On the east end of the rookery the bachelors are numerous, having hauled out on the slope.

The pups are again back on the slope, from which they moved yesterday on account of the rain; many cows are with them. It is too windy to go over to Zapadni to see if any pups have been drowned. One of the pups noted yesterday as being newly born is dead this morning.

One thing badly needed, is charts of the various rookeries in perspective, showing the chief topographical features, such as conspicuous rocks, gullies, outlying rocks, and small bays. On one of these it would be practicable to plot the distribution of the seals from year to year in such a way as to show any marked changes.

#### AUGUST 5.

Dr. Jordan and Mr. Clark, with Jacob Kochuten and the mule team, went to Polovina to see what effect the storm had had on the pups there.

It was rather a surprise to find the sky entirely clear and the sun shining brightly. This is the first occurrence of this kind since our arrival on the islands.

#### POLOVINA ROOKERY.

At the angle of Polovina rookery with the sandy beach where, on the 23d instant, a number of dead pups were noted, we found 28 pups washed up in the same manner and in the same condition as those at Tolstoi. The dead pups were swollen, denuded of fur in most cases, many having the umbilical cord attached, and all having the appearance of being crushed. All were too far gone for dissection.

The cows were absent from the harems on the extreme point at the angle, though the pups were huddled together and sleeping on the rocks. The harems on the sandy beach have deserted to the rocky level above. The recent surf ran completely over the ground they formerly occupied.

With a glass 30 other dead pups were counted among the rocks at the foot of the low cliff and on the edge of the cliff above. A depressed smooth tract leads down to the cliff. This throughout its length is strewn at intervals with dead pups. Twenty-eight are counted above the last lot. There are doubtless many more among the flocks of black pups that gather on the tract. The bulls here are numerous, and on the 23d of July were very restless and quarrelsome. They are still fighting, more or less. All but a very few of the pups have the appearance of being dead a long time. Two fresh ones are gathered in for examination.

The harems on the rocks which extend out to a point and which are not much above the level of the water at high tide have been driven in, and we find no difficulty in passing along the edge under the cliff, a thing which we could not do on the 23d of July.

Hundreds of pups are swimming in the pools among these low-lying rocks. They scamper away to the cliffs, spitting and snarling at us for disturbing their sport. One little fellow gets cut off and sees no way of escape except to follow out to sea one of the channels through which the water is rushing in. He tries it for a few feet, but hurries back. Then he goes out again on seeing us. After we are past he comes in and runs off to the cliffs. There are bachelor seals playing in the pools with the little pups, but no mother seals. Some of the little fellows swim well. There are a few dead pups among the stones, but not many, or they are not easily seen.

Virgins are plentiful. A big plump cow sits in an uneasy position on a stone and is watched over by a young bull. She is wet, just in from the sea. Jacob says she carries an unborn pup.

Two dead bulls are to be seen on the rookery, one in a position often assumed by the bulls in rest—lying flat on the stomach. A number of the dead bulls seen on the

various rookeries have been in this position: notably one on the Reef, which lies in the same position as one of these. At a distance one could imagine them sleeping. These bulls are in a position where they can not be reached, and they are too rotten to handle. These, as well as the cows seen dead on the rookeries, seem all to have died a very long time ago—early in the season.

Passing along the front, 2 dead pups are all that are to be seen on the rocks at this point; doubtless some are hidden. Ten are counted on the sandy tract above the cliff edge, 4 additional ones beyond, making 14 in all.

A crushed pup is found in a crevice in the rocks, in which a dozen or fifteen others are huddled. They are piled thick upon him. He has the umbilical cord attached. It can not be determined whether the pups have crushed him or not. He could not have been born in there, but could have fallen down from the edge of the cliff, which is 15 feet high at this point and covered to the edge with harems.

#### POLOVINA CLIFFS.

All the little caves and hiding places under the cliffs of Polovina are full of pups. A cow makes her way up the runway, apparently with the placenta still hanging from her. A dead and rotten cow lies at the foot of the cliff. It is near this place that the bleeding cow was seen on the 23d of July. It can not, however, be the same. The harem is apparently gone, but the pups are there still, 4 of them.

To a young bachelor the most alarming thing that can happen is to find himself away from the herd. The bachelors stay nearer the rookeries now, and young cows are mixed in with them in charge of young bulls. The idle bulls are notably fewer, many of them having gone to take the place of harem masters who have left.

The cows now run away readily from the pups. The young bulls desert likewise in isolated harems. Virgins are about everywhere with bulls. Many are on the hauling ground, and the young bulls have trouble in holding their impromptu harems in the mass of holostiaki. They keep up a great groaning and fussing.

It is to be noticed that Polovina, like Tolstoi, has no runway for the bachelors to haul out in. The hauling ground lies behind the rookery and has to be reached by passing around the angle of the beach or up through a slide in the cliffs above the rookery. The holostiaki show a tendency to stampede through the harems, as on Tolstoi, though not so many are seen to do it.

Harems are creeping up through the breaks in the cliffs beyond the main part of Polovina. Two very large harems are now on the level where we walked on the 23d without disturbing any. Another is far out, 20 or 30 yards, containing no pups, and is probably made up of virgins. There are pups in the other harems.

#### POLOVINA.

A slow-moving cow is awakened from sleep outside the lines of harems; she moves as though weak through sickness or old age. If her trouble is due to old age she is the first seen. Before she can be secured she has entered the line of harems, and we lose sight of her.

Seven dead pups are counted in the hauling ground at some distance from the edge of the rookery. Three that are fresh enough to admit of examination are taken. The others are too far gone.

The whole upper part of Polovina is a depressed area covered with sand packed hard and mixed with small boulders, but few large rocks. In a hollow where it broadens below there are 30 dead pups not counted from below. There is still much fighting among the old bulls in this hollow.

Fifteen more dead pups are on the top of slope in the edge of the harems. A number are fished out with a bamboo pole and hook. Most are in a rotten condition. Half a dozen of the freshest ones are taken for dissection. One pup was found lying on a sharp stone, the impression of which could be seen in its breast when it was turned over. No doubt was left as to the cause of its death. This is one of the worst of the rookeries as regards the fighting and stampeding of bachelors. The higher ground is especially bad. There is still many superfluous bulls.

#### SLEEPING PUPS.

It is very hard to awaken sleeping pups. You can sit down in the midst of a pod and rub their noses without disturbing them. When once awake they sniff at you and when they take in the situation they hasten away snarling and protesting vigorously. The awaking of one does not necessarily wake the others. The last little fellow allows himself to be rolled over and over before he opens his eyes. He sits for a moment looking curiously, then moves off. After getting away a few feet it seems to dawn on him that something is wrong and he sets up a vigorous snapping and snarling, at the same time hastening away.

One pup in a pool is seen shaking a piece of kelp in his jaws as a little puppy dog would play with a piece of stick.

#### THE CURIOSITY OF THE SEALS.

An old bull with an injured back is shot. His skin is taken for museum purposes. He does not show any recent injury. Probably an old injury now healed, but leaving the animal a cripple. The rough hurried dissection does not show it.

We are now back at the angle from which we started, having circled the rookery. The pups we routed out at first and also the cows on the rocks at the water's edge, are all back as though not disturbed. Hundreds and hundreds of pups are swimming and sporting in the tide pools of the rocky reef here at low tide. The water at a distance of 10 or 15 yards is alive with holostiaki. They stand up and gaze with an inquisitive stare, approaching us as closely as they dare, to witness the skinning of the bull. All the neighboring bulls show a mild interest in this. Occasionally a bachelor takes fright and rushes madly out to sea, the others following; but they are quickly back again.

It is always the sudden movement, whether of a stranger or of one of their own number, that alarms the seals. They act very differently in the sea from what they do on land when alarmed. When they have the sea behind them they are confident of their ability to escape and are much more daring.

#### THE FIGHTING OF THE BULLS.

A bull quickly knows when he is outclassed in a fight and gets away as soon as he can, pretending not to notice his opponent further. If he turns on his pursuer it is to save his hide, not to renew the fight. When he turns, the bull following will stop. Then it is not difficult for the defeated bull to make his escape. The old bulls



are not much inclined to follow up the young bulls just now, and protest feebly against their presence in and about the rookeries. They are growing lean, and their courage and pugnacity goes with the loss of fat.

In the state of nature the superabundance of fighting males would greatly tend to diminish the rate of increase of the seal herd. This check has perhaps prevented them from outrunning their food supply.

Many of the dead cows seen of late seem to date back to the time when those were killed at Vostoshni. Probably all were either shot by poachers or killed by bulls at about the time of parturition.

A virgin cow in charge of a large bull in the rear of the rookery shows signs of coming in heat. The bull smells her over and mounts her, she assisting him; but he withdraws and lies down. Tries again, and again leaves her. This is the first approach to lack of virility that has been seen. There may be some other cause for the bull's failure. The bull is a strong and vigorous looking fellow, but young. After fifteen minutes there is no evident disposition to resume. The bull lies sleeping and the cow sits prunning herself.

Among the pups at Polovina there is occasionally seen one with eyes stuck together by matterly excretions aggravated by sand. Doubtless the sand causes irritation and suppuration.

Seven pups are gathered in that are fresh enough to be examined, and will be brought home. Footing up the various groups of dead pups counted we find that this rookery shows a total of 171 by this superficial count. It will be necessary to make a more thorough examination. This mortality among the pups becomes a matter of considerable interest and importance, as these pups have all died prior to any possible effects of pelagic sealing, which does not begin until August 1.

## DISSECTIONS OF PUPS.

In the afternoon Dr. Jordan, assisted by Dr. Voss, dissected the pups brought in from Polovina. Mr. Stanley-Brown, Judge Crowley, and Mr. Macoun were present at the examination. The following is the record:<sup>1</sup>

1. A large well-fed pup; the pleural cavity found to contain a teacupful of blood; lungs utterly crushed and dark purple with congestion; liver crushed, full of contusions; right kidney contused; other organs uninjured; stomach containing some milk; pup saved in alcohol.

2. A young, well-nourished female pup, with umbilical cord attached; lungs crushed and congested, the lobes full of blood; heart contused, its blood vessels congested; liver congested and full of blood; stomach empty; kidneys intact, saved in alcohol; the bones very soft and flexible, do not break.

3. Moderate-sized female pup; fat; sleek skin; no blood in pleural cavity; lungs empty and crushed flat as if sat upon; liver, kidneys, and heart normal; stomach empty; not badly crushed, but enough to kill.

<sup>1</sup> By the investigations of 1897 we are led to believe that the great majority of these seen on Polovina died as a result of the parasitic worm *Uncinaria*. That these dissections show so evidently crushing or trampling to be the cause of death is explained by the fact that the pups, weak and dying from *Uncinaria*, readily fell victims to the trampling of the bulls, which became the immediate cause of death.

1. Large female pup, well fed; lungs perfectly flat and empty; has been sat upon and smothered, as if under a crushing weight; heart and kidneys intact; liver slightly contused; stomach full of milk.

5. Large female pup, well fed; lungs crushed and congested; liver with slight contusion; milk in stomach; heart not injured, vessels full of blood; other organs uninjured.

6. Oldish male pup, very lean, taken from among the bachelors, probably run over and crushed by them while weak from hunger; lungs completely crushed; liver and other organs uninjured.

7. Male pup, very lean; no fat; one lung badly crushed; heart contused; liver congested; stomach empty; died from crushing, under pressure; probably trampled upon by bachelors while weak and hungry.

#### THE DRIVES.

None of the drives can now be shortened except to the disadvantage of the seals, because the killing grounds are best located near ponds into which the animals can be turned to cool off and refresh themselves. The nearest ponds are at present utilized. A killing ground sometimes used for the Tolstoi drives has a pond near by in the early part of the season, which later becomes dry. After the water has gone, unless the weather is particularly favorable, the seals must be taken on some distance further to the Ice House Lake.<sup>1</sup>

It is to be remembered that the temperature of the water of the ponds into which the seals are turned to cool off is warmer than that of the ocean. The temperature of the water in the killing season is very much higher than is the sea in winter. No seal has ever been known to show sign of a chill. The nearest approach to it is when a southwest rain, accompanied by wind, beats upon the animal, parting its fur and making it look miserable. Its discomfort is due not to the cold but to the beating of the rain. It is doubtful if, with the thick fur, and especially the blanket of blubber which the seal possesses, it is at all affected by the temperature of the water.

A 5-year-old bull, castrated by some unknown cause, is reported as found on St. Paul some years ago. It had fine, soft, smooth fur, above the average in value as in size. This raises the question whether it is possible to practice castration for the purpose of letting the bachelors grow older and larger before killing. The skin of a 5-year-old without the wig would be a magnificent one.

#### LAGOON.

It is no more surprising that the families on Lagoon rookery go on their way in full sight of St. Paul village, one-third of a mile away, than that St. Paul village goes on with the rookery so near. Neither the seals nor the Aleuts can see the inside household workings of the other; and each is wholly indifferent to the presence of the other.

The bull seal is far more dangerous to man than he imagines man to be to him. If the bull seal were as aggressive as he is strong, he would drive man from the island. But he never pursues; he only guards his home.

<sup>1</sup>This note is influenced by the current belief held by the people of St. Paul. It is still a fact that the great killing ground on St. George has no water. While water is desirable it is not essential.

## EXPERIMENTS IN DOMESTICATION.

The living pup kept for the purpose of experimentation in the matter of starvation weighs 12 pounds to day. It was picked up on Zapadni August 1.

It is said that pups have been brought up to the village before. They can not be made to eat. Cow's milk, pumped into them with a syringe, was ejected. They would not take anything, and invariably died. As a rule, they never seemed to get tame, and remained just as savage as ever. Messrs. Webster and Morgan are said to have succeeded once in getting one to eat bread, fish, etc. It became tame, and used to go back and forth to the beach, finally becoming a nuisance, crawling into berths at night, etc. It went away at last, and was not seen again. No other was ever known to eat, and this story of "Little Jimmy" may be apocryphal.

Two 2-year-old fur seals were taken down to San Francisco in 1891 to the Woodward Gardens. They refused to eat anything, and escaped once by climbing a wire fence. They were retaken, but died in about six months. They must, of course, have eaten something to have lived so long. To thoroughly test the feasibility of maintaining the fur seal in captivity the pup should be taken when a few hours old. They could then be taught to feed. When older they will not.

## MISCELLANEOUS NOTES.

The following miscellaneous notes were obtained in interviews with residents on St. Paul:

Bulls first reach islands, depending on the season, from the 5th to the 10th of May. They sometimes come as late as the 1st of June. The bulk arrive about May 20.

The cows first come about June 10; rarely earlier. Most come about July 15.

The first pups are born about June 15. None known to be born on the snow. Some are said to have been born on the ice, but none have been seen by Mr. Redpath.

The bachelors—2, 3, 4, and 5 year olds—come on the hauling grounds by May 15. The yearlings appear later—about the middle of July, more or less. Many bachelors, from 2 to 5 years old, stay till the middle of January.

The bulls leave from and after August 1. Some stay till November, but most of them leave in August. The cows and pups leave together the latter part of November, depending on the condition of the weather. They leave on account of the winter storms, and all go within two or three days.

The pups are not weaned on the island. They nurse as long as they stay. When pups were killed in November they were always found with milk only in their stomachs.

The statement that the driveways were lined with carcasses of seals that died on the road was probably true in very early times, before 1870. At this time long drives were common. Sixteen skins is the most ever known to be taken from seals that died on the way. This was on a drive in dry, sultry weather from Tolstoi to Lagoon killing ground. It occurred in the eighties.

Road skins were taken on one or two drives from the Reef and Tolstoi this year. In these cases the tired animals might have recovered, but were killed to save time.

The natives do their work now just as they have always done it. Government agents were not required to appear on the killing ground until five or six years ago. They often did so, but were not under obligation to do so.

The pods of seals driven up to the clubbers are about the same size as always. Occasionally the club is thrown at an escaping killable seal. It brings down the animal almost as surely as if struck by the club in the hand. Sometimes a killable seal is struck in this way among the bulls which can not otherwise be reached. This method of killing, however, is discouraged by the Government officials because of criticism, and is not often resorted to.

No females are driven up from the rookeries. Occasionally a female hauls up with the bachelors, especially after the last of July, and gets driven in. They are never found in the early part of July. Such females are easily recognized and rejected by the clubbers.

#### REEF ROOKERY.

On the Reef, Dr. Jordan found that the 2 little cows seen at the Point on Sunday were gone. The rocks were drenched with surf, which is still high. The isolated harem on the west side contains the bull, 2 cows, and several pups, all drenched with surf. The wounded cow is also gone.

#### ARDIGUEN.

The bull Z is in his place. The young bull Y has several cows near him, and thinks he owns them; he tries to round them up.

The white half bull on Zoltoi occupies the same place as for a week or more, on the rocks above the water.

#### GORBATCH.

Only 4 dead pups washed up by the surf are seen on Gorbateh. The waves are excessively high. A seal in a breaking wave looks like a great fish. But 1 dead pup to be seen in the long slide at Gorbateh Point. So steep is it that the moving bulls slip and shove the pups along without trampling them.

The seals at Gorbateh have for the most part moved up out of the reach of the surf. There are 3 seal-lion bulls lying out on the rocks at the point where there have been but 2 for some time past.

#### PHOTOGRAPHS.

Mr. Macoun photographed Kitovi and Lukanin rookeries again this morning. Photographs taken at this time are of interest as showing comparative changes for this season, but are not reliable as giving data concerning the extent or population of the rookeries. The greater part of the mothers are at sea and the rookeries are now full of half bulls and virgin cows. After July 20 (probably before, but it is clearly marked then), the rookeries lose their distinctive forms. The pups gradually work up the slopes, the mothers follow them, and many harems, mostly small, are formed beyond the original lines of the rookery in charge of half bulls. The virgin cows become numerous about the 28th of July. Dates regarding these matters can not be made very definite, as the changes are all very gradual and vary in different sets of harems. Photographs, to be of value, should be taken on practically the same dates in successive years, and those to show conditions in the breeding season must be taken between the 10th and 20th of July.

Many bulls that have had no cows in the height of the season probably now have a considerable number of late arriving cows and virgins.



## MR. LUCAS'S NOTES ON ST. GEORGE.

I went over to Zapadni to-day to see if any pups were drowned in the recent gale, but found none. It commenced to blow Sunday night, the storm continuing quite severe Monday, and gradually going down Tuesday. The surf at Zapadni was very heavy, but the seals played about in it, diving below the crest of the waves like fishes.

The seals are perceptibly more timorous and nervous than they were, even the holostiaki taking fright more readily than when we first arrived. The bulls which lie about on the outside of the harems do not show fight.

## AUGUST 6.

Dr. Jordan, accompanied by Judge Crowley, Chief Apollon, and Jacob, went with a mule team to North Shore to get specimens of hair seals, and to investigate the site of an old rookery (Marunichen) which is said to have formerly existed there.

Mr. Clark visited Gorbach and Ardignen. Mr. Macoun photographed Tolstoi rookery and counted dead pups, finding 209 on the sand beach of English Bay where recently 185 were counted. In the afternoon the *Corwin* returned Mr. Lucas and Professor Thompson from St. George. They report seeing a "killer" on their way over, about 10 miles off St. Paul.

Mr. Stanley-Brown reports to-day that he counted 476 rookery bulls on the sands of English Bay in the space of a mile. These were not half bulls, but bulls which have done or could have done service on the rookeries. This probably marks the return of the first consignment of rookery bulls which have gone to feed.

## GORBATCH ROOKERY.

Under the cliffs on Gorbach a cow comes in from the water, stopping on a rock at the edge and calling her pup. The little fellow comes down, getting wet in reaching the rock. He climbs up and takes his meal under difficulties. Another cow on a similar rock is letting her pup nurse. The little fellow stands on his hind flippers in the water and can just barely reach the nipple.

A pup is seen to hold his nose down, as if drinking, in a little pool or cup-like depression in the rock full of rain water. He puts his head down into it several times and then holds it up like a bird. The operation has the appearance of drinking, but apparently does not diminish the water.

The white bull on the long slope of Gorbach is still in his place. There are three cows and numerous pups about him. In fifteen minutes two of the cows go over the edge of the slope. He makes no particular protest. Cows are leaving other harems and going up to the level parade ground above, where there are several large harems. Some are probably old cows, but most are virgins in charge of young bulls. One harem is located over at the pile of rocks, with the cairn on top, more than halfway across the parade ground.

In a pool of considerable size, around the corner from the long slide on Gorbach, are a hundred or more pups playing in the water. The heavy surf washes into the pool, driving the pups to the upper end. As it flows out the little fellows allow themselves to be sucked out through the runway, tail first. When almost too far out for safety they scramble back with great energy and show of fright, only to repeat the performance with the next roller. They act as though they fully appreciated the danger, but were seeing how near to it they dared go. They enjoy the fun immensely.

## ARDIGUEN

On Ardiguén B is found to have moved down off the flat with his 7 cows. He has evidently been down there since the time he and C were stampeded. C is on the flat still with 24 cows. A has 6 cows on a shelf under the bank. There is a new bull from the top in a position between B's old place and A's original place. He has 3 cows. Y has 6 cows. X is down in the slide with 6 cows. The water bull Z has probably been driven out.

## MARUNICHEN.

At Marunichen on North Shore a herd of about 100 hair seals is found hauled up on the sand by the sea. A bull and a cow were shot and skinned for museum specimens.

The true seal lies horizontally on land. It can raise its head only slightly and barely touches the ground with its fore flippers, which are short and armed with claws, only the hand (carpus and metacarpus) being exerted. It can not stand up as the fur seal does, because it can not touch its fore flippers to the ground. The hind flippers are short and stout, only the tarsus and metatarsus being exerted. The tail is flat, much larger than in the fur seal. The pup, born in May on the ice, is now weaned and swims about with a cooing call. The male seal is half larger than the female. The hair seal can move on land only by the undulation of the body. It can not raise its head or belly from the ground.

The female hair seal had some crabs in its stomach, also many beaks of a large variety of squid, many ascarid worms, and several large soft bodies, which proved to be the axis of the arms of cuttlefish or squid. These and the worms were preserved. The stomach of the bull contained bones of codfish, much bile, and ascarid worms. Both animals were very fat, the female giving little milk. The pups are well grown now and swim about with head above the water. The hair seal can not take the dolphin leap which the fur seal does. It does not use its arms in the water, but swims with the hind flippers only.

## THE ABANDONED ROOKERY.

At Marunichen, where the ancient rookery was located, the rocks of columnar lava are all rounded apparently by the action of the water. The grass on the hauling ground is short, but there could not have been much of a hauling ground, as the stones are angular and not as usual worn smooth. It does not seem possible that there could have been any considerable body of seals here. It is said that the oldest inhabitant on the island, only remembers the time when the rookery existed.

## KILLING GROUNDS.

Among the qualities to be considered in the location of a good killing ground are nearness to the sea, as smooth a road as practicable, nearness to a pond of water, nearness to the rookery. The nearness to the sea is very important, because the seals in returning to the water go faster than they are driven up. It is important that there be a pond of water in which to cool off the seals when heated.

At the killing ground on Tolstoi, just back of Middle Hill, there was, in the earlier part of the season, water in the depression. At the last killing there was no water remaining. The sun came out hot and it was necessary to let free about a thousand

seals, and even then several were overcome by the heat before they could get back to the sea and had to be killed. At the same time the presence of water is not absolutely essential, as is shown by the main killing ground on St. George Island, below the village, which has no water. Where the water is not present unusual care is necessary.

#### AUGUST 7.

Dr. Jordan and Mr. Lucas were present in the morning at the food killing from Lukanin. Mr. Macoun and Professor Thompson walked to North Shore and Bogoslof. In the afternoon Dr. Jordan, Mr. Lucas, and Mr. Clark visited Tolstoi, to further investigate the dead-pup question.

#### THE FOOD KILLING.

In the morning a small drive of seals from Lukanin was made to supply fresh meat for the natives. The drive was, as usual with drives from Lukanin, made up largely of small seals. One old female was included in the drive. She had evidently had a pup, but it was probably dead. That she had bred was certain.

One very small seal, a yearling, was found to be a cow and was killed for examination. One other, a little larger, proved to be a yearling holostiak. Of the pod of 30 the rest proved to be males. Five were killed as 3-year-olds. One yearling was smothered on the drive and one was slightly hurt by a blow on the nose. Two were overcome and skinned by the wayside. There was too much hurry this morning. It is evident that there is need for constant oversight and care. The Aleuts can not be trusted too implicitly.

Two more very small seals are examined and prove to be yearling holostiaki. Another adult cow is found. She has had a pup, but it is probably dead. The Aleuts recognize these old cows at once. Two more small seals are examined and found to be holostiaki. They are just a little larger than females, but in the case of the yearlings the Aleuts can not always tell the sex.

One more little cow was found and let go. Three small ones caught and examined prove to be holostiaki. One is seen with a bloody nose. Another very little one examined is a holostiak. One more, a very small one, examined proves to be a cow. This makes 3 yearling cows. The presence of these yearling females does not necessarily prove that the young males and females associate on the hauling grounds, as the adult cows show that the drive was made from close to the rookery, and the yearlings may, like them, have come from the outskirts of the breeding ground.

#### MR. LUCAS'S NOTES.

Several stomachs opened; only stones, worms, and mucus in them. Examination shows nematodes in a number of stomachs and a small species of tapeworm in 3 or 4 stomachs. About 3 or 4 out of 5 have some sort of worms in the intestines just below the caecum—usually not more than 1 or 2 worms in an intestine, though 6 were in one instance. The tapeworm is not so universally present as the nematode. The mucus is not secreted as a result of the irritation due to the worms. There is no direct relation between the worms and the mucus. Mr. Adams reports finding a tapeworm 3 feet long in a seal, the head in the caecum.

One stomach had an irritated spot in it like a small abscess: the stomach was full of water; worms buried head first in the irritated spot; they are probably the cause of the irritation. A stomach contained broken mollusks, dead shells, and pebbles. Seals swallow small stones either to allay irritation or by accident. One stomach contained a piece of sea weed, undigested, several inches long, attached to a small stone. No trematode worms in any stomach. Liver and viscera in general very clean. One or two hearts were opened, but no filaria found. No parasites were found in the lungs. Shot was found in the body of a 2-year-old bull this morning.

#### DR. JORDAN'S NOTES.

A number of the seals of the different classes killed were brought up to the village for examination and study. The weights of the animals were as follows: Yearling male (large), 47 pounds; yearling cow (small one), 32 pounds; 2-year-old (rather large male), 66 pounds; 3-year-old male, 86 pounds; cows (adult average), 80 pounds.

The following measurements were noted:

Yearling cow: Tip of nose to root of tail,  $36\frac{1}{2}$  inches; girth of chest behind fore flippers, 25; about body at pelvis,  $18\frac{1}{2}$ ; at neck, 19; over shoulders, 28; length of flipper to axil,  $13\frac{1}{4}$ . Center of eye just midway between tip of snout and ear; eye  $2\frac{1}{2}$  times in length of snout.

Two-year-old bull: Length, 42 inches; girth behind shoulders, 29; pelvis,  $20\frac{1}{2}$ ; neck,  $20\frac{1}{2}$ ; over shoulders, 32; behind flippers, 16.

Three-year-old (moderate size, growing thin): Length to root of tail, 49 inches; girth of chest, 31; pelvis, 21; neck,  $20\frac{1}{2}$ ; over shoulders,  $36\frac{1}{2}$ ; behind flippers, 18.

#### YEARLINGS.

Autopsy of yearling female: Ovaries very small; as yet wholly undeveloped, as is uterus and other sexual organs. No impregnation possible at this stage; none exists.

Yearling male: Smothered in drive by others crowding on him. Lungs much congested; air mostly crowded out. Heart full of clotted blood, though still warm; a clot of blood in auricle. Lungs the chief source of injury.

The lungs of many of the seals killed were examined; no other found with injured lungs. One shows slight congestion. It is evident from these examinations that but little injury results to the seals from the drives. This drive has been a severe one.

The skins of the yearling male and female were taken for museum purposes.

#### THE FIGHTING OF THE BULLS.

In a state of nature the superabundance of fighting males would tend to greatly diminish the rate of increase of the seal herd. This check has, perhaps, prevented the seals from outrunning their food supply, which in its possible limited state would furnish another check and offer a premium for wider migrations.

#### IDLE BULLS.

There is a distinction not always made at sight between the idle bulls of 6 years and over and the half bulls of 5 or 4. The idle bulls hold their ground fairly, especially if with a cow. The 5-year-old will invariably run away.



Of the idle bulls, probably one-third of those seen at first now have cows, largely, but not wholly, virgins. Those with one cow are now as fierce as the regular bulls. A much smaller number of bulls would suffice, and doubtless all females would be served were there not nearly enough bulls to control the rookeries. All virile bulls, young and old, hang around the rookeries, the stronger the nearer, either above or below or on the slide. As a rule the strongest are the nearest the center of life on the rookeries. The energy wasted by the bulls in fighting would doubtless enable them to serve many more cows were the number of bulls more limited.

#### MAN AND THE SEALS.

To the presence of man the seals are at all times and under all circumstances utterly indifferent. To his movements, however, they are acutely sensitive. If you sit still near any rookery, the seals will soon cease to notice you. The cow will bleat with mild curiosity and the sleepy bull will keep one eye open, but until you move again they have no fear. The disturbances man makes on the island no more affect the habits and distribution of the fur seal than the shooting of hens in the garden affects the habits and nature of poultry. The great bulk of the cows on the island never know of the existence of man at all, never see him, hear nor smell him. It is only the bachelors and outlying cows that come in contact with him, and that not often enough or severely enough to produce other than a passing impression. In a few places (Gorbatch, Kitovi, and Lukanin) this season men have been seen almost daily by a limited number of seals, and the cows nearest the points of observation start up in alarm until rounded up by the bulls, or sometimes they flee to the sea when the intrusion is close. But the alarm soon passes away. The observers avoid scaring the seals where possible.

#### PERMANENCY IN AGENTS DESIRABLE.

The Government should retain its competent agents during good behavior, as the company does. Messrs. Redpath and Webster have been long in the service of the two companies and have a thorough knowledge of every phase of the practice relating to seals. The Government changes its agents every four years, making the appointments a matter of political spoils. It takes an agent a year or two to learn his business, and very few have either ability or training for acquiring knowledge of the seal herd. The Government's interests are seldom as carefully managed as the company's. When the Government agent has become somewhat experienced a change puts a new and untried man in the place.

#### A SUPERINTENDENT OF THE SEAL HERD.

In addition to the agents as now appointed there should be a competent naturalist and observer constantly in charge of the herd. He might belong to the staff of the United States National Museum or to the Bureau of Animal Industry. He need spend but two months here. The Government could well afford to pay such a man a good salary, for if the seal herd is properly protected such a man could save thousands of dollars every year to the Government, besides being in a position to give authoritative advice in case of international disputes.

## TOLSTOI ROOKERY.

On the way to Tolstoi several pups and one bachelor were seen lying dead on the beach at the head of the lagoon, where they had probably been washed up from lagoon rookery by the recent gale. All were too rotten to make it possible to determine the cause of death.

At Tolstoi the water to a distance of 10 or 12 feet from the shore was found full of swimming pups. The rocks were filled with others who were about to enter the water or had just come out. These pups were swimming apparently with ease and safety right in the surf, which was breaking with considerable force.

## DISSECTIONS OF DEAD PUPS.

It is now possible to pass for a distance along the water front of the sandy area, and from the rocks and lower part of the sandy tract a number of dead pups were secured which were not too far gone to dissect. The following is a diagnosis of causes of death in 19 cases:<sup>1</sup>

1. A female pup, in fair condition, found on the rocks near the first harem; slight contusion in the lungs; liver crushed; gall bladder broken so that gall had flowed out among the intestines; other organs normal; evidently crushed by a bull.

2. A male, in fair condition, a little lean; left side injured throughout length; the left lung congested and flattened out; other organs normal; evidently trodden upon, pressing the left side flat.

3. A female, poor condition, very thin; right lung badly congested; other organs normal; no milk in stomach; crushed, probably when weak from hunger.

4. Female, thin; head crushed; suture between frontal and parietal bones split open and bones spread apart; all the muscles of the breast very much contused; lungs, throat, and heart badly contused; no milk in stomach; evidently crushed.

5. A female, in fair condition, not too fat, but well nourished; found at water's edge, jammed in between rocks; recently dead; an old pup with grayish fur; could not have been stepped on where found, but may have been drowned and wedged into the rocks by recent gale; right lobe of lungs shows contusion, crepitation in the crushed part, contusion probably due to contact with the rocks; water pours out of windpipe; clear case of drowning.

6. Male, in fair condition, but not fat; lungs in good shape; heart with little blood; liver very dark; head all right; cause of death not apparent.<sup>2</sup>

7. Female, with absolutely no fat; lungs badly congested; other organs normal; but recently dead; still warm; crushed and suffocated while in a weakened condition due to starvation.

8. Male, excessively lean, not a particle of fat; lungs badly congested; heart crushed; liver black; crushed while in starving condition.

9. A large male found among the rocks as if drowned; left-side muscles all contused as by banging against the rocks; lungs badly congested; liver slightly injured, evidently by pressure; heart empty; contusion over middle of right hip; stomach full of milk; probably drowned and thrown on the rocks by the surf in a recent gale.

<sup>1</sup>It was on these and similar autopsies that the theory of trampling as a cause of death among pups was put forward in 1896. The whole subject must now be revised in the light of the more extended investigations of 1897.

<sup>2</sup>This pup and No. 12 were probably the victims of *Uncinaria*.

10. Female, in poor condition; lungs crushed and very badly congested; other organs normal; trampled upon when weak.

11. Female, in good condition; lungs crushed and badly congested; head uninjured; stomach full of milk; crushed.

12. A well-fed male found under a rock so wedged in that it was with great difficulty that the rocks could be crowded apart to release it. These boulders must have been piled upon the pup by the recent heavy surf, as he has not been dead long; lungs show congestion; heart has little blood; stomach full of milk; had been drowned and washed up by the surf.

13. A female, in fair condition, but little fat; lungs badly congested; very recently dead; uncertain whether death was caused by drowning or trampling; found in the rocks, where might have been crushed by water bulls or washed up by surf.

14. Female, very greatly emaciated, not a scrap of fat; lungs very badly congested; heart full of clotted blood; evidently smothered under pressure of bull while in a starving condition.

15. Female; fat; well fed; lungs badly congested, especially on right side; empty of air; heart crushed and filled with clotted blood; stomach full of milk; crushed.

16. Male; rather thin; found in the sand; skin and muscles much bruised about the shoulders; lungs very much congested; heart full of clotted blood; aorta full of blood; liver very dark; but recently dead; crushed to death.

17. Female, found in the sand; fair condition; some time dead; lungs discolored; somewhat congested; heart nearly empty of blood; a little milk in the stomach; air completely pressed out of lungs; sat upon by a bull.

18. Female, well nourished; found in the edge of the rocks just off the sandy tract; milk pouring out of its mouth; lungs somewhat congested and wholly devoid of air; breast crushed flat; crushed by bull.

19. A fat female pup, well nourished; plenty of milk in stomach; lungs badly congested; pressed flat; no air in them; heart almost empty of blood; crushed to death.

#### CAUSE OF DEATH.

The foregoing pups were all picked up either in the edge of the sandy tract or on the rocks adjacent to it at the angle of Tolstoi rookery with English Bay. At the point in question the seals have been very thickly massed and there has been a great deal of fighting among the bulls. The harems at the point incline to extend in a thin wedge toward the sands of the beach beyond the rocks. The bachelors have probably attempted to make a short cut in going to sea and this has resulted in fighting and been the cause of the excessive mortality at the point. The same condition, however, extends the length of the flat sandy area devoid of stones. It is evident that there can not be less than a thousand dead pups in all here.

#### LIVING PUPS.

A little pup was found fastened between the rocks in such a way that he could not get out, and when released was in a very weak condition, either through injury from the pressure of the rocks or through hunger. He went slowly and painfully up out of the rocks to the sand. A pup in this condition must fall a victim to the first bull that runs over him.

A little pup was seen to pick up a piece of bone in its teeth and shake it about as a dog would a chip. It would be as reasonable to infer from this that pups ate bones as to infer that they eat kelp because they play with it. Several pups have been seen to play with the giant kelp (*Macrocystis pyrifera*) just as this pup played with the piece of bone.

#### DROWNING AND TRAMPLING.

Having had an opportunity to-day to approach the rookery closer than ever before, the causes of loss of life among the pups seem clearer. Mr. Lucas feels that his opinion, formed at St. George, that ordinarily few pups are drowned, must be modified. Drowning depends upon the topography of the rookery, which also determines the death rate in general. Flat surfaces of rock or sand, but particularly sand, allow the pups to be trampled on by bulls; pups are either suffocated or crushed. Sloping beaches of bowlders, if angular, permit pups to recede and hide; rounded bowlders are worse than angular ones, and when the shore is steep and the surf strikes it obliquely as at Tolstoi, a certain number of pups are drowned. The safest rookery is that where the harems are located in volcanic shelves strewn with angular bowlders. Sandy places are death traps for pups. However, the number of healthy, well-fed pups drowned at this stage is small. Part of those drowned have become weakened by starvation, and in these cases, as in cases of certain crushing, drowning is only a secondary cause.<sup>1</sup>

#### AUGUST 8.

Dr. Jordan, Mr. Clark, and Mr. Macoun counted dead pups on Kitovi and Lukanin rookeries in the forenoon and Reef rookery in the afternoon. Mr. Lucas and Professor Thompson dissected those fresh enough for examination. In the evening the *Kush* called, bringing Mr. Townsend from Unalaska. Mr. Lucas immediately went on board for a cruise among the pelagic sealers.

#### THE COUNT OF DEAD PUPS.

A beginning was made on Kitovi rookery toward a more thorough investigation of the dead pup question. The rookery was entered and all the seals driven off, Mr. Macoun and Dr. Jordan making the count of dead bodies together, verifying as they went along, so that in almost every case both saw the pups counted. Probably not half a dozen were overlooked on the whole rookery.<sup>2</sup> All the pups that were sufficiently fresh to make examination possible were dissected by Professor Thompson and Mr. Lucas. Probably all that had died within ten days were so examined. The great majority of the dead pups died early, most of them having the umbilical cord attached.

<sup>1</sup>The pups here found dead from drowning on Tolstoi were doubtless sick pups which had gone down on the rocks of the beach and while unable, from weakness, to get away were overtaken by the surf. They were noted to be in poor condition. The mortality here ascribed to trampling, it must be repeated, was at the bottom in reality due to a wholly different cause, though trampling in the majority of cases was actually the immediate cause. The weak and anemic pup suffering from *Ucinaria* was stepped upon because it had not strength to get out of the way.

<sup>2</sup>The experience of 1897 in picking up and actually removing the dead carcasses on Kitovi rookery, after a more careful count, showed that many had been overlooked. While these counts of 1896 therefore seemed at the time to be accurate they were probably all below the actual facts.



No very great difficulty was experienced in making the bulls move out of the way. Care was taken to avoid alarming the cows unnecessarily.

Beginning with the south end, to Kitovi Point, 15 were counted; from the Point to the high ridge near the middle of Kitovi, 28; to the green cliff below the amphitheater, 15; to the end of Kitovi at Lukanin Point, 51; a total of 109.

One pup otherwise well was found with sore eyelids. No emaciated pups were noticed, but one little one seemed weak. One dead cow too much decomposed to permit of examination was found.

The count was continued in the same way along Lukanin rookery from Lukanin Point. To the gully between the first and second green cliff north of Lukanin Point there were found 70 dead pups; to the end of the last green cliff, 41; making a total of 111. The rest of the rookery was left to be counted later. Two dead cows were found, both examined by Mr. Lucas, but found too rotten for close examination.

## DISSECTIONS OF DEAD PUPS.

The following autopsies of dead pups were made from Kitovi and Lukanin rookeries by Mr. Lucas, assisted by Prof. Thompson:

1. A male pup; emaciated; not fat; lungs congested; heart full of clotted blood; kidneys slightly engorged; gall bladder empty; intestines not injured; a little feces in smaller intestine; stomach empty.

2. A male pup; moderately fat; the umbilical cord attached; subcutaneous tissue around neck slightly congested; lungs much congested; liver, kidneys, heart, and other viscera normal; rectum full of inky olive-colored feces.

3. Female pup; some time dead; condition good, fat; lungs normal, crepitating; gall bladder full of orange-colored bile; kidneys sound; no bruises visible; stomach containing not far from a quart of thick, white milk; intestines full of dark, shining excrement; lower intestines a little inflamed; preserved for reference.

4. Female pup; condition fair; lungs healthy, crepitating; stomach empty; skull entire; heart and other viscera apparently normal; lower intestines a little inflamed; preserved for study.

5. A male pup; condition good, very fat; lungs slightly congested on left side and middle side of right lobe; heart normal; intestines somewhat inflamed; stomach empty; liver somewhat discolored by extravasated bile; a good deal of bile in stomach; kidneys normal.

6. Male pup; not long dead; eyes clear; emaciated; lungs greatly congested, do not crepitate; stomach empty.

7. Male pup; fair condition; lungs normal; liver normal and somewhat light in color; gall bladder empty; intestines and kidneys normal; stomach empty, containing a few hairs.

8. Male pup; considerably decomposed; lungs much congested; stomach empty.

9. A female pup; condition good, fat; lungs normal; decomposition advanced.

10. A male pup; poor condition, but not emaciated; slight extravasation on chest; lungs slightly congested, crepitating; suffusion of bile in moderate quantity in stomach.

11. Male pup; emaciated; stomach empty; lungs badly congested, no air in them.

12. Female pup; poor condition; subcutaneous extravasation on left side of neck; lungs badly congested; stomach empty; other viscera normal.

The last pup was the only one among the 111 on Lukauin which was in a condition for examination.

One adult female was examined which had probably died from a bite in the neck. Decomposition was too far advanced to make examination of the internal organs possible.

A second adult female died in parturition, from false presentation of the fetus, which was full time.

#### REEF ROOKERY.

In the afternoon the counting of dead pups was resumed on Reef rookery. The observers passed through the middle of the rookery driving everything to the right and left, making a reasonably accurate count. Mr. Adams and Judge Crowley were present. Professor Thompson took notes while Mr. Lucas dissected the dead pups fresh enough to handle.

#### COUNT OF DEAD PUPS.

Only 2 dead pups were found on Ardiguén rookery.

In the first of the wedge-shaped masses of seals on the Reef, 163 dead pups were counted, 3 dead cows, and 2 dead bulls. The adult seals were all too rotten for examination. In the second smaller wedge, which ends at a little sandy shore with a hauling ground beyond, were 56 dead pups and 1 dead cow. In the third mass, which extends along the shore, not forming a distinct wedge or extending far inward, there were 63 dead pups and 2 dead cows. In the fourth and largest mass, which ends in a broad hauling runway and extends up to the pile of rocks behind to the hauling ground of the Reef, there were 169 dead pups and 9 dead cows. Eleven of the pups were in the runway of bachelors above the pond. In the long patch between the two ponds were 197 dead pups and 5 dead cows. The middle of this sandy and somewhat muddy flat is especially fatal. A smaller runway separates this from the next patch, which lies on the rocks along the water front ending at the cliff in the middle of the end of the parade ground. In this patch there were 146 pups and 2 dead cows. From the first to the second cliff beyond there were 43, and from here to the end of the rookery there were 123 pups and 2 dead cows.

Totals for the entire rookery: Pups, 950; cows, 24;<sup>1</sup> bulls, 2.

Most of the pups had been dead for some time, the fur being worn off the head and in some cases off the entire body. Probably not more than 10 dead pups fresh enough to examine, besides those turned over to Mr. Lucas, were seen on the rookery

#### RELATION OF GROUND TO THE DEATH RATE.

It becomes evident that there is an important relation between the number of dead pups and the nature of the ground on which the harems are located. In the worst tracts (the flat and sandy areas) there is an average of 2 pups to a harem; in the more favorable tracts, 1 pup to a harem. In Kitovi the ratio is less than 1—109 pups to 168 harems.

<sup>1</sup> In 1897 12 dead cows were counted on this same rookery. In many cases the cows were plainly bitten and torn by the bulls. The diminished number of cows seemed to have left as idle bulls animals which had had harems in former years and which were consequently rendered unusually savage.

The dense patch between the two ponds contains a considerable death trap, and at the edges adjoining the bachelor runways at either side there are many dead pups, showing excessive fighting along the harems near the bachelors. The north end of the rookery is specially favorable for breeding ground, having few dead pups. The four great central masses contain a rather high proportion, the sandy and muddy tracts especially. The losses here chiefly date back to the beginning of the season, the pups being trampled upon in the sand while very young, no opportunity being afforded them to get into the shelter of the rocks.

## GENERAL NOTES.

The sandy tract between the ponds might be helped by removing the stones from the surface of the hauling ground and forming them into a sort of fence on the edges of the harems. This would prevent excursions of bachelors into the harems and to a certain extent keep the pups from wandering out and getting stepped on by the bachelors.

One pup with a bloody nose was noticed. Another very pale-colored pup with pinkish eyes seems to be a half albino. One cow was seen with a large gash in her side, like a spear wound, partially healed up. She was nursing her pup. The bad scars seen early in the season on bulls and cows are now well healed. One pup with a patch of skin and muscle larger than one's hand torn out was seen. The wound opened into the body cavity, exposing the intestines, and the flap of torn skin trailed on the ground as the little fellow walked about. He seemed not greatly inconvenienced, but could not recover. He was killed by the Treasury agent, Mr. Crowley. The little fellow was very tenacious of life and showed the tremendous vitality of these creatures when their wounds are in the skin and muscular system. Nearly all the deaths result from injury to the lungs and vital organs.

One case of copulation with a virgin female was interrupted by the counting. The blame was laid by the bull on one of his neighbors, whom he attacked vigorously.

Two other cases of copulation were noticed, one with an old cow. In the cases last noted the cow and bull seemed very eager, the bull beginning his work within 10 or 15 feet of us, and paying no attention whatever to our presence, though both cow and bull faced us.

A little pup with a great length of dried placenta attached to him, impeding his movements, was stepped upon by a bull and injured so that he was unable to walk. He was killed by Mr. Lucas, but dissection failed to show any organ injured. This shows that serious injury can be inflicted on a pup without its organs showing clear traces of it on superficial dissection. In a number of cases a rough autopsy such as can be made in the field has failed to show any cause for death. Another larger pup was hurt by a bull striking him. Though evidently quite seriously hurt, it was thought that he would recover, and he was therefore allowed to return to his place.

A pup was seen with serum running from one eye. No other injury was apparent, and the little fellow seemed lively. Not more than 5 or 6 emaciated pups were seen on the entire Reef.

Reef rookery is still lively. Large, vigorous bulls seem bent on keeping harems together. These are evidently idle bulls now come into possession of harems. One bull was seen to throw a cow 10 feet, and two others ran away with cows. Some 2-year-old cows back of the rookery were carefully guarded by bulls.

## DISSECTIONS.

The following pups were dissected from the Reef:

1. A female pup; long dead; good condition; cord attached; extravasation of blood on chest and neck.
2. Male pup; good condition; very fat; eyes fresh; viscera normal, except that the right lung is collapsed; stomach full of milk, pink in color.
3. Female pup; good condition; lungs slightly congested, not crepitating; contents of stomach yellowish brown; subcutaneous extravasation over left rib just over gastric region; stomach walls greenish brown in color.
4. Male pup; good condition; fat; lungs slightly congested toward base; stomach full of milk; viscera normal.
5. Male pup; fresh, fat; large extravasation over posterior ribs; pericardium inflamed and full of blood; stomach containing small stones.
6. Male pup; condition fair; bruises all round the abdominal region; lungs congested, especially toward apex on both sides; stomach distended with milk.
7. Female pup; very fat; stomach distended with milk; viscera apparently normal and sound; skull intact.
8. Female pup, young; slight extravasation round neck and shoulders; greater extravasation on forehead and around head; lungs somewhat congested, especially on left side.
9. Male pup; much emaciated; lungs much congested and collapsed; somewhat bruised about head.
10. Female pup, good condition, fat; viscera normal; no inflammation in peritoneum; kidneys soft and decomposed, though rest of viscera in good condition.
11. Male pup; lungs normal; viscera decomposed; no obvious cause of death.
12. Large male pup; skin torn off one-half right side of ventral portion of abdomen. (Killed by Mr. Crowley). External oblique muscle torn through on right side. This pup was going about alive and active when killed by the Treasury agent.
13. Male pup, small. Seen to be injured by a bull's hind flipper. It was unable to walk and lay helpless. On dissection no internal injuries could be seen.
14. Male pup, large, emaciated; lungs congested; other viscera normal.
15. Male pup, poor condition; lungs much congested; very dark in color; other viscera normal, but quite destitute of fat.

None of the adults were in a condition to dissect. The presence of 9 of these cows in the most dense mass of seals on the Reef suggests the rough treatment of the bulls as a cause of death.

## AUGUST 9.

Dr. Jordan and Mr. Clark visited Lukanin rookery and finished the count of dead pups there in the afternoon, afterwards visiting the "slide." The count of August 8 gave 111 on Lukanin to the end of the green cliff. The completed count gives to Lukanin 205 dead pups.

## LUKANIN ROOKERY.

One dying pup was seen; large, well nourished, but dumpish and unable to move. It lay between two rocks, where it might have been stepped upon. As it could not recover, it was killed. It proved to be a male with plenty of fat. The stomach full of



milk, containing at least a pint; both lungs crushed, the right lung utterly collapsed; other organs in normal condition; has evidently been stepped upon and crushed.

A little pup was found gasping, with a spasm like hiccough for each breath. It was killed. A small female pup, very lean; the right lung congested,<sup>1</sup> hardly crepitating; left lung normal; other organs likewise; stomach wholly empty; lower part of small intestines full of dark greenish fecal matter; starvation the probable cause. It is interesting to note that this pup, which was evidently starving, had the symptoms ascribed by early observers to death by sunstroke. It was starving.

#### ROOKERY CONDITIONS.

This part of Lukanin is less steep, the rocks are smaller and smoother, and it adjoins the hauling ground, which is a source of danger to straying pups before the idle bulls leave. All idle bulls are now away from their former positions behind the harems; they lie sleeping on the sands, or are busy on the rookeries, which the old bulls have as a rule now left. Those having harems of virgins are still interested. The idle bulls are to some extent needed in the economy of the rookery. A ease of copulation was seen, apparently unsuccessful, for the time being at least.

In the rain one mother lies partly on her back. A pup climbs on her and lies there. She sleeps on, but the pup is awake and restless.

A cow becomes alarmed at us and plunges off a 10-foot vertical cliff, falling on her back on the stones. She gets up and moves on, seemingly all right. The pup follows and falls 6 or 8 feet, striking on its feet.

A pup, otherwise well looking, has one eye gone. The hole is full of yellow pus which runs out in quantities. It may be the work of the gulls. They pick out the eyes of dead pups and might peck at the eye of a sleeping pup, thus destroying it. It is said that a very considerable number of young pups are killed on Robben Island in this way by the burgomaster gull. A reward of 5 copecks (5½ pence), it is said, has been offered on this account for each bird killed by the natives.

One old bull who has waited all the season behind Lukanin has now two cows in charge. The photograph of last year shows a small harem in the same position. Probably few of the idle bulls fail wholly to get cows before the season is over.

A female pup, but recently dead, was opened: stomach found to be filled with milk, its walls slightly injured; lungs flat, greatly congested, crepitating; its heart was full of clotted blood; left lobe of liver congested. Evidently died from crushing.

A dead cow seen on Lukanin rookery had froth issuing from her mouth. Milk oozed out of the opening where a wound caused by a bite occurred in her belly.

#### ARDIGUEN.

The bull in harem A is on his shelf, active and very lean; he has 8 or 10 cows. The old green-backed cow, often referred to, is there. B is in his place with 2 cows. C is active and holds 16. X is below A, with pups about him and 4 cows near. A new bull, very black, is in A's old place. Z is back with 4 cows, one very affectionate, lazily biting him. Eleven cows scattered below X. D is active, with some 10 cows or more. F is fast asleep with 2. E and G are both gone and have

<sup>1</sup> This congestion was found later to be a characteristic of starvation, as was also the dark fecal matter, the latter due to bile.

been for some time. There are 31 bulls, not more than half seemingly old timers, on the whole of Ardignen. There are 189<sup>1</sup> cows present, and 431 pups. This count, however, is not likely to be final, as it was made from the top of the bank, and there may be a large number of pups and a few cows hidden.

Ardignen presents extremely favorable conditions for pups, there being apparently only 2 dead pups in the entire region. No bachelors run down in this slide, which is well provided with angular rocks. There is no hauling ground at Ardignen, its bachelors going around on the parade ground of the Reef.

Three young bulls are still waiting patiently behind. Many of the cows in the harems are young females.

#### ROOKERY MANAGEMENT.

It would not do to give Treasury agents general authority to shoot idle or superfluous bulls, though many of these should be disposed of. Such action would not be safe except under skilled direction and after a thorough study of the needs of the herd. Such work should follow the appointment of a superintendent of the herd and be under his control.

Such a superintendent might do much in the way of caring for the rookeries, clearing out the bowlders from the runways of the bachelors, forming these into low stone walls between the runways and the harems and even at the back. These walls should not be too artificial in their make-up. They need not be high, only inconvenient to cross. This would allow of egress and ingress, but by rendering both difficult the animals would not wander across them in an aimless manner. They might serve as a means of preventing the straying of pups, which are often found half starved or dead in the hauling grounds, where they have wandered away with the bachelors and become lost from their mothers.

Stones might be rolled down from the slopes above certain places, as at Tolstoi and the Reef, to cover bare, sandy tracts, which are now definitely known to form death traps. These places furnish unimpeded opportunity for the movements of the bulls, and the luckless pups wandering about over them are trodden upon. Where the ground is full of bowlders the bull can not move so easily and the pup can crawl under the edges of the stones and find protection. With some expense many of the bad places could thus be fixed. Rock can be found within a reasonable distance of any of the defective breeding grounds.

There are pools in some of the harems that become filled with rain water, and the excrement of the animals mingling with it produces a fearful stench and filth. These should be filled up with sand and strewn with rocks or else drained. Even in the rocky areas are pools above high tide which become filled with rain water and likewise filthy. Openings might be drilled into these so they might drain off. It may not make any difference to the seal as it is, but while a hog might not object to a filthy pen, the breeder who lets him live in one is not thought well of.

On some of the exposed rookeries it might be possible to so pile up the rocks on the water line as to make a protected pool, replenished by the sea, in which the pups might learn to swim guarded from the force of the waves. At the angle of Tolstoi

<sup>1</sup> The total number of cows in July was 550. The count of cows is reasonably accurate, but a count of pups is impossible from the bank, and is difficult from below, as they lie under the bowlders out of sight.

with English Bay thousands of pups were seen the day after the big blow, and when the surf was still very high, swimming in the open sea front. Some of them were constantly being carried out too far and deposited far below on the beach at English Bay, whence they would go back and swim up along the shore, each breaker throwing them up on the rocks, from which they would scramble back into the water. There are on some of the rookeries pools of the kind suggested, and they are frequented and thoroughly enjoyed by the pups.

On some of the rookeries, as Tolstoi, Gorbatch, and Polovina, there seems to be a lack of openings or runways through which the bachelors can pass in reaching the hauling grounds in the rear of the harems. It is the constant tendency of the bachelors to pass down through the harems instead of going around to the ends. The intrusion of a bachelor or idle bull upon the harems in the breeding season causes the greatest confusion. Each bull, sometimes two or three at a time, will rush at him and either drive him back or throw him bodily from harem to harem until he gets to the water. The rushes of the bulls in the early season after bachelors or against their neighbors, or to prevent the wandering of restless cows, is the cause of death to pups in a large number of cases.

This problem of rookery management is one of great importance and one which the Government has as yet failed to take seriously. It should have been provided for at the outset and will certainly need immediate attention if the herd receives proper protection at sea.

#### AUGUST 10.

Dr. Jordan, Mr. Clark, Mr. Macoun, Professor Thompson, and Judge Crowley visited Northeast Point for the purpose of counting the dead pups.

On the way, a stop was made at Polovina, and Mr. Clark and Professor Thompson counted the dead pups on the main rookery, beginning at the angle near the sand beach where the bachelors haul out; Dr. Jordan beginning at the northern end, counted Little Polovina and the cliffs to Polovina Point.

#### LITTLE POLOVINA.

Two large and very ugly pups were seen among the bachelors at Little Polovina and were carried to the nearest harem. Virgins are very numerous, hauled out on level ground behind.

Little Polovina and the portion of Polovina under the cliffs are largely made up of the flat tops of lava columns. These give way to areas covered with bowlders and rocky lava holes farther south. The smooth columns are rather unfavorable, but the 9 pups dead at the extreme end on these columns seem to be mostly starved ones, who have strayed from the large pods in which they belonged. One of them is now dying. The rookery on the whole is a very favorable one. Only 47 pups in all were found dead.

Mr. True's observations suffer from being closely confined to Lukanin and Kitovi rookeries. Different things happen in massed and differently placed rookeries.

On Little Polovina is seen a semi-albino pup, light russet brown, with pink flippers and eyes, a fine fellow, strong, but partly or wholly blind.

Much soft light-yellow excrement is to be seen everywhere. The rookery ground is very foul scented from this and urine. Pups can get down to the sea in most places here only through runways or slides. The cliffs are vertical to the height of 20 or 30 feet.

A bull in copulation is very clumsy; he has his mouth open and seems much fatigued; draws off when done, with mouth open and groans. The cow is an old one without large mamma; may have lost her pup. The bull is excessively thin. The cow tries to get away now that it is over, but the bull resists. They bite each other in the usual way.

There are 40 bulls in all with harems in Little Polovina. Forty-five were counted in July. There are many fine pups. The mortality is small, partly because there is no great body of seals pressing down from behind. There is a passageway down to the sea in the middle of the rookery, rather smooth and rocky, but there are no dead pups in it.

An evil-minded old bull runs over 5 or 6 pups and falls with his breast on one, which toddles off seemingly not hurt. It takes a heavy weight to crush these sturdy fellows when they are a month old. Those that have succumbed were for the most part but a few hours old.

#### ROOKERY INSPECTION.

Going through a rookery from end to end in this way makes some disturbance and excitement. Cows, bachelors, and pups flee in haste; bulls go slowly and try to stop the cows; some stand their ground and can not be moved, but they are few at this stage. In three minutes, however, the whole excitement is over, and as soon as you pass they resume their places.

At this season half of the bachelors are in the water off the rookeries; half asleep in the banks behind; many, especially the older ones, in the sand. Cows take to the water when alarmed, but probably soon return. Wet cows coming in after feeding are less numerous now than ten days ago. More than two-thirds of the cows are off all the time. There is a large and well-beaten hauling ground far from the breeding grounds, midway between Little Polovina and the main rookery. The bachelors come up through a narrow runway in the cliffs.

#### DEAD PUPS—POLOVINA CLIFFS.

Cows are apparently not heavy enough to crush strong pups a month old. They run over them without compunction. A bull steps on a little weak pup under the cliffs. It is apparently not hurt much, but walks away slowly as if dazed. Two dead pups were apparently killed by falling stones and dirt from the cliff above. More than a fair proportion of starved pups would appear on dissection. A pup losing its mother three weeks ago would still be fresh if dead. None of the rotten pups could have starved.

There are some yearling females on the hauling ground. No dead adults. Twenty of the dead pups are seen along the edge of the hauling ground; scarcely any in most harems. There are 51 dead pups in all on the cliffs portion of Polovina.

#### POLOVINA—COUNT OF DEAD PUPS.

Mr. Clark began the count of the main rookery at the angle of Polovina sands. It was found possible to pass along the brow of the cliff and also the flat for some distance back, driving the seals into the water or inland. By returning along the outer edge of the harems and driving the seals into the area counted it was possible to closely inspect and count the entire area.



The sandy area at the angle of the cliffs was an important death trap. Harems were here crowded close together. To the first small projecting cliff 94 dead pups were found. There were 93 on the lower section of the sandy depression which drains down to the foot of the cliff; 35 were on the rocks at the immediate foot, and 58 on the flat beyond and within 25 feet of the edge. One dead pup lies on the rocks.

Beyond there is another depression draining down to a runway or break in the cliff. There are 48 dead pups on the stones at the foot and 28 are visible within a short distance of the level edge.

A number of bulls at this point are very fierce and immovable. The cows for the most part give way. One harem of 2 cows seems very little inclined to move. The bull is willing to fight all comers. On going around to the other side it is found that one of the cows has just given birth to a pup. The placenta is still attached to the pup and also the cow. This accounts for her courage and the courage of her master. She shows the maternal instinct of protection and stands guard over her offspring. She is not further disturbed.

There are 21 more dead pups to the break in the cliff wall at the green moss-covered rock. On either side of this rock is a runway frequented by cows and bulls. At the meeting point below are 6 flattened dead pups closely packed together. There are 32 pups in all at this runway and on the rocks about its mouth. There are 57 on the flat above within 50 feet of the rock.

In another runway beyond there are 13 in the slide and 6 at the mouth on the flat above. There are 15 dead pups on the flat to the little runway that goes down just beyond Polovina Point.

In retracing the rookery on the flat above 84 outlying dead pups are found, 4 dead cows, and 1 dead bull, making in all 635 dead pups.

The count of Polovina finished, the trip to Northeast Point was resumed, arriving at 1.30.

#### NORTHEAST POINT.

After lunch Dr. Jordan, Professor Thompson, and Mr. Macoun began to count the breeding ground on the west half of the point, beginning at the southernmost end and working up toward the top. Mr. Clark, accompanied by Judge Crowley, took the east side, beginning just opposite the village and counting round toward the west to meet the others.

#### VOSTOCHNI.

At the most southern patch on the west side, Dr. Jordan found favorable rookery conditions, the ground being covered with coarse boulders.

Some yearling cows were seen, and there was much stewing among the bulls over them. One cow of very large size was seen, weighing perhaps 100 pounds.

One dead male pup, greatly emaciated, was dissected. Lungs found congested; evidently starving; no fat whatever. Had probably been run over by a bull while in weak condition. One dead cow and 1 dead bull were seen in this patch and 59 dead pups were counted.

The second patch is likewise covered with coarse boulders, and is favorable rookery ground. The bulls are pretty fierce. The pups are unusually fine looking. Yearling cows are running with the pups, playing with them and acting like them. They are full of curiosity. One starving pup seen.

Nearly all the living pups in a healthy condition, have the inside of the mouth and teeth largely stained with dull yellow. The starving ones have the mouth white. This same peculiar color is seen in the mouths of bulls.

The total of dead pups for this patch is 95.

Next follows a short beach piled with seaweed. Evidently there is a strong tide running around a large rock in the sea. On this beach there are 93 dead pups washed up by the surf. They are mostly fairly fresh. Some are perhaps drowned, but the bulk have been washed off the rocks farther along and thrown up here.

The next patch is located on a rocky prominence covered with large bowlders. On this sort of rookery ground the bulls leap from one large rock to another and therefore rarely hit the pups. There are few dead pups; 29 in all.

Then follows a hauling ground which extends back from a small sandy beach. On this beach there are 19 pups washed up. The sand here is true sand, not lava. It must have been washed from some distance, but is characteristic of a number of the smaller beaches also further around the head. One dead bull and 2 cows.

For the present the large patch at the base of Hutchinson Hill is omitted, as is also the narrow strip extending to the hauling ground south of the hill. Beyond Hutchinson Hill the count is resumed. There is a long sandy beach covered with coarse bowlders. On this beach are 31 dead pups which have been washed up, together with 2 dead cows. One of the 2 dead cows, which was fresh, was skinned for museum purposes. On examination it was found to be in a hearty condition. A spear had pierced the skin of the breast, entering the mammae, which were full of milk. On removing the skin of the head it was found to be badly contused as if from a severe blow. The lungs were badly congested; the stomach empty. It is probable that the cow had been speared, then clubbed, and getting away, she was finally drowned in the surf and had been washed up by it.

#### MORJOVI.

In the first patch on the east side Mr. Clark counted 103 dead pups and 1 dead cow. A pup in the water was seen playing with a short stick, lifting it up and shaking it as a dog might.

A pup was found imprisoned in the crevice between two rocks. Its flippers were white as if bleached; it showed the grayish tinge of age, but seemed well nourished. It was found to be attached by an unusually large umbilical cord to a rotten placenta which was caught in the rocks, holding the little fellow prisoner. The cord was cut and the pup placed on a flat rock. He had never used his flippers, and could not get about. He had evidently been well fed.

A large and well-nourished pup was found curled up under the lee of a rock in a position where it could not have been stepped upon. It was found on opening it that the body cavity was full of milk, which poured out when an opening was made. The stomach was burst open. Evidently the pup had been stepped on after taking his meal, and had crawled among the rocks to die.

On a rock were a lot of spewing of fish bones as if vomited by a seal. A small pup was seen lying asleep with an injured eye. On approaching closer to examine it the pup started up and a stream of pus gushed out of the eye socket.

In a small patch to the south of Sea Lion Neck there were 6 dead pups; in the patch on the opposite side of the neck there were 7. Both patches were favorably situated for rookeries, being on large rounded boulders.

No dead pups were washed up on Walrus Bight. There are 298 dead pups in the large sandy tract just beyond the Bight. This sandy flat is a death trap. Two dead pups were found between here and the large patch reaching to Northeast Point, which contained 146, with 2 dead bulls and 2 dead cows. At the water's edge a young bull with one blind eye (moon eye) was seen to rush into the place of a bull which stampeded at our approach. The blind bull could not see us and was disappointed when he had to leave.

The sea lions on the point took to the water and set up a wild chorus of bellowing. About 50 of them swam along the shore, stopping every few minutes to stretch out their great necks and roar in unison. The whole band would go under at the same instant and reappear to take up the roar where they left off. They followed us offshore down the beach for half a mile. When we were past their rookery they turned back.

#### DEAD PUPS.

A male pup, greatly emaciated, was dissected at the point. The lungs on both sides were greatly congested. The muscles on both sides of the breast showed evidence of contusion. The heart was full of clotted blood; the stomach empty. It had been crushed to death when in weak condition.

The fresh dead pups to be found on the rookeries are of two kinds, first, very lean and emaciated ones, pups which have lost their mothers or strayed from them and partially starved, being trampled upon and killed when in a weakened condition; second, large, well-fed pups: of these there are only a few. These pups have met their death, as it were, by accident. They were caught in awkward positions, have been stepped upon when their stomachs were filled with milk, or have been struck with unusual force.

The bulls do not intentionally step upon the little pups or maltreat them, though often they forget and rush over them in a blind, reckless fashion. The little pups show considerable skill in getting out of the way of danger, and when getting around in attendance upon his ordinary duties the bull avoids stepping on them. When he is blinded by anger or desire to collar an intruder, he thinks of nothing else, and woe to the pup on whom he sets his weight.

Professor Thompson dissected 11 dead pups on Vostochni rookery. As the results are practically the same as those shown by the autopsies on Kitovi and Reef, it is not necessary here to give them in detail. They will be treated in a separate connection by Mr. Lucas.

In the evening Professor Thompson and Judge Crowley returned to the village in one of the buckboards, Dr. Jordan, Mr. Maconn, and Mr. Clark remaining over night to finish the count in the morning.

#### MR. LUCAS'S NOTES.

At sea on *Rush*.—The weather fine; alternate fog and semisunshine, with moderate sea. In the morning opened 11 female seals and 1 male. Out of 18 seals already

opened the stomachs of only 4 contained food; all contained nematodes. Noticeable is it that none of the stomachs contained pebbles of volcanic rock such as were found in stomachs of bachelors on St. Paul. In the evening we obtained 1 male and 13 females. But 5 stomachs contained food; none pebbles; nematodes in all. One 5-year-old male was thrown overboard by schooner *E. B. Marvin*.

#### AUGUST 11.

This morning proved suitable for photographing, and Mr. Macoun went to get views from Hutchinson Hill. Dr. Jordan and Mr. Clark began the count of dead pups at the south end of the hill.

#### VOSTOCHNI.

Inasmuch as no count of cows and harems was possible on this tract in the height of the breeding season, Dr. Jordan made a count of the bulls and Mr. Clark counted the pups. A count of harems at this time will necessarily be imperfect, but while the bulls are not the same, the harems now marked by the presence of bulls correspond in a rough way to the original ones.

At the very outset of this rookery there is a death trap. The rocky shore is well adapted for rookery purposes, but the harems extend back into a level sandy flat which adjoins a large hauling ground. As we approached, a band of bachelors immediately set out through the rookery by a short cut to the sea, sweeping the cows and pups with them. Of course, they could not do this in the breeding season, but the attempt to do it, which was frequently made, doubtless occasioned a great amount of fighting. Here, as at Tolstoi and Polovina, there is a tendency for the harems to extend out in a wedge-shaped mass, across the point of which the bachelors are always trying to pass instead of going around.

There was a dead bull in the level flat and 3 other dead bulls at its outer edge; more evidence of fighting.

A large female pup, greatly emaciated, was found lying gasping and jerking with spasms—another case of "snustroke," so called. The pup had voided a quantity of dark fecal matter like coal tar, and its lower intestines were full of the same excrement. The organs were in normal condition; not a trace of fat. The pup was starving. Dr. Voss says that in his opinion this dark fecal matter found in the intestines of a number of starving pups may be due to intestinal hemorrhage, the black coloring matter coming from the breaking down of the blood cells in the intestines.

Those pups which lose their mothers early do not grow; they turn gray and look old while still dwarfish in size. One starving pup crawls to us as if asking for help.

Another albino russet pup is seen apparently partly blind. It is strange that so many of these albinos should be blind.

Some bulls, not many of them, try to avoid stepping on the pups. A bull is seen with a very bad scalp wound now almost healed but which will leave a scar. Apparently few of the wounds inflicted by the bulls on each other early in the season fail to heal before the end.

#### THE COUNT.

This first group of harems to the south of Hutchinson Hill contained 263 dead pups to the point where the sea lions sleep. There were also 4 dead cows and 4



dead bulls. Mr. Macoun, having finished his photographing, entered upon the work at this point.

To the foot of Hutchinson Hill there are 255 dead pups. There are 2 additional dead bulls and 7 dead cows.

Under Hutchinson Hill is another sandy area like that on Tolstoi, and rivaling it in deadly effect. In this tract there were 887 dead pups; 10 dead cows, and 1 dead bull.

Professor Thompson suggests as a result of examination that the pups with brown bellies and brown shades upon the axillary parts are females, while those plain black on the belly as well as above are males. This should be verified.<sup>1</sup>

A small living pup found with a patch 2 inches square torn from his back, the wound full of pus; it is unable to use its hind flippers, but seems active in spite of the injury. The pup was killed, as it could not be expected to recover.

One fine pure white albino pup, large and strong, was found which was blind but very active. It took hold of a notebook and shook it violently. The yellowish substance which coats the lips and teeth of the pup appears as a yellow brown stain on the book. As he is blind, and therefore worthless, his skin is taken for museum purposes.

The great patch northwest of Hutchinson Hill begins beyond the sandy tract with hard smooth ground containing many rocks which are, however, too small and too far apart to be of use. The corner next the hauling ground on the eastern side of Hutchinson Hill is very bad; some other places are moderately so.

The bulls on Northeast Point are unusually ugly. The young bulls, with large harems behind the rookery, are easily driven. Many old ones with one or two cows on the rookery grounds can not be budged even now.<sup>2</sup>

The day is wonderfully clear, giving a beautiful prospect from Hutchinson Hill of the ocean and the island. Walrus Island shows distinctly in the distance.

The bad place directly under Hutchinson Hill is composed of smooth hard ground with no depressions. It can easily be mended by rolling in stones after the breeding season. In the breeding season, it is no more possible to inspect the inside of a rookery than the lair of a bear. Hence small rookeries which can be overlooked from cliffs have been studied instead of large ones. One studying only small rookeries has no idea of the difference of conditions on the large ones.

One greatly emaciated pup, apparently dead, proves to be insensible, but still alive. It is killed and its skin taken. A pup with an eye full of pus seems to be very active. Some little pups show evidence of starving; the fat is disappearing from their shoulders and rump; their ribs feel bare. Such pups do not grow. Their weight is not half as great as that of well-fed pups.

<sup>1</sup> Later observations at the time of the examination of pups, to determine the relative proportions of the sexes, showed this not to be the case. Doubtless the brown-bellied pups are those destined to become the silvery throated animals.

<sup>2</sup> It became evident in 1897 that the idle bulls do not become fixed in their positions in and about the rookeries much before the arrival of the cows about the middle of June, whereas the regular harem masters take their places early in May. It is doubtless the earliest arrivals which leave first, and the idle bulls which have fasted for a shorter period are still comparatively fresh. These are the ones which stand their ground in August.

Another pup dying of starvation is wholly insensible. These are pups which have in one way or another lost connection with their mothers.<sup>1</sup> The pups still active, but showing signs of starvation about the eyes, the large head, uncertain gait, and a lack of plumpness, will be found to be the product of pelagic sealing. Similar changes are shown by the pup starving at the house, which is still alive.

One bull has a singular voice, like a fog horn. The pups and harems are now grouped to the top of Hutchinson Hill. In the breeding season but one bull with a harem was located on this hill, and his 2 cows ran away.

A cow is seen dragging herself along, unable to move her hind flippers. Several bulls have been killed on account of this, but their examination has not resulted in indicating the trouble. Another pup is seen with pus running out of his lost eye.

At the foot of Hutchinson Hill 2 bulls were fighting. One got badly routed and was very angry. When he saw me sitting on a stone near by he came after me with the same force and vigor that had been displayed against him by the other bull. I of course resigned the stone to him without parley and he continued to hold it for a long time in a self-satisfied way, as if the fact that he had routed me was some solace to his wounded pride.—(Dr. Jordan.)

#### HEIGHT OF THE BREEDING SEASON.

The height of the breeding season lasts until about the 20th of July, after which time the authority of the bull is not very potent with the cows, many of whom are then going into the water. At this time it is possible to stampede a harem of cows by approaching too near. Frequently they will leave in a body and take to the sea. But this is not so serious as a similar stampede would be in the height of the season, for at the latter time the bull has become listless and makes little if any objection, except perhaps in the case of individual cows, which may be those not yet impregnated. The pups also are strong and active and are podding by themselves. At the same time the bull himself will retain his position, and no power can stampede him except the attack of a larger bull. The so-called stampedes are usually due to the attempts of half bulls and idle bulls to enter the harems in the breeding season, either to steal cows or to take up places there.

A cow that had a bad gash above her flipper on July 25 is almost well now.

#### ESTIMATE OF HAREMS.

Part of the harems and cows on Northeast Point rookeries was counted by Mr. Lneas and Dr. Stejneger on the 16th of July. But no count could be made of the immense numbers under Hutchinson Hill and to the southwest of it. A count of the harems was made to day by Dr. Jordan. In this count of bulls an effort was made to include only those in service, not half bulls. Many were idle in the breeding season, and many then in service are now gone. This spoils the accuracy of the count, but it is probably not far from correct.

Dividing the whole rookery into two parts, the east and west, the former has 243 harems; the latter, 975. The harems on this rookery seemed unusually large, and it

<sup>1</sup> A mother killed at sea on August 1 might have been away several days, and a young pup, under these circumstances, might have been without food for a week before August 1, thus giving from fifteen to eighteen days, a sufficient time in which to starve.

seems about right to use the 17.3 average per harem for the whole of it. This would give the total of seals for the east side as 3,565; for the west side, 15,575. The distribution of dead pups for the two sides is: East Northeast Point, 485; West, 1,808. This corroborates the original estimates, which gave the proportion of the two sides as 4,328 and 15,879.

The division of the rookery is taken from the point itself. This throws the great mass under Hutchinson Hill and to the southwest of it into the western part. The western side we have called Vostochni; the eastern side, Morjovi.

#### POLOVINA ROOKERY.

As we passed this rookery on our way home almost the whole population, bulls, cows, and pups, were down on the low reef of rocks which extends out into the sea from the base of the cliffs off Polovina Point, it being low tide. The pups and holostiaki were playing in the pools, and the cows and bulls were lying around on the rocks or sitting up, wet after their bath. They had evidently taken to the sea on account of the sun, which shines brightly. A photograph of the rookery taken from the point of the cliffs showing a scene like this one would be extremely picturesque.

#### UNIT OF SPACE.

An experiment was made with a view of determining the ground occupied by closely massed seals. One of the pods of dead seal carcasses on the killing ground at Polovina was measured. These seals are laid out on the average as closely together as we have seen living seals in the thickest portions of the crowded rookeries. The patch measured 285 by 31, or 8,835 square feet. It contained 650 bodies, which would give an average space of  $13\frac{1}{2}$  square feet to each. Mr. True's estimate gave 23. Mr. Elliott's 4 square feet, including no space for pup.

#### MR. LUCAS'S NOTES.

At sea on *Rush*. The wind light; sea smooth; foggy. Sixteen seal bodies were obtained—15 females and 1 male—from the Canadian schooner *Aurora*. Three 2-year-olds recently impregnated. The blood vessels of both ovaries and both branches of the uteruses were much congested. Both ovaries contained Graafian follicles in various stages of development. It seems apparent that the first impregnation may occur in either branch of the uterus, but that subsequently impregnation and delivery alternates, as shown by Mr. Townsend, whose statements regarding the condition of females at sea are sustained in every particular.

Cases of twins have been reported by sealers, and from the evidence at hand it would seem that such cases, if real, must occur among females bearing for the first time. There is a possibility that a female which bred early in the season might, if not impregnated until late, become pregnant in both branches of the uterus.<sup>1</sup>

<sup>1</sup> Such a course would, in the nature of things, tend to eliminate the animals following it, as after allowing sufficient time for both branches to recover and be prepared for impregnation, the period of gestation would throw the birth so late in the fall that the pups could not survive. It seems essential in the economy of the seal that one horn of the uterus be ready for impregnation almost immediately upon the delivery of the other.

## AUGUST 12.

Mr. Lucas and Mr. Townsend returned on the *Rush*. Dr. Jordan and Mr. Clark, with Judge Crowley and a boat's crew, visited Sivuteh Rock in the morning, making a count of the dead pups on Tolstoi and Lagoon rookeries in the afternoon.

## CONDITION OF SEALS AT SEA.

The following is an abstract of Mr. Lucas's report of the results of his cruise on the *Rush* among the pelagic sealers:

"On the evening of August 9 the bodies of 7 seals were obtained from the Canadian schooner *Agnes McDonald*, and 12 bodies were obtained from the American schooner *Decahls*. On the 10th of August 13 bodies were obtained from the Canadian schooner *E. B. Marvin*, and on August 11, 16 from the Canadian schooner *Aurora*. One 5-year-old male was thrown overboard from the *E. B. Marvin*.

"Two of the 48 bodies obtained were young males; the remaining 46 were females from 2 years old upward, some being very old. The 46 females were carefully examined by Mr. Townsend and myself, with the following results:

"Forty-three were breeding females with nursing young, and 3 were 2-year-olds just arrived at the age of first impregnation. Forty-two of the females, including the 3 2-year-olds, had been recently impregnated, while the condition of the remaining 4 was somewhat uncertain, and the ovaries were reserved for further examination.<sup>1</sup>

"In regard to food, it may be said that only 14 contained any trace of it, and in the majority of cases this consisted of squid. Next in order of importance is pollock, while a single individual contained bones of a cottontail.

"The results obtained from the examination of the 48 bodies are so strictly in accord with the observations made by Mr. Townsend in 1895 that it would seem unnecessary to pursue this branch of the investigation further, unless it should be deemed best to continue it at a later date.

"It is apparent that the large majority of seals taken by pelagic sealers in August are females with nursing young, and that an equally large majority are females which have been impregnated and would, if spared, bear young during the coming year. The females noted as not impregnated may, on closer examination, prove to have been, and not a single instance of a 'barren female' has come to light."

## MISCELLANEOUS NOTES.

Mr. Lucas reports that the "intestinal worms" in the stomach of the hair seal taken at North Beach, a few days ago, on closer examination prove to be the soft axes of the tentacles of the octopus.

As touching the age of seals, Mr. Lucas finds that in yearling and 2-year-old females the whiskers are black, while in the younger breeders they begin to turn gray; in the older ones they are quite white. He also reports that very black-bellied pups are not males, but are younger pups which have not begun to shed their hair; the brown-bellied ones are older. On examination of the teeth, etc., the barren female found with the bachelors on the Reef hauling ground seems to have been about 5 years old.

<sup>1</sup> Closer examination showed the majority of these doubtful cases also to be impregnated.



Mr. Lucas finds that when the liver is thin and dark, the lungs have very blackish congestion and the intestines contain more or less blackish fecal matter, it is a case of starving to death. The congestion of the lungs is probably produced by injuries that would not affect well pups. Drowned pups have usually a little water in the lungs. The lungs are pale, the outer organs in good condition; sometimes there is water in the stomach.

Kotik, the experimental pup, weighed 12 pounds on the 4th of August. His weight to-day, August 12, is 9½ pounds. He is beginning to show loss of flesh. The little starving pups noticed within the past few days on the rookeries show the same characteristics—hollow places over the shoulder blades, the ribs, and the hips.

#### SIVUTCH ROCK.

Dr. Jordan counted the harems on this rookery and Mr. Clark counted the dead pups. Of the latter there were 50, all told. The number of harems proves to be larger than was supposed, counting with a glass from the Reef, only a part of the breeding ground being visible from that point. There are 63 harems, represented by bulls at this time. This is doubtless an unsatisfactory count, but it is better than the original. This island therefore represents quite a respectable rookery of 1,090 cows—but little smaller than the Lagoon. The ground is very favorable for rookery purposes, as the low death rate shows. There are two hauling grounds occupied by the bachelors—one at the north end and the other at the south end.

A bull was seen at some distance in the water trying to keep a cow from swimming off. He finally picked her up in his mouth as a dog might a duck and carried her in to the shore, depositing her on the rocks and standing guard over her.

A good many pups obviously starving are still strong and active. That they are starving is shown by the absence of fat over their ribs, scapula, and rump and by the disproportionately large size of the head. The plumpness of the normal pup has given way to an unusual slenderness. The starving pup at the village gives a standard of comparison. While he is still very active and pugnacious, he is plainly starving and the end is not far off.

#### TOLSTOI DEAD PUPS.

The count of the dead pups on Tolstoi rookery was made by Dr. Jordan, Mr. Macoun, and Mr. Clark in the afternoon. Mr. Lucas, assisted by Professor Thompson, dissected as many dead pups as were fresh enough for examination. Mr. Townsend photographed the dead pups on the sand flat.

The great area of hard, sloping sand, with the beach below, was found to contain 1,495 dead pups, the vast majority of them apparently having been killed at the beginning of the breeding season, when this region was covered so thickly with seals that they looked like a great swarm of bees. This portion of Tolstoi was the densest of all the rookeries in the breeding season.

The dead pups were especially numerous in the center of the large wedge-shaped mass as it appears in the early part of the season, and also underneath the northernmost green cliff. The rocky slope over this cliff contains many dead pups, the rookery floor being here made up of rock in place, with occasional large bowlders. There are many concave depressions, and the few bowlders are too far apart to be of service.

Farther to the south, on the ragged rocky slope between the green cliffs, there are few dead pups. Its extreme steepness and the numerous angular bowlders protect it well. There are very few pups dead along the cliffs to the south, except in some places where the rocks are smooth and the bowlders far apart. All the dead pups found along the cliffs died early. The total for the cliff portion of the rookery was 289.

The number of pups washed up on English Bay by the high surf ten days ago has now grown to 232. All of these are pups long dead, most with the umbilical cord attached. Some of the pups found on the rocks at the water front below the sandy flat seem to have been drowned; but the whole number of the pups drowned is very small—not over a dozen. The total for Tolstoi rookery is, therefore, 1,895 dead pups, 7 cows, and 1 bull.

The bulls in the center of the great wedge-shaped mass are more ferocious than the outlying ones. Those near the water and at the head of the cliffs are easily driven. But some of the old ones can not be moved at all.

Very many pups just beginning to starve are noticed. A few are nearly gone. Most of these seem fairly attributable to pelagic sealing.

Mr. Lucas notes that at Tolstoi a small starving pup ran at him and bit a dead pup he was carrying so firmly that the living pup was raised from the ground and carried several steps hanging to the dead one.

A number of dissections were made, but as the results do not differ materially from those already given they need not be here recorded in detail. They will be treated by Mr. Lucas in another connection.

#### PARTIAL COUNT OF LIVE PUPS.

On the way home an attempt was made to count the living pups on the Lagoon rookery. Mr. Macoun and Mr. Clark made the count of live pups while Dr. Jordan counted the dead pups.

For a part of Lagoon rookery the count of live pups was easily made. But at the extreme end, where the harems spread over the entire width of the rookery, the count became difficult. Many of the pups also were in the water on the lagoon side. As it seemed impossible to make an accurate count of the remaining pups, the work was abandoned until another time. On footing up the pods of pups counted, however, several hundred more live pups were found to have been counted than there were cows on the entire rookery in the height of the season. Mr. Clark's count was over 1,600, while the whole number of cows on Lagoon rookery was only 1,474. This state of affairs raises an interesting problem and makes it necessary to count the live pups, for they are evidently largely in excess of the apparent number of cows.

#### LAGOON DEAD PUPS.

Seventy-eight dead pups were found on the lagoon, 4 dead cows, and 2 dead bulls.

One cow was seen with two bloody spots on her neck from which blood was dripping. She was either shot or speared. She had just given birth to a pup, which was doing well; the youngest of the season so far. About half of the dead pups on the Lagoon rookery are wedged in among the rocks below the level of the surf. Many of them are fresh looking, as if they had been drowned in the high surf of a few days ago. The usual number of pups beginning to starve were seen here. A small percentage of the dead had probably starved.

The Lagoon rookery is located on a spit formed of rounded bowlders thrown up by the surf, or more likely pushed up by ice floes. It presents a hard ground for either seals or man to move about on as the bowlders are very irregular. The death rate on the rookery is extremely small, though it is exposed to the full force of the surf, and landing when the water is high must be fraught with danger. The small number of dead shows clearly that the number of drowned pups is small.

## DISSECTIONS.

Two pups supposed to have been drowned were brought home to be examined. Mr. Lucas reports no evidence of drowning.

The following is the record of the dissections:

Male pup, fat; extravasations over neck and chest in subcutaneous district. Lungs highly congested; hard, containing much blood. Serous fluid in thorax; right side of heart much distended with blood clots.

Female pup, very thin; lungs flaccid, congested; kidneys also congested; subcutaneous tissue congested over back and side of thorax. Black slime in rectum.

## AUGUST 13.

The count of dead pups on Gorbatch was made by Dr. Jordan, assisted by Mr. Macoun. Mr. Lucas dissected such dead pups as were fresh enough for examination.

## GORBATCH DEAD PUPS.

The northern end of Gorbatch, beginning below Zoltoi to the green cliff, has 426 dead pups. Here there are four small death traps, the one opposite the first bight being a space covered with flat stones offering no protection. The next, very bad, is a sandy district at the end of the cliff's right under the high pinnacle with the small concavity adjoining it.<sup>1</sup> Another bad place lies behind and abutting the last green cliff. All spaces in which seals are massed are dangerous to pups, whether covered with sand, hard earth, or rounded rocks. They are only safe when the bowlders are large and angular. The rocks here are hard and worn as slippery as glass.

Along the rocky edge of Gorbatch, at the foot of the smooth cinder slope between the last green rock and the hair-seal point, are 232 dead pups. South of this point to the end there are 54. This region is largely composed of coarse columns flattened at the top with a high cinder slope, containing some very steep slides, along which a seal that has occasion to go down is likely to slide from top to bottom. All these parts are densely occupied, the number of bad places being exceedingly small. This tract, covering one-fourth of the whole rookery, has but about one-fifteenth of the dead pups.

On the very steep slide at the south end, in which numbers of seals are coming and going, there are numerous large pods of pups, but only 2 dead ones were found. When the seals are frightened they rush for this slide, and are often piled up in a congested mass at the bottom, but they work their way out, because they can not be jammed against rocks. On the rocky columns near by the pups leap from rock to rock and tumble down, bounding like rubber balls. When they get fastened in a crevice they extricated themselves as readily as a cat would.

<sup>1</sup>These sandy spaces were in 1897 found to be infested with *Uncinaria*.

In the large pods on the cinder slope scarcely any dead pups were found. The process of podding is evidently one of the most efficient means for their protection. These slopes have practically no dead pups, which shows how much safer a steep incline is than one less steep or almost flat, as at Tolstoi and Polovina.

A number of pollock bones were found on the rookery; evidently either spewed up or passed off as excrement by some seal.

There were 5 dead cows and 1 dead bull on Gorbatch rookery. The total number of dead pups was 712.

#### GENERAL NOTES.

The yearling females are now found going about on the rookeries wherever they please in the harems, playing with the pups, with half bulls, with the bachelors; they seem to be privileged characters, are not molested, and behave very much like pups. The pups are now largely shedding their hair. Many have large brown patches where the black hair has fallen out, showing the brown under fur.

From examining a number of pups with reference to sex it seems that the brown belly is not, as suggested, peculiar to the female. Those with the brown bellies seem simply to be older ones that have begun to replace their black coat with brown ones, the brown showing first on the under parts. The next long hairs that come out are grayish. At present the long hairs are black.

There seem to be very few wet cows coming in. A number, not more than one-fifth, old cows are on the rookeries. The existing harems are largely made up of virgin 2-year-olds. Virgin 2-year-olds which were served early are now scattered about among the bachelors.

While at the beginning of the season many harems of 40 or more cows were counted, these early began to diminish and the smaller ones to increase; cows would run away or be stolen. It is probable therefore that the number of cows impregnated by one bull does not exceed on an average 25 cows, but no exact data is at hand as to this. The largest harems to be seen at this time on the rookeries belong to the bulls which were idle at the height of the season. These idle bulls and many half bulls have invaded the rookeries and have taken places in the harems where the old bulls once stood. There are a few old cows in their harems, as the pups with them show, but the majority are virgins which have lately come upon the rookeries.

#### DEAD PUPS.

The autopsies of dead pups which have been made within the past few days represent very well the relative value of the different causes of death for those pups which die within the first ten days of August. It must be remembered, however, that the vast majority, say from 95 to 98 per cent, of those now counted as dead perished early in July. The greater part of them are rotten to-day. When they were fresh enough for examination, it was impossible to get on the rookeries to reach them. The first ones examined had to be drawn out from the harems by means of a long pole with a fishhook attached to the end.

A certain small percentage die in July of starvation either through straying off or from losing connection with their mothers in some way. There have been found from 5 to 20 dead cows on each rookery. The pups of these, if born, would naturally starve. Pups are only now beginning to starve to death in noticeable numbers.



In the enumeration of Gorbateh rookery 712 dead pups were found. Of these all which were not too rotten to handle were dissected. Eight were so examined. Probably not more than 15 dead pups in fresh condition were to be found, about 2.9 per cent of the dead pups on the rookery. I doubt if the percentage of deaths within ten days on any of the rookeries would exceed this.

A growing percentage of pups are now showing signs of starving and in their case the cause is probably pelagic sealing. Within a few days many will die from this cause, provided they are not trodden upon by some bull and killed before starvation has run its course.

#### MR. LUCAS'S NOTES.

The black, tarry feces in emaciated pups is probably due to bile, as it is present in all very much emaciated animals. In starving, suffocated pups, the lungs are deeply and darkly congested; the liver is small, thin, and dark; more or less thick tarry matter in the intestines, in one case much of it formed in the stomach.

#### AUGUST 14.

Dr. Jordan, Professor Thompson, Mr. Macoun, Mr. Lucas, and Mr. Clark went to Zapadni to complete the count of dead pups.

Mr. Clark was left off at Zapadni Reef for the purpose of making, if possible, a count of the live pups there, and also a count of the dead ones. A very accurate count of cows was made on this rookery in the breeding season.

#### LIVE PUPS ON ZAPADNI REEF.

The count of live pups was made by breaking up the narrow line in pods of 100 or less and making them run back along the beach until a count could be made. This rookery is a very narrow one, and as a high surf was running the pups could not take to the water. By shifting the whole rookery about 200 feet in the direction of Little Zapadni it was possible to make each pod pass over a space sufficient to insure a reasonably accurate count.

There was found a total of 3,758 live pups, to which must be added 104 dead ones, making a total of 3,862 pups born on this rookery. The total number of cows counted here was 2,256. The count, while not absolutely accurate, is very nearly so.

Zapadni Reef, like the Lagoon, is an unprotected reef facing on the bay, and receives the full force of the surf. The pups here were quite expert, and went boldly out into the breakers when hard pressed. The surf was running high and toward the end of the count a number of pods took the water, swimming out and down toward the foot of the bay. Oftentimes the little fellows were caught on the crest of a breaker and landed high and dry on the rocks. They lighted like cats, always right side up, and immediately put out to sea again. Sometimes they would attempt, as the older seals do, to dive under the crest of a wave, but were not so well able to time their movements and were more often carried back. None were seen to be hurt.

#### DEAD PUPS.

After the count of living pups the rookery was again gone over and counted for dead pups. One hundred and four were found on Zapadni Reef, the whole space

being admirably adapted for rookery purposes, covered as it is by large bowlders like the lagoon. One dead bull, 5 dead cows, and 1 yearling holostiak were also found on this rookery. One of the cows and the holostiak were fresh, and the skins were taken for museum purposes.

The dead cow contained a full-time fetus, evidently all right. It was saved and brought home for data as to weight and measurement. The fetus was ready to be presented head first, contrary to the order of presentation in the birth witnessed on Ardiguen, where the hind flippers appeared first and the head last. It is to be noted that here is a pup still unborn, showing that the limit of births extends late into August.

The lungs of the cow were found to be badly congested. She might have been roughly handled by a bull. No other cause of death seemed apparent.

The holostiak showed a crushed skull; evidently from a blow on the head. There was also considerable congestion on the back of the neck and shoulders. Might have been the result of a blow at a killing, but as no killings from this region have been made since July 27, and as the animal must have died within a few hours, this can not have been the cause.

As a rule no worms are found in the stomachs of the pups dissected. A few were found in the small intestine of a starved pup. They probably do not get them until they begin to eat fish.

#### PROPORTION OF PUPS TO COWS.

A count of pups at Zapadni Reef confirms what we were led to expect from the count on Lagoon. It is significant as showing that through the coming and going of cows on the rookery, it happens that at no one time can all the cows be found, or even much more than one-half of them. The counts, therefore, on which the census of the rookeries has been based are not true to the facts. They can, however, be corrected if we can ascertain the proportion between the cows actually present and the pups born. It will be necessary to count Kitovi and other places to determine and verify this excess of living pups, and, if possible, to form a new basis of enumeration. This discovery necessarily affects the estimate of True and Townsend for last season, which was based upon the supposition that all the cows were present when it was made in July.

#### LITTLE ZAPADNI ROOKERY.

The count of dead pups on Zapadni and Little Zapadni was made by Dr. Jordan and Mr. Macoun, Professor Thompson and Mr. Lucas, dissecting such as were fresh.

Little Zapadni is a steep hillside covered with coarse angular bowlders. Among the large rocks are many depressions full of rainwater, and excessively filthy from the excrement of the seals.

This rookery has very few dead pups. Of all the rookeries on the island it is the most difficult for a man to walk over. The total number of dead pups was 134; there were 6 dead cows. A living cow was seen which had been severely wounded on the back. The wound was beginning to heal. A yearling female was noticed playing with the pups much as a girl would play with dolls.

Eighteen dead pups were found on the sandy beach between Little Zapadni and Zapadni proper.

## ZAPADNI ROOKERY.

The count of Zapadni was made beginning at the north end, just beyond the sand beach. At the very beginning of the rookery there is a level sandy place with only small stones scattered over it. In this patch were found 4 dead cows, 1 dead hair seal, and 135 dead pups. Considering the size of the place, this is a high death rate.

The next patch, also extremely bad, lies in a sort of gully. It is a regular death trap. There were in it 352 dead pups and 2 dead cows. This is a long concave depression, like the bed of a stream, with a thick mass of seals over its bottom and massed on the low stony hills on either side in the breeding season. On the round stony hill between this mass and the next were found 153 dead pups.

## ZAPADNI GULLY.

Next comes the so-called Zapadni "gully," the most effective death trap of its size for pups on the island. This is a long winding depression, 1 or 2 rods in width, broadening at intervals and narrowest at the lowest part just before it spreads out into the broad sandy flat which lies above the round bowlders of the beach. All parts of the gully were filled with dead pups, but particularly the part just above the wall of green rocks which bounds it on the south. Very many dead pups were also found on the bowlders at the water's edge.

In this depression, at the height of the breeding season, much fighting was seen among the bulls, and there is no protection for the pups and nothing to impede the movements of the fighting bulls. Besides this, bands of roving bachelors came down the runway at the upper end of the gully and passed through the harems to the water below. In the breeding season the entrance of a half bull in this gully was the signal for a general fight until he was thrown out at the lower end. The bachelors are tempted to use this runway because it is smoother than the ordinary way over the rocks. The gully and the sandy beach below contained 663 dead pups.

On the rocks below this gully a cow had just given birth to a pup. She seemed greatly distressed over the disturbance. All the other cows in the harem left her to go in the water. She remained, however, by her pup, as newly made mothers have frequently been seen to do. Those with older pups run away, leaving them to take care of themselves. Even the young bull in the harem to which the cow belonged has left his post.

A pup was seen to approach a little pool of rain water and sip it, as though drinking. Whether he really drank any or not was impossible to determine.

South of this gully is a parapet of rocks covered with green sedge. On the hill behind this there were 35 dead pups. The ground is but scantily covered in the breeding season.

Very few fresh pups are seen except on the rocks at the water's edge. Some of these are starved, occasionally one apparently drowned.

Next comes a rocky beach that extends some distance along the shore, having 292 dead pups and 1 dead bull. Another broad beach extends back on the sandy ground, but has no runway for bachelors through it. It has 184 dead pups and 1 dead cow.

Then comes a break in the rookery, which serves as a runway to the hauling ground near its middle. This is followed by a long beach extending backward at intervals in sandy flats and having some bad ground, on which are 290 dead pups, 7 dead cows, and 2 dead bulls.

The next large patch extends back along the rocks for some distance and is extremely fatal in its lower part, where the level ground adjoins the rocky beach. It has 448 dead pups and 1 dead bull.

From this point to the south end of the rookery the cliffs are composed of large columns and great rocks, on which there are very few dead. On the rocky portion, which includes the whole south end, there were 155 dead pups.

Above the cliffs on the flatter rocks and more level districts there are 388. Flats with sandy tracts abound in this region, and in them the mortality is greatest. There are 2 dead cows and 2 dead bulls.

Two cases of copulation were noted. One young bull with a 2-year-old cow seemed very awkward, but eager. One bull entirely blind was noticed. He seems pitifully helpless, groaning and snorting at the disturbance, but without being able to see what was going on about him.

## SUMMARY OF DEAD PUPS.

ST. PAUL.	
Kitovi.....	109
Lagoon.....	78
Lukanin.....	205
Tolstoi.....	1,895
Zapadni.....	3,095
Little Zapadni.....	131
Zapadni Reef.....	104
Gorbatch.....	712
Ardiguen.....	2
Reef.....	950
Sivutch Rock.....	50
Polovina.....	635
Little Polovina.....	47
Vostochni.....	1,808
Morjovi.....	485
Total.....	10,309

About 2,500 pups have been crushed by bulls on Tolstoi sands and the two northernmost gullies of Zapadni. Of these certainly 1,500 each year could be saved if the spaces in question were covered with rocks. The mortality must have been greater when the great masses of seals of early days were on the rookeries. It is not too much to say that 100,000 pups have been needlessly trampled to death in these places since the United States assumed control of the island. The vast importance of the seal rookeries would justify the going over the rookeries each year in a careful inspection and putting each one of the death traps in the best possible order.

There are as many pups on Little Zapadni, Zapadni Reef, and the rocky slopes as on Tolstoi sands, and the mortality on these Zapadni rookeries reaches a total of only 238, while on Tolstoi sands there are 1,495—over six times as many.

## RECORD OF DISSECTION MADE ON ZAPADNI ROOKERY BY MR. LUCAS, ASSISTED BY PROFESSOR THOMPSON.

In the first five of the following cases examination was not made, the cause of death being obvious:

1. A pup crushed under a rock.



2. A crushed pup greatly emaciated.
3. A crushed pup in good condition, jammed in rocks.
4. One young pup; thin; left eye sore.
5. A recently dead pup; eye picked out; bleeding at nose; too dirty to be handled.
6. Male; emaciated; found washed up on the beach; no food in stomach, which contained water; trachea full of foam; liver shows emaciation; also black matter in stomach and intestines. that in stomach probably due to regurgitation; drowned.

NOTE.—After exposure to air the lungs fill and turn red. There is none of the deep congestion found in starved and trampled pups.

7. Female, large, fat; found at high-water mark; contusion on back and left side; watery fluid in abdominal cavity; foamy mucus in trachea; lungs congested; normal feces; normal viscera; liver normal; stomach distended with air; injuries and drowning.

8. Female, fair condition; found on sandy spot; recently dead; lungs congested, flat, no air; stomach empty; viscera normal, also heart; no contusion visible except over left frontal, slight; apparently drowned.

9. Male, large, fat, recently dead; left lung congested; right lung not congested, but does not crepitate; stomach full of milk; liver, intestines, and kidneys healthy.

10. Male, large, good condition; blood about normal; left eye gone, orbit inflamed; no contusion visible on body or head; lungs healthy; stomach distended with milk; viscera normal; no visible cause of death.

11. Male, fat, large; found on sand; blood fluid; lungs congested, solid, hard, leathery, incompressible; liver much congested; kidneys somewhat congested; stomach full of air.

12. Female, fat; stomach full of milk; organs in good condition except right lung, which is congested; found on sand among rocks; probably crushed.

13. Male pup, fair condition; a bad bruise on abdomen, near rump; testicles squeezed out; died slowly; found where he probably fell from the rocks above; lungs congested, the left flattened; stomach empty; bruises caused by fall.

14. Female, fat; lungs watery, flabby; right lung slightly congested; stomach full of milk; somewhat bruised about chest; some little time dead, but quite fresh; spleen slightly bruised; ventricles very much clotted; bruise on right side of frontal region; probably bruised by surf and drowned.

A pup with a suppurating eye killed at Zapadni was brought home. On examination the eye was found to be injured by a bite or possibly by the peck of a gull. A slight contusion above the orbit. The eye was cut out and saved in formalin. The pup was killed by being strangled and being knelt upon; it took between three and five minutes to kill him. The lungs showed congestion as in other pups examined. No sign of external contusions were found.

#### MR. LUCAS'S NOTES.

Most of the dead pups counted have been long dead; recent ones very few. Two freshly drowned pups were found on Southwest Bay sand beach, but the total number drowned is small. Many of the drowned pups are emaciated and would have died anyhow. Starving pups once washed off the rocks would be less able to get back than healthy ones.

Gulls pick out the eyes of pups, or at least of many pups, soon after they die, but I am in doubt as to whether they pick out the eyes of living pups, much less kill them. In the case of very young pups this might be possible were it not for the fact that when the pups are young the harems are full and the mothers of the pups near them. The mere presence of the mother is a source of protection, though as a rule the female seems very indifferent to its offspring.

## COLONEL MURRAY'S COUNT.

Colonel Murray reports the following completed count of harem and idle bulls for the rookeries of the two islands:

Date.	Rookery.	Harems.	Idle bulls.
ST. PAUL.			
July 18	Northeast Point .....	1,595	1,095
15	Halfway Point <sup>1</sup> .....	285	254
13	Lukanin .....	205	125
13	Kitovi .....	190	100
14	Reef <sup>2</sup> .....	900	411
22	Lagoon .....	115	40
16	Tolstoj .....	325	220
16	English Bay <sup>3</sup> .....	100	111
16	Zapadni .....	477	310
	Total .....	4,192	2,666
ST. GEORGE.			
July 29 <sup>4</sup>	East .....	179	55
30	Staraya Artel .....	75	75
30	North .....	225	110
Aug. 1	Zapadni .....	182	100
	Total, St. George .....	661	330
	Total, St. Paul .....	4,192	2,666
	Grand total, 1896 .....	4,853	2,996
	Grand total, 1895 .....	5,000	2,800
	Decrease .....	147	
	Increase .....		196

<sup>1</sup> Polovina and Little Polovina.

<sup>2</sup> This includes Gorbatch and Reef rookeries.

<sup>3</sup> The breeding ground we have designated Zapadni Reef. The discrepancy here between Colonel Murray's count and that of Dr. Jordan (176), is so great as to suggest that the former count, made from the shore in the rear, is not so accurate as the latter, made from a boat in front.

<sup>4</sup> From the results of the investigations of 1897 we are led to doubt the value of counts of harems made after the 25th of July.

## AUGUST 15.

## COUNT OF LIVE PUPS.

Dr. Jordan and Mr. Clark made a count of the live pups on Kitovi rookery. The method employed was to cut off a pod of about 100 pups or less and run them off from the main body until they were strung out in a narrow line that could be counted. As soon as one pod was counted a second was run off, and this process repeated until the whole rookery was covered. The pups would ordinarily have taken to the water, but a tremendous surf was running directly against the rookery front, preventing their doing so. The result of the count can not be more than a hundred out of the way, and is, if anything, an underestimate.

Beginning at the south end of the rookery to Kitovi Point there were 649 pups. To the grassy wall of cliffs at the middle of Kitovi there were 2,244. To the great green cliff, 922. To the beginning of the great amphitheater, 1,049. To the end of

Kitovi, 1,076. The total of live pups for Kitovi is 5,940. To this should be added 109 dead pups to find the total births (6,049) of this rookery for the season of 1896. The cows counted on Kitovi in the height of the breeding season numbered 3,152.

A cow with one hind flipper bitten off squarely at the angle of the body was seen. The sore was fresh; otherwise she was all right.

One pup jumped off a rock 6 feet high, lighting on his nose on a sharp stone. He seemed surprised, but went off as if unhurt. Two pups leaped off in very high surf. Failed to appear anywhere. When last seen one had its mouth open panting. Probably both drowned. One very large cow was noticed. She weighed probably 100 pounds, and had white whiskers.

Many of the pups were so full of milk that they could hardly waddle. They often voided excrement when hurried. Some of the cows are looking fat, as if well fed.

#### STARVING PUPS.

The presence of starving pups is evident, some staggering along in the rear of every pod driven off. When mixed up with the general herd of pups they are not so conspicuous as when an effort is made to drive them. Then the starvelings fall behind. Some of these seem less emaciated than the one we have at the house for experiment; but they will all die within a few days. They are undoubtedly chargeable to pelagic sealing. Evidently many pups will die from this cause on Kitovi within the next week. Probably those to die first are younger ones whose mothers had been at sea some time before they were caught by the sealers.

Even a small rookery like Kitovi seems like a great city when you try to count the pups.

#### PROPORTION OF COWS AND PUPS.

It is certain from the count of live pups that only about half of the females who breed are on the rookeries at any one time from the beginning to the end of the season. There are probably more on the rookeries at the height of the season than at any other time, but there is no time when all, or anywhere near all, the cows are present at one time. Probably no cow leaves until after she is impregnated. Then the older cows doubtless take to the sea and the rookery spreads; that is to say, extends backward through the incoming of the fresh cows, who give birth to their pups in the new harems formed around the idle bulls at the back of the former rookery line.

The virgins come in also and fall in with the idle bulls, so that very few, if any, bulls in the course of the season fail to get some cows. As a rule, each cow remains in the harem where her pup is born, although the form of the harem and its discipline relaxes as the season advances. By the middle of August the cows move about much as they please. But while a cow often follows her pup, still oftener does she call and wait for it to come to her. By the middle of August the pups know the whole rookery and can find their way anywhere. They can then be driven in pods and handled just as bachelor seals are.

The error made by all observers from the first has been that they supposed that there was a time of greatest density and compactness and that at this time virtually

all the females were present. The partial failure of previous observers to appreciate the real situation has been due mainly to the fact that they could not go near enough to what they were observing or could not kill specimens to verify their observations. The absurd notion that the rookeries had to be left severely alone has left their condition a matter largely of conjecture.

The failure to appreciate the true condition of the fur-seal herd which the count of live pups and of dead ones shows emphasizes as nothing else can the need of careful and systematic study of the fur-seal herd. There should be a competent naturalist who understands the breeding habits of animals. He should have the power to control the interests of the herd, and every facility should be afforded for carrying out his plans.

Mr. Lucas visited Gorbatch this afternoon and dissected a dead female, preserving the fetus for study in dentition.

A middle-aged female found to-day on Gorbatch. She had an old wound from bite on the rump. The cause of death was probably wrong presentation of fetus, the back of the head being presented toward vagina and wedged in pelvis. Contusion on head.

At noon the *Corwin* came to anchor off Lukanin Bay and sent a boat ashore. It was decided that Mr. Lucas and Mr. Macoun should go to St. George Island to make a count of the trampled pups there, and accordingly they went on board in the evening for an early start in the morning.

Early in the afternoon H. M. steamers *Satellite* and *Icarus* came to anchor off East Landing. The *Satellite* called for the purpose of taking Professor Thompson to the Commander Islands. Dr. Jordan decides to accept the invitation of Professor Thompson to accompany him.

#### THE EXPERIMENTAL PUP.

Kotik, the starveling, died to-day. His end seemed near, but was not expected for a day or two. No one saw him die. He was found prone on his belly, his mouth wide open and pressed on the ground. He probably died gasping, as the starving pups on the rookeries were seen to do. Evidently the final breaking down comes quickly. He weighed exactly 9 pounds when dead. His external appearance did not give evidence of so great emaciation as the starved pups on the rookeries, probably because he has not been trampled over by other seals. Perhaps his confinement has hastened his end somewhat. He has been kept in a large box having the top and bottom open, so that he rested on the ground and was exposed to the weather. Mr. Lucas took Kotik on board the *Corwin* with him to dissect on the way over to St. George.

#### ARDIGUEN.

Mr. Lucas reports one harem in the slide to contain 50 females. Two new harems, presided over by 5-year-old bulls, have been formed. The bull in charge of the large harem, an old one, is as active as ever.

#### AUGUST 16.

At 9 o'clock Professor Thompson and Dr. Jordan went on board the *Satellite*, and at noon the ship sailed for the Commander Islands. It is expected to return by the



first week in September, and to bring back Mr. G. E. H. Barrett-Hamilton, a member of the British commission now on the Commander Islands.

MR. LUCAS'S NOTES.

I counted dead pups on north rookery of St. George, finding 259. The eastern part of the rookery is composed of large, angular boulders, narrow, and as a whole good; no death traps anywhere.

Recently dead pups are few, only 1 fresh one secured; 9 were dead on the bluff slope where the harem of 135 was. Emaciated pups are also few here, and there is a greater proportion of plump and well-nourished pups. Among the dead pups was found a prematurely born pup about a foot long and weighing about 3 pounds. One cow seen with broken right foreleg; is so badly injured as to be scarcely able to move over rocks. On the rookery traces (eyes and beaks) of squid were seen which were apparently vomited up by a seal. The condition of these spewings indicates how rapidly a cow may return from the feeding ground.

AUGUST 17.

In the afternoon Mr. Townsend and Mr. Clark went out to the lagoon to experiment on the feasibility of herding seals there. The native chief, under Mr. Crowley's orders, sent half a dozen men to drive a pod of seals from Lukanin.

HERDING OF SEALS.

A boat was rowed up the channel to shut off the outlet. A count of the seals was made as they were turned into the lagoon in small pods at the upper end. The drove numbered 950.

The seals during the counting showed all the symptoms of fatigue which they manifested after the drive and at the killing grounds, though the drive was made but a short distance from Lukanin to the head of the lagoon over a grassy slope wet with rain. The fatigue seemed only temporary. The animals get tired very quickly and recover as quickly. None were injured. When the seals entered the lagoon they quickly spread over its entire surface, and in a few minutes a large number were trying to cross the rocky ridge at the Tolstoi end of the lagoon. This is the point at which the seals released from the drives at Ice House Lake make their way to the sea. They act as if the way was familiar to them. It is strange that seals from Lukanin should do this, as they are never turned into the lagoon from their regular drives.

The tide had begun to fall and the seals began to follow the current out of the channel. Many of the seals, of course, showed no disposition to escape, and spread out over the lagoon enjoying themselves, as they usually do before the rookeries.

One man found no difficulty in guarding the passageway across the Lagoon reef, as the seals necessarily go slowly on land. The seals are said to attempt to get to the sea by way of Tolstoi when held in the lagoon, probably because they can hear the roar of the surf from this direction.

Mr. Crowley says that 400 or 500 seals turned off from one of the drives last season for some reason did not leave the lagoon, but stayed there three or four weeks swimming about in the water and hauling out occasionally on the sand beach at the upper end.

The tide began to rise, and it was more difficult to keep the seals from escaping by way of the channel; 75 or 100 of them kept constantly approaching the boat, which was held in mid-channel by an oarsman. When within a hundred feet they could be turned easily by a shout or by holding up an oar. The seals turned about and swam back 400 or 500 yards, but returned persistently. In trying to land Mr. Clark and Mr. Townsend on opposite sides of the channel several bands of 25 or 30 escaped before the boat could get back into mid-channel. No amount of yelling on one bank would turn them if both were not guarded, as they would simply keep close to the other bank.

Two boats with a man in each, however, could keep the channel against any number of seals, and a paling put across would make it impossible for them to get by. With one man at the angle of the bluff and a man every quarter of a mile along the shore of the lagoon the seals could be kept indefinitely in the lagoon.

In the evening the seals were found scattered over the entire upper surface of the lagoon. A large number were bunched at the foot near the channel. None had attempted to withdraw by way of Tolstoi or Lukamin.

The storm increased all the afternoon, and blew across the marshy ground over the channel in such a way as to make it extremely uncomfortable maintaining the guard there. At 7 o'clock, therefore, it was decided to release the seals for the present. After the departure of the company's steamer another trial will be made. There seems no doubt that 20,000 seals could be guarded in this lagoon if necessary. If the lagoon were fenced, of course there would be no question.

If seals can be kept in the lagoon, it will be possible the last week in August to drive the bachelor seals on the hauling grounds into the lagoon and keep them there until September 1. This would effectually keep them out of the way of pelagic sealers, thus reducing the pelagic catch.

A more important bearing of this experiment, however, is that if it is possible to so keep the seals in this lagoon, the rejected ones from the drives can be kept from returning to the hauling grounds. This would save their being driven and redriven, thus reducing the labor of handling the seals on the killing fields.

#### MR. LUCAS'S NOTES.

At St. George 134 dead pups and 6 dead cows were counted on Staraya Artel.

The live pups could not be counted, as many were in the water and more were hidden among the rocks. Few emaciated pups are on this rookery, although some were seen.

One apparently gravid cow, large, heavy, and sluggish, was seen. Nearly all the cows were off the rookery, and a large proportion of pups were either in or by the water. It is a favorable rookery, except on the rather flat slope, where the death rate as compared with the number of cows counted is greater than on North rookery.

Mr. Macoun and Colonel Murray counted dead pups on Zapadni; 75 were on the hillside, 124 on beach—199 in all—and 2 dead cows.

In the afternoon I counted dead pups on Little East rookery with Mr. Judge. A count of living pups was also made and 1,319 found; this number, with the 31 dead ones, gave a total of 1,350 pups for the rookery. Only one of the dead pups was fresh. This one had died of starvation. There was 1 dead cow.

Mr. Macoun and Colonel Murray counted dead pups on Great East, finding in all 112 dead pups and 2 dead cows.

## AUGUST 18.

## HERDING SEALS.

An experiment was made this morning with a view to determining the effect on the temperature of the water in a pond or lake produced by herding a body of seals in it. Three hundred and fifty seals were driven from Lukanin, where 900 seals were driven from yesterday afternoon, and held four hours in the little pond beside Ice House Lake. The temperature of the pond before the seals were put in was 50° at the border and 1° lower in the middle. The pond is shallow, having an average depth of only 2½ feet. The seals were put in at 10.35. Below is a record of observations made with a common mercury thermometer:

Time.	Weather.	Air.	Pond temperature.	
			Border.	Middle.
		°		
10.30	Clear .....		50	49
10.45	Sunshine and light fog.....		50	.....
11	Light fog.....	54	51	50
11.15	.....do .....	54	52	.....
11.30	Sunshine and fog .....		52	51
11.40	Sunshine and fog; light breeze..	52	52	.....
12	Fog and light breeze.....	54	53	52
12.15	.....do .....	52	52	52
12.30	Fog and breeze .....	53	53	52
12.45	.....do .....	52	52	52
1	Thick fog and light breeze.....	52	52	52
1.15	.....do .....	52	52	52
1.30	Thick fog.....	49	52	.....
1.45	Light fog.....	50	53	.....
2	.....do .....	50	53	.....
2.15	Thick fog.....	47	53	.....
2.45	.....do .....	47	53	.....

On two occasions the temperature of a cove occupied by seals for half an hour was taken separately and found to be 1° higher than the open water. The temperature of Ice House Lake at 12.45 and 2.10 was 52°, the same as that of the pond in which the seals were. The last five observations were made by Mr. Clark; the others were made by Mr. Townsend. Mr. Clark's air temperatures were taken with the thermometer wet and in the wind; Mr. Townsend's were taken in the shelter of the long grass.

The pond adjacent to the one in which the seals were held and larger in extent did not show any remarkable difference of temperature. Both ponds were sheltered among the hills, and the gradual increase of temperature from 50° to 53° may have been due to the effects of the sun as noon was approached. The pond was about half an acre in extent. It is evident from this experiment that Webster Lake, Lake Anton, and certain of the ponds about Polovina could be utilized for holding the bachelors from these rookeries. The salt lagoon is conveniently located for all the rookeries of the southern end of the islands, and if need be those from Zapadni and Polovina could be driven there.

At 3 o'clock the seals were driven over and turned into the lagoon. They swam down through the length of the lagoon and crossed over the neck at the point which is the usual exit of the rejected seals turned out from the killings at Ice House Lake.

## TOLSTOI.

In the afternoon Tolstoi rookery was visited with a view to counting the live pups under the cliffs. Passing by the sandy tract, a bull and two cows were the only adult animals on the sand which would not give way. One of the cows was found to have a newly born pup still wet and unable to walk. The mother fondled over it and snapped viciously at two starved pups which were trying to nurse her. The bull seemed quite as fierce and dangerous as at the height of the season. They were not disturbed further.

Under Tolstoi cliffs 2,164 pups were counted. The water for a distance out was lined with pups swimming, mingled with holostiaki. No attempt was made to count them or any of the pups that took to the water during the count. There were probably 500 of them in the water. Another difficulty arose from the hiding of the pups in the caves and holes among the rocks. As many of these were counted as possible, but two hundred pups might easily have been overlooked in out of the way places. This is especially true of the part next the head, which is made up of great bowlders piled in confused heaps, in the angles and crevices of which the pups were thickly packed.

A large cream-colored albino cow with pink flippers and eyes was seen at Tolstoi Head. She was a fine-looking animal. Her presence was noted at the time of the count of the cows early in the season.

## ARDIGUEN.

In the course of the afternoon Mr. Crowley and Mr. Townsend counted pups on Ardignen. Cows were counted here on July 13 by Mr. Townsend and found to number 550. The number of live pups counted was 650. The pups were counted twice in an hour and a half, the second count tallying closely with the first. The first count was made from the overhanging bluffs; the second by passing through the rookery. Not more than 30 pups were in the heavy breakers along the shore.<sup>1</sup>

## AUGUST 19.

## THE COUNTING OF LIVE PUPS.

An attempt was made by Mr. Clark and Mr. Townsend, assisted by Judge Crowley and natives, to count the live pups on Gorbateh rookery, beginning at the north end. After counting for some distance it was found utterly impossible to manage the seals. In the first place the pups could not be kept from taking to the water, and once in it they either remained there or swam ahead if counted, and back if not counted. Then in every crevice in the rocks the little fellows would pile up on one another so that they could neither be got out nor counted. It even seemed that some of them would be smothered, so thickly were they packed in. The seals could not be worked off gradually, and either went in large bodies, trampling the pups, or else the pups accompanied them into the water.

<sup>1</sup> We can not help feeling that this count failed to get all the pups among the rocks. They certainly could not have been seen from the bank, and as the count on the rookery merely corroborated the one from above, it does not add strength to it. In 1897 this little rookery showed most decided shrinkage. Three harems, aggregating 78 cows, were wholly wanting, and yet a careful count of the live pups in August gave 736. We are therefore inclined to believe that Ardignen was underestimated in 1896.



It is evident that the counting of live pups is not practicable on the wide rookeries unless they can be driven out to a level place, and this is not possible, except at considerable risk to the pups.

In two instances we were repeatedly driven off by female seals who seemed to have pups in pods which they were bound to defend. These mother seals could not be driven, and returned to the attack when hauled a considerable distance down the slope. Cows with newly born pups have been noted thus brave, but never those with older pups. No bull could have made more trouble than these cows did.

#### PROPORTION OF THE SEXES.

With a view of determining the proportion of the sexes, a number of pups on Gorbach rookery were examined. In the first lot of 136 pups, 70 were found to be females and 66 males. In the next lot of 79, 40 were found to be males, 39 females. In the next pod of 126, 80 were males and 46 females. Another lot of 63, 36 were males and 27 females. Another contained 24 males and 30 females. Thus out of a total of 458 pups, 246 were males and 212 females. The discrepancy arises in one pod of pups found in a cave, the great majority of which for some reason were males.

In examining these pups the question of the color of belly was kept in mind. It was found that both males and females had brown bellies, and vice versa. Nor did the brownness seem to have anything to do with size, the largest as well as the smallest pups having light bellies.

At least 20 starving pups were seen on Gorbach to-day in the small part of the rookery counted. Three of these pups were all but dead, wholly unable to move or get about. They were unconscious, and only a fitful jerky breathing told that life still lingered in them. Two others were dead, but still warm, and manifestly starved to death.

The pups examined as to sex were for the most part taken out from the little groups huddled in the crevices of the rocks. Where they were piled up still after half an hour the undermost ones were in a heated condition, as indicated by their flippers when handled. It would not do to try and count the living pups on these rocky rookeries.

#### ARDIGUEN.

At 4 o'clock the slide of Ardignen was visited. The place seemed practically deserted. Only one bull is at the head of the slide, probably B. There are no bulls at all on the main part. Six young bulls maintain position on the water's edge and are teasing 2-year-olds and passing cows. Apparently most of the cows are at sea. The pups are down on the rocks at the edge or in the water.

Pups are imitative little creatures. One slides down the incline of a smooth stone, lighting on his nose. Another came down and did exactly the same thing, following his example.

Two freshly dead starved pups are seen on the slide. A number of living pups show the effects of starvation.

Interesting to note the peculiar position in which the animals lie. A cow is lying on a rather steeply inclined rock with her head toward the top, her pup lying beside her in exactly the same position. Two cows are lying on flat stones with their heads hanging down over the side; apparently have no fear of a rush of blood to the head.

## COWS AND PUPS.

Cows are seen to recognize their pups. The cow seems to shake her head as she calls over her pup. The pup imitates her, and the recognition is considered mutual. The cow seems to assure herself by smelling. The pups know their mother's voice. Cows snap at strange pups, and the strange pup treats the cow with indifference when he knows she is not his mother. If the reception of a pup by its mother is not as cordial and definite as could be desired, there is nothing lacking in the vigor of the rejection of the strange pup.

The indifference and stupidity of the average seal is well shown by the case of the pup which just now has found its mother on a low stone in shallow water. She was apparently suited with the position, and does not intend to move, but the pup is in trouble. To get at the nipple it must stand on its hind flippers in the water, and every time the surf comes in is nearly swept away. Still the cow keeps her place, letting the pup work out the problem for itself. Presently the cow slips off the rock and swims out to sea. The pup follows hot after her. For some time the two can be distinguished, the pup swimming over and about the cow.

## MR. LUCAS'S NOTES.

At East rookery two recently dead starved pups were found. The pup starved on St. Paul as a chick died in fifteen days, so that these two can have died as a direct result of pelagic sealing. Naturally many of the females must have gone to sea before the 1st of August, so that their pups were without food for a week or more before pelagic sealing began.

From numerous observations it is apparent that cows when wet will allow pups to nurse. It is also apparent that the pup recognizes its mother's cry. The seal's sight is not very acute. While watching for sea lions three times it was necessary for me to frighten away cows which walked directly up to me, so close that two more steps would have brought them on me.

## SEA LIONS.

I killed a very old sea lion at St. George to-day. Sea lions hauled out 150 to 200 yards from where we were skinning their mate. They rub noses in the water. Females seem to have a peculiar movement of the head, moving it up and down, with a slight vibratory motion. This apparently means something to the pup. Sea lions are much more sociable and affectionate than seals; the pups accompany their mothers in swimming, and haul out beside them. Bulls, cows, and bachelors haul out on the same grounds, but the bachelors seem to keep more or less together, and are less suspicious. Where are the yearlings?

The peculiar chalky appearance of the excrement is probably due to the crabs on which the animals feed. It is believed that the sea lions feed near the shore, and food found in the stomach strengthens this.

Sea lions like to go in compact herds. They lie on one side with flippers out like humpback whales.

A pup rests on the shoulders of its mother in the water, and is carried some distance in this manner. No sea-lion pups are seen to nurse, and the mammary glands of the female killed indicate that the pups have been weaned.

Pups play together both on land and in the water. Some of them chase after a gull which lights near them. A sea-lion pup coughs up a pebble which flies a foot at least.

#### AUGUST 20.

Went with Mr. Townsend in the buckboard to Zapadni to photograph the death traps.

A sleeping pup on the sand flat of Zapadni Gully was found among the dead ones. Upon being awakened it went into spasms, rolling on its back and then on its sides, gasping, biting the ground, jerking with its flippers, its whole body convulsed. The hollow places over the shoulder blades, the well-defined ribs through the skin indicated that the pup was starving. It cried piteously all the time. After about three minutes it staggered to its feet and moved off across the sand flat, stumbling and falling prostrate every few steps. It will die perhaps in course of the day.

Many starving pups are to be seen to-day. Twenty-five are counted on and about the sandy flat at the foot of Zapadni Gully. All of these will die within a very few days.

#### POLOVINA ROOKERY.

After lunch we drove across the country from Zapadni to Polovina. Mr. Townsend counted the live pups under the cliffs of this rookery. He had counted the cows on this portion of the rookery in the height of the season.

A total of 2,445 live pups was found, and 51 dead pups were counted here on August 10, making a total of 2,496 pups for the season. The count of cows made on July 15 gave 1,268. The ratio of almost 2 to 1 cow holds as a general thing so far as the count of pups has been made.

The opportunities for a correct count on Polovina cliffs was good, it being possible for the greater part of the distance to count from above without disturbing the pups as they lay below. In only one place, where the harems extended above the edge of the cliff, was it possible to drive everything on to the flat above and then run them off in small pods.

There was an unusual number of holostiaki on Polovina. Mr. Townsend said that he had not seen so many in any one place for a number of years. They were mostly yearlings, 2-year-olds, and 3-year-olds. Very few old bulls or half bulls were among them. The line of the bachelors extends from the middle of the main part of the rookery, all along the edge of the cliff, to the little hauling ground at the head of Polovina cliffs. There seemed to be the usual number of seals in the water off the cliffs.

Many virgin cows were noted on Polovina and at Zapadni. On the dense portion of Zapadni rookery photographed were a large number of yearling females playing with the pups, one group of 4 being particularly conspicuous. There were pups in the pod bigger than the little yearlings. Of course the noses of the latter were sharper and the body a little longer and slimmer, but when they lay down in such a way as to hide the white belly they could scarcely be distinguished from the pups about them.

#### THE DEAD PUPS.

In going over Zapadni and Polovina rookeries to-day it becomes evident that it will not be possible to clearly distinguish between the pups to be counted in October

and those recently counted. Between those which died in July and those which died in September there will be a clear line of demarcation. But between those which died about August 1 and those which have died since August 15 no line can be drawn. There will therefore be a considerable area of confusion, which will widen as time goes on. It will not be wise to go over the rookeries to pick up the freshly dead ones, and in event of doing so it can not be certainly said whether the freshly dead ones have or have not died since the recent count. The only way is to count everything to be found on the rookeries after October 1, deducting from the number those already counted. This will give a result somewhat less than the facts, as some will undoubtedly disappear, but one which can not therefore be impeached, because it will necessarily be an underestimate.

Numerous instances of excrement on the rookeries and hauling grounds were seen on Zapadni and Polovina rookeries, voided both by pups and cows.

On Polovina an immense pod of 400 or 500 pups was rounded up on the level above and allowed to run off gradually, so that a count could be made. They acted just like a pod of grown seals would, only with worse effects on the pups. If they were in any way pressed they piled up on one another two and three deep. They sprawled about, panting from their exertions just like the older seals. Some of the pups that had lately nursed vomited up milk. Others, probably also with full stomachs, voided excrement. On the whole, it seems best not to try a count of the live pups except on the thinner and less densely populated rookery patches.

To date 102 dead pups, taken at random from the rookeries, have been dissected. Of this number 53 have been males, 49 females. The mortality would therefore seem to be evenly distributed between the sexes.

#### MR. LUCAS'S NOTES.

I found the pups going freely into the water on North rookery of St. George. It is wonderful what an amount of pounding in the surf they will stand and seem to enjoy. A pup was noticed at a distance from the rookery swimming across a cove a quarter of a mile away, the first seen to do anything of the kind.

The grass on the hauling ground is much worn by the trampling, and it is evident that wear and growth must both be rapid. The rookery is almost deserted, and there are about as many seals in the water in front as when we went through on Sunday.

Two recently dead starved pups were seen. It is evident that many starved pups will be washed away and never seen, as their instinct at this age, as well as their desire to find their mothers, will draw them toward the water.

Saw to-day a fresh placenta, which was not on the ground Sunday.

#### AUGUST 21.

Mr. Townsend and Mr. Clark went to Northeast Point to count the live pups on the patches in which the cows were counted on July 16 by Dr. Stejneger and Mr. Lucas.

#### MORJOVI.

Mr. Townsend took the east side of the point, beginning to the east of Webster House. In the first large patch, where Dr. Stejneger and Mr. Lucas counted 967 cows, Mr. Townsend found 1,524 pups on land. A large number were in the water which it



was impossible to count with accuracy. He estimated them at 200. On account of the rough character of the rookery bed it is altogether likely that the count is slightly below rather than above the actual figures. It is always difficult to count pups which are hidden in the crevices. Some are asleep and entirely out of sight.

On the lower side of Sea Lion Neck the count of cows was 87; there were 149 pups here. On the other side were two patches, in the first of which were 56 cows. In this patch there were 222 pups. The next patch contained 84 cows. There were 38 pups on land. Off shore from these two patches were about 40 pups swimming. These pups evidently belonged to both patches, and it is probable that the pups from both sides of the neck intermingle, so that some may have belonged to the other side. For 227 cows on Sea Lion Neck there were counted and estimated 449 living pups.

For a total of 1,194 cows counted, 2,173 living pups and 116 dead pups. The total of pups was therefore 2,289, which must be approximately the number of breeding cows frequenting these grounds during the season.

#### VOSTOCHNI.

Mr. Clark counted the live pups in the three patches in the west side of the point which had been counted. The first of these, in which 527 cows were counted, 904 pups were found; in the second, containing 1,366 cows, 3,058 pups were counted; in the third, containing 994 cows, 1,059 pups were counted.

There is then a total of 5,011 live pups for a total of 2,887 cows counted. For this same space and the intervening beaches 295 dead pups were counted, making a total of 5,306 pups.

A large number of the pups were in the water. An attempt was made to count these as they returned to shore, but it could not be accurately done.

The pups of the three patches had all united and a continuous band of the pups extended across the intervening sand beaches. The total of the pups, however, belonged to the three patches, as a considerable hauling ground lay between the last patch and the next one.

A cow with a white ("moon") eye was seen on this rookery. A bachelor was found among the stones in the runway leading to the hauling ground, down which a number of seals had passed. The animal was lying helpless and dazed. The eyes twitched and rolled, and the muscles could be seen twitching under the skin. The bachelor was rolled over and handled. It showed no trace of injury. It could not be induced to rise. On returning in half an hour it was gone.<sup>1</sup>

#### MR. LUCAS'S NOTES.

##### ARDIGUEN.

I returned to St. Paul and visited the slide, finding very many pups in the water. There are 2 freshly dead pups in the gully. Two old bulls are still on duty and a 5-year-old, which is very active and impressed with his own importance.

A number of cows quarrel among themselves and prevent another from climbing a rock. Pups very clearly recognize their mother's voice and distinguish it from

<sup>1</sup> Later, in counting the starved pups, several similar instances were noted. The animals seemed to fall in a helpless condition as the result of fright. They always recovered in a few minutes, and went off as if nothing had happened.

the call of other cows. The mothers seem to rely most on the sense of smell for their recognition.

An old bull is seen playing in the water among the other seals.  
Zoltoi bluffs are now very thinly populated.

#### ST. GEORGE DEAD PUPS.

The complete count of dead pups and cows on St. George is as follows:

Rookery.	Dead pups.	Dead cows.
North.....	259	7
Staraya Artel.....	135	6
Zapadni .....	199	2
Little East.....	31	1
Great East.....	112	2
Total .....	736	18

On Little East rookery 1,319 living pups were counted. The count of cows for this rookery in the height of the season was 355.<sup>1</sup>

#### AUGUST 22.

#### LAGOON PUPS.

A count of the pups on Lagoon rookery was made this morning at low tide. This rookery was carefully counted for cows in July and found to have 1,474. The number of living pups this morning was 2,406. There were 78 dead pups counted, making a total of 2,484 pups, and consequently an equal number of cows actually on the rookery. A number of starving pups were seen among the living ones, many of whom will die within a week.

In numerous places on the rookeries dripping blood marks are to be seen. This was noticed on Gorbateh, at Zapadni, Polovina Cliffs, and on the Lagoon this morning. It looks as though blood was dripping from freshly wounded seals. None seen in pools, but drop by drop over the stones as if left by the animal while moving.

It is getting late to count pups. They swim so freely and are so active that it is difficult to keep the count from getting confused. The pups had covered the entire width of the reef of Lagoon this morning and were going into the water on both sides. The entire forenoon was spent in the work and the result is fairly accurate, though not satisfactory.<sup>2</sup>

<sup>1</sup> It is now known that this early count was very inadequate, as the position from which the rookery was inspected left a large part of it concealed from view. In 1897 the rookery was more closely inspected in July and found to cover space which was not seen 1896.

<sup>2</sup> The fact that in 1897 with fewer harems and fewer cows this rookery showed more pups than in 1896 leads us to believe that in the latter year the count was an underestimate. For 1,474 cows in 1896 there were 2,484 pups; for 1,319 in 1897 there were 2,598. There were 5 less harems in 1896.

If we summarize these various counts of live pups we get the following results:

*Live-pup counts.*

Rookery.	Cows.	Pups.
Tolstoi Cliffs .....	1,498	2,664
Kitavi .....	3,152	6,049
Zapadni Reef .....	2,256	3,862
Lagoon .....	1,474	2,484
Polovina Cliffs .....	1,268	2,496
Northeast Point (west) .....	2,887	4,412
Northeast Point (east) .....	1,194	2,269
Total .....	13,829	24,256

It is evident, therefore, that a correction for the absent cows must be added to our former estimates of the rookeries. Taking the average of the total number of rookeries counted, this correction seems to be 75 per cent. With this data at hand we may complete our preliminary census, which is as follows:

*Census of breeding seals and young, 1896.<sup>1</sup>*

Rookery.	Harems.	Cows (count).	Actual total.
ST. PAUL.			
Kitovi .....	182	3,152	6,049
Lukanin .....	147	2,543	4,450
Lagoon .....	120	1,474	2,484
Tolstoi (main) .....	389	6,729	11,775
Tolstoi (cliffs) .....	108	1,498	2,664
Zapadni .....	583	10,085	17,648
Little Zapadni .....	210	2,400	4,200
Zapadni Reef .....	176	2,256	3,862
Gorbateh .....	302	5,224	9,142
Ardiguen .....	27	550	652
Reef .....	504	8,719	15,258
Sivutsh Rock .....	63	1,090	1,907
Polovina (main) .....	138	2,387	4,177
Polovina (cliffs) .....	86	1,268	2,496
Polovina (little) .....	45	779	1,363
Vostochni .....	975	15,879	27,148
Morjovi .....	293	4,328	7,773
Total .....	4,348	70,361	123,048
ST. GEORGE.			
North .....	225	3,891	6,809
Little East .....	44	761	1,350
East .....	135	2,385	4,086
Zapadni .....	182	3,148	5,509
Staraya Artel .....	75	1,297	2,269
Total .....	661	11,432	20,023
Grand total .....	5,009	81,793	143,071

Bobrovi (Otter Island) had 1 harem, containing 5 cows and 5 pups.

Where counts of live pups have been made these counts are used as they stand, the 75 per cent correction being only applied to rookeries not counted.

LUKANIN CLIFFS.

In the afternoon Mr. Clark visited Lukanin Cliffs. One case of attempted copulation between a young 5-year-old bull and a virgin 2 years old was seen. The young bull was awkward and was not successful during the half hour watched.

<sup>1</sup>For criticism and revision of this census, see census of 1897.

A cow was seen to come in out of the water with a gash across the top of her head as if clipped out by a glancing blow from an ax or knife. The wound was not fresh. It might have been made by a spear point.

Near the foot of an incline at the end of the cliff is a little pup, doubtless recently dead from starvation. Four other pups were seen in the course of half an hour to approach the little fellow and smell him over in a critical way.

#### COWS AND PUPS.

Wet cows were watched with reference to the recognition of pups. Nearly every one was followed for a few feet from the water by pups waiting there. The cows snapped and snarled at the pups. The pups kept at a safe distance.

One wet cow was seen to come up to the edge of the cliff, snapping at every pup in her way and calling all the time for her own pup. She followed along the cliff to its end, stopping at intervals and calling. No pup appeared, and going down to the water from the other end of the cliff she swam out to sea beyond the belt of swimming seals. Then she turned about, playing along in the water, rolling over and over, moving down toward the place where she first landed. She then came slowly toward the shore, but was lost when she came again into the belt of swimming seals.

Four cows were watched come in from the water and either pick up their pups or go to them. Two were seen followed from near the water's edge by pups which afterwards proved to be their own, though the cows apparently paid no attention to them until they reached their places under the cliffs. The little fellows trudged along behind, answering the mother's call. One of the cows routed out four pups sleeping on a flat stone, apparently that she might take their place. Her own pup came up and put its nose to her throat, calling and shaking its little head. She answered, also shaking her head.

Two cows were seen to make their way up the incline nearly to the top. Both were calling for their pups. Neither seemed for some time to attract attention. At last a little pup was seen to enter the bottom of the slide. It was wet and struggled up, calling in response. Though over a hundred feet below and scores of calling cows and pups between, it was plain that the pup knew its mother's voice and was following it. After much hinderance by quarrelsome pups and snarling cows, it at last reached the mother and was received with the usual tokens of recognition.

The other cow had gone in the meantime to the very uppermost edge of the slide. She sat for some time pruning herself, calling at intervals. No pup seemed to hear her. At last she started down through the sleeping pups to a stone and routed up a pup, who got up responding to the cry she made. She went back to the position she had first chosen, the pup following her.

Considering these cases one can not help believing that the pup recognizes its mother's voice and can follow it a considerable distance; that if the mother really wants her pup right away and it does not respond at once she hunts it up herself; otherwise she may wait.

#### MR. LUCAS'S NOTES.

I went with Mr. Townsend and Mr. Macoun to Polovina. A further examination of 186 pups was made with a view to determining the proportion of the sexes. Of these 89 proved to be males and 97 females.



A glance at this rookery, now that one can go over it, shows why so many dead pups have been reported here. The flat top of the hill is fairly strewn with dead pups in every stage of decomposition. Mr. Clark counted 584 dead pups here on August 10, where on July 23, Professor Thompson and myself saw only 8. At the latter date the dead pups were hidden by the living seals or lay where they could be approached. It is a very bad rookery, flat, with small bowlder area.

Live pups proved very strong and active when examined for sex. They snapped and snarled viciously. Mr. Townsend received one bite. I allowed one to bite my hat. The pup held it very firmly and shook it savagely.

#### AUGUST 23.

It rained all morning and most of the afternoon. The company's steamer *Homer* left for San Francisco, having at last discharged her cargo. Mr. Townsend sailed with her.

In the afternoon, Mr. Lucas visited Gorbach and the slide.

#### MR. LUCAS'S NOTES.

##### ARDIGUEN.

But 1 bull, the oldest (B), is left of the harems at the head of the slide. A light rain is falling, and this part of rookery is deserted. The cows call their pups, but do not always take care to select a good spot for nursing. One cow sits on the rock in water where the sea at times washes completely over the nursing pup.

The young bull at the head of the slide is gone. The old bull seems to pay court to but 1 cow, and that the 2-year old. In fact, the 2-year olds are almost the only cows now looked after.

From the way the pups play in and by the water it is more and more evident that we may get but a small proportion of starvelings: many will be drowned and, with others, may be washed away.

At the castle-like ledge of rocks midway in the parade ground there have been 300 or 400 bachelors hauled out for some days. To day they are gone, but a considerable area of the grass on the parade ground is brown with their tramping.

On the level along the crest of the slope are a number of groups of seals, evidently made up of holostiaki and cows, probably also yearlings and 2-year-old females. A number of pups are also to be seen in the groups.

#### AUGUST 24.

After breakfast a visit was paid to Lukanin Cliffs. The young bull and 2-year-old cow seen in copulation on Saturday, were in the same place. The bull has two or three other virgins and some old cows about him—a respectable harem.

Gulls were seen lighting at intervals in the rocky point below the cliffs on which a number of cows and pups were sleeping. The cows aroused and drove them off. On going down to see what the gulls were after, a space on the rocks about a foot square was found spattered over with half-digested fish remains vomited up by some seal. One of the cows had withdrawn, but the other maintained her position, and seemed bent upon driving me off. A quantity of the material was gathered up. The cow kept charging in vicious manner all the time. She could not be driven off at first,

but was finally induced to leave by throwing pebbles at her while hidden behind a stone. Throwing things at her while in view produced only the effect of adding to her rage. When out of sight she soon became frightened at the falling stones, the cause of which she could not see. The half digested flesh was washed out of a quantity of the spewings and the bones, worms, etc., preserved in formalin for future study. On a rock at a short distance more spewings were found.

#### AMPHITHEATER OF KITOVI.

Mr. Lucas, Mr. Macoun, and myself visited the Amphitheater at Kitovi. We went down the slope to the cliff overhanging the water and watched the pups and holostiaki swimming in the water. Some confusion was occasioned on our first approach, but after we were seated no attention was paid to us.

Out of six bulls watched with a glass 3 did not show any trace of testes; and yet one of the bulls whose testes did not show was particularly attentive to his cows. One very large bull showed no trace of testes in the scrotum. Mr. Lucas raises the question whether these testes are not drawn up as in some squirrels after the breeding season is over. Certainly the testes are not as a general thing so prominent as they were in July.<sup>1</sup>

Pups were apparently swimming for sport around the isolated rock in the bight. On the rock was a cow nursing her pup. There may have been a harem here in the breeding season. There are now a number of young females in charge of 2 young bulls, who are very active and attentive.

One little yearling, very distinctly marked, is playing in the water with the pups. She has a light ring about each eye and a light patch of peculiar shape on her throat which contrasts strikingly with her brown fur. She is evidently treated by the others as a pup. A holostiak catches her by the back as she attempts to climb on the rock and pulls her down into the water. A pebble dropped over the seal while swimming along under the water causes it to dart away instantly, like a fish. It then comes to the surface almost immediately, standing up in the water and looking curiously at the spot where the stone fell. It is evident that the seal's sense of hearing in the water is acute.

Many of the pups are diving for seaweed and playing with it. None are seen to eat. Mr. Macoun says that he does not now think that the pups eat seaweed, but he thinks that they eat the small crustaceans and tunicates which abound on the rocks. He noticed in the water close to the sporting pups 3 small blennoids (?) and numerous amphipods. A number of pups will be killed to settle this question of feeding.

The grace and dexterity displayed by the pups while swimming does not harmonize with statements of certain writers that they are the "pudgy," "clumsy," and "helpless" portion of the seal herd on the migrations, a prey of the enemies in the sea. With the practice which two months of swimming will give, the pups will be able to care for themselves. If they lack in any respect it will only be in endurance. They go through all the motions of the older seals and spend most of the time in the water. They are evidently in training for the coming long swim.

<sup>1</sup> See observations in the latter part of September, showing that whether the testes show or not depends upon the position in which the animal lies, the organs being under its control.

Mr. Lucas says: "Although I have seen many cows come out of the water to nurse their pups, I have never yet seen one in the water going out to sea or coming back. They are so erratic and indirect in their actions that I do not believe they ever go to or return from their feeding grounds direct. They stop by the way to play. No animals I have ever seen seem to enjoy the water so much as these."

When we went back up the slope the cows had closed in with their pups behind and some of them went literally head over heels in their efforts to get away.

One young bull, 4 years old, is playing old bull and dashing about after the cows, but does not keep them; tries first one then another. They pay little attention to him.

#### AUGUST 25.

##### MR. CLARK'S NOTES.

As the morning was clear and the sea fairly smooth, Judge Crowley and I with a boat's crew went to Otter Island, between 7 and 8 miles from St. Paul to the south, arriving at 10 o'clock.

##### OTTER ISLAND.

The landing on the island is difficult, being possible only in one spot on the north side. There is a small house going to ruin, formerly used by the guard stationed here to keep off raiders. Otter Island used to be a favorite spot for raids. The schooners could lie hidden on the southern side, sending their boats around to the landing in the fog. A schooner is said to have taken 1,500 skins here in one night. After the establishment of the 60-mile limit the guard was discontinued. The guard endeavored to drive the seals off and prevent their landing.

The central portion of the island is a level grassy plain sloping toward the north side. The south side is a rocky cliff sheer 50 or 60 feet, and at both ends of the island the ground rises in steep slopes which break off abruptly to the water below. The western end is the higher, recorded at 350 feet, and represents half a cinder cone. At the eastern end is a volcanic crater.

The surface of the central portion is like that of St. George, boulders covered with moss, rendering walking difficult.

On the northern side there is a slight depression containing a small quantity of rain water. At the eastern end is a great cave into which the water flows, and which swarms with sea birds. As the surf is breaking at the mouth of the cave exploration of it is not possible.

##### BLUE FOXES.

The island is marked in every direction by fox runways, some of them freshly used and with numerous eggshells lying along them. Only 2 foxes were seen, one white and the other blue. About the hole occupied by the white fox 12 puffins were counted; only the brains eaten out.

On the southern side of the island is a great semicircular gallery filled with screaming sea birds, and 2 or 3 outlying rocks are literally alive with gulls and aris.

It seems that the foxes on Otter Island do not do very well. Food becomes scarce, and they take to the ice in the winter and either get to the other islands or are lost at sea. Last year only 8 were found—all old fellows. They looked gaunt

and hungry, as though they had eaten up all the young ones and were pressed with hunger themselves. As the men spent a week in catching them, it may be suggested that the scarcity of foxes might be due to the fact that all were caught, or nearly all.

#### THE HAULING GROUND.

The hauling ground on the island is on the northern slope. It is of considerable extent and in early days a large number of bachelor seals frequented it. The efforts of the guard to break up the hauling ground by driving off the seals seem not to have produced the desired effect. The extensive yellow grass is here as conspicuous as on any of the hauling grounds of the other islands.

We found 219 seals, more or less—some of them got into the water before it was possible to count them. They were for the most part on the rocky reef that runs out toward St. Paul, a reef resembling the one at Polovina. Only 64 seals were hauled out on the grass above the bank. The hauling ground, as marked by the seal grass, is of considerable extent, though 2,000 to 5,000 seals could have denuded the whole territory, judging from the effect produced by the present small band.

Among the seals on the reef of rocks there were 1 fine-looking bull and 5 good-sized and healthy pups. The mothers were, of course, not distinguishable from the bachelors and escaped with them, leaving the pups behind. It is the first time in the memory of anyone on St. Paul that breeding seals have been found on Otter Island.

It will be interesting next year to see whether this harem is again to be found, and whether any additions looking toward the establishment of a rookery are made.

The question arises, with the 60-mile limit in force, why the seals should not be allowed to haul or even to have a rookery on this island. The reason assigned is that it is difficult to handle the seals there; but it would be no more difficult for a crew of men to go over to the island in boats and kill the seals there than to go to Zapadni. The skins are now brought by boat from Zapadni.

#### MR. LUCAS'S NOTES.

Observed a number of old males on Zoltoi for testes. In the larger old ones they show very plainly; in the young ones not so plainly. With the young bulls it seems largely a question of the position of the body; sometimes they show, sometimes they do not.

Old bulls are scattered about everywhere—on the bluffs, on the sands, by the landing, under the bluffs at this end of the Gorbateh, and in the little cove on the west side of Zoltoi.

The smaller bachelors have almost disappeared from among the bulls, which sleep in the sun and enjoy life, their favorite position being prone on the stomach, spread out as flat as possible.

The pups are beginning to straggle from the rookeries. Two are found under the bluffs a quarter of a mile from the Reef. Two more a little nearer; one runs up the rocks to escape; I find that he can run over the bowlders about as fast as I can.

#### ARDIGUEN.

At 4.30 I visit the slide. Seven wet cows are at top of gully; other cows are coming up; some call and the pups go to them. One cow starts across in the



direction of the Reef: 11 pups and two 2-year-olds join the party and all hurry along, the pups leading. Five more pups and a cow also start. Two pups have died since Sunday; two more weak ones are seen. A large number of small ones are in the slide; one is not over a week old.

## AUGUST 26.

## MR. CLARK'S NOTES.

Mr. Lucas and I went this afternoon to Lukanin and Kitovi rookeries.

The most striking thing about the rookeries to-day is the general air of restlessness among all classes of seals except a few sleepy old bulls. One can not show himself for an instant without starting the seals. Probably the clearness of the day has something to do with it. The bulls in the back part of the rookeries are all young fellows, 5 or 6 year olds. Along the water front are a number of good-sized bulls, with here and there a young one.

## LUKANIN.

On Lukanin the central space along the beach is entirely deserted. The cows and pups are either in the water and within a few feet of it or else far back in the slides and among the bowlders, where the idle bulls, now gone, held sway a week or more ago. The bachelors and cows mingle together on the edge of the hauling grounds.

From the appearance of Lukanin to-day one must believe that after all there is something in the "spreading" of the rookeries, but the real spreading occurs after all the old cows have arrived, had their pups, and been served. The harems, in so far as they can be called such, are composed of virgins, and may be located anywhere. These are very conspicuous about the rookeries. It does not seem at all necessary to suppose that any of them are impregnated in the water.

Among the bachelors on the slope of Lukanin cows may be seen nursing their pups, and pups are wandering everywhere. In the water they seem to have no limit to their range to-day. They can be seen more than halfway up the length of Lukanin sands.

Several wet cows are seen to come in and find their pups, apparently going directly to them. Three cows have come in and have been wandering about for half an hour without finding pups. This is not strange, for their pups may be swimming across the bight and halfway up to Stony Point.

One wet pup is seen coming up as if from the angle of the hauling ground. Looks as if it was taking a short cut home. Is 200 yards or more away, but coming straight for the angle of the foot of the cliff, following along the rear of the rookery. Stops and apparently picks up a pebble, swallowing it. Then it takes another and another. It throws back its head while swallowing. It resumes its way directly to the foot of the cliff. Calls about as if hunting for his mother. Goes up to a number of cows. Wanders off among the bachelors. Comes back: climbs up on a stone. Goes down to the water. Finds two other pups with whom he seems to be acquainted and stops to play with them. Does not leave the place within ten minutes, when we leave.

From the top of Lukanin Hill we look down on a lot of young bulls with virgin cows. Around are cows nursing their pups, and bachelors of all ages. On a stone

just below us are 2 young bachelors. They must be 4-year-olds. But they show the testes distinctly. They should have been killed this year: they will have wigs started by next season.

I agree with Mr. Lucas, on looking at these bachelors, that it is necessary to readjust our ideas of 4-year-olds. What we have called 4-year-olds are probably 5-year-olds.

#### SWIMMING PUPS.

As we come to the end of Kitovi we find that the pups are playing in large numbers in the kelp bed of the little bight. On the rocky reef that juts out here there are hundreds of them, and the water about is full. They can also be seen on the rocks and under the black bluffs above East Landing. Below this there are still pups. Going down to the beach we find them swimming in both directions in little bands of from 2 to 25. They stop at our feet and dive for kelp, bring it up in their mouths, snatching it from one another. One is seen to come up with a dead shell. You can hear his teeth rattle on it. He drops it three times and dives, recovering it each time.

Following down along the beach past East Landing, pups are seen at every point swimming both toward Kitovi and toward the Reef. A dozen or more, with some bachelors, are on the rock in the water off the village killing grounds. Bachelors, probably yearlings, are swimming in numbers with the pups. Do they set the example, which the pups follow, in going so far away?

Two of the pups are upon the rocks near East Landing, shaking themselves and playing in the sun. They take to the water and swim off.

At the ledge of lava rocks where the sand dunes begin are 250 or 300 bulls hauled out. Five pups are out with them. On approaching, the pups and a number of the bulls begin dropping from the ledge into the water. One half bull comes up to the edge and looks down. He turns deliberately around and backs off, holding himself by his front flipper and chin and feeling for bottom with his hind flippers. They do not reach, but after hesitating a while he lets go and drops to the bottom, tumbling over backward.

Following down along the cliffs to the north end of the reef, every few rods in the water are little bands of pups swimming in both directions. There is evidently a line of connection made between the Reef and Kitovi. Perhaps a visit along the beach above Lukanin would show that the pups of this rookery and Polovina are also visiting.

Crossing over to Gorbateh, pups are seen in the surf off Zoltoi sands and along toward Spilki and all along to the Lagoon. Mr. Redpath says that pups from Lagoon rookery have been out on the rocks at Warehouse Landing to-day.

Judge Crowley and Mr. Macoun report killing a pup which was just coming out of the water. The animal was selected with a view to showing whether or not the pups seen in the water are feeding. The pup's stomach contained upwards of a quart of rich milk and a few pebbles, nothing else.

#### MR. LUCAS'S NOTES.

In the morning a bull seal was killed for a skeleton. To get him the lot on the slope of Zoltoi were driven up to the village killing ground. One showing age was

wanted. The drive contained about 50 old bulls, 50 half bulls, and 100 bachelors. It was an astonishing sight to see all these huge brutes driven by two or three men when any one of the bulls could easily have driven off the drivers.

One bull that dragged his flippers killed; showed no apparent injury. Another bull was seen to do the same thing on the other side of Zoltoi.

In the afternoon I went to Lukanin. The rookery looked deserted, seals being down in the water or well up the slope.

Wet cows were coming all the time and yet we can see more out at sea. We can not see any in the water that show evidence of going out to sea, yet they are constantly slipping in and coming up the slope to find their pups. Cows simply emerge from or are lost in the line of sporting seals.

There is no directness about the beasts: the only thing they can do without stopping is to run away when frightened. A pup roams about and swallows several pebbles. Why do they swallow them?

After supper I go out with Mr. Clark to the end of Gorbatch and stay till dark. Rookery life goes on at night as in the day. The seals are still sporting in the water and those on land are talking to one another. There are 3 new bulls at the Slide. They are playing at running harems, quarreling with one another, and trying to talk to the cows.

The question of testes is still a puzzle. This afternoon we saw two 3-year-old bachelors in which they had entered the serotum and showed plainly, while the two very old bulls killed in the morning have no show of testes at all, i. e., in serotum.<sup>1</sup>

#### AUGUST 27.

Mr. Lucas, Mr. Macoun, and Judge Crowley went this morning to Northeast Point

#### MR. LUCAS'S NOTES.

The seals are now up to the top of Hutchinson Hill, and some 6-year-old bulls are on duty almost at the summit. Although this rookery has dwindled sadly, yet the view from the hill is still wonderful in its abundance of seals. The gregariousness of the seals is well shown by the fact that, although there is almost unlimited space at the foot of Hutchinson Hill, some areas are thickly packed with seals, while between these areas are great stretches of unoccupied ground.

There are 2 beautiful dark-gray females near the top of the hill—no white patch under throat. The variation of the seal in size and color is remarkable. Given 2 specimens and it would be easy to make 2 species on both external and cranial characters. Some bulls are almost uniform light gray, others a dark velvety brown with yellowish manes.

Some burgomaster gulls are prospecting among the seal and one tears and eats a dead pup. But I still doubt if they ever kill pups.

The chances of a female coming in heat and escaping unimpregnated are very small. Between the old bulls in the harems and the young bulls after the harems have broken up, as at this date, every female has good chance of being served.

Walking down the various rookeries south of Hutchinson Hill is now a curious experience. Everything is so quiet, where in July all was uproar—bulls quarreling

<sup>1</sup>See later notes under date of October 11 and 17.

fiercely, cows teasing and stampeding, with idle bulls roaring on the sides and at the rear of the harems. It really seems like Sunday in a big city.

I note a patch of excrement on the sand, and from its appearance infer that this oily, dark excrement plays an important part in the black slime so characteristic of old deserted hauling grounds.

Mr. Macoun has a huge male sea lion shot. He bleeds quarts of blood and the water is stained far around. The pup seals swim in it with indifference and the other seals do not seem affected. They are naturally alarmed by the two shots, but not very badly. All seals are now very timid and restless. The bulls and bachelors wander for long distances.

The day is warm and sunny and the seals enjoy it very much, sprawling around asleep or now and then "fanning" with their hand flippers. Do so many fan because they need to or simply because they are imitative?

#### MR. CLARK'S NOTES.

I walked out over the drives and hauling grounds of Tolstoi, Middle Hill, and English Bay. There are no dead bodies on the drives. Bones were scattered over some of the ground, but these were probably brought up by the foxes, as similar scattering bones are to be seen on all parts of the island.

It is a superb day. The sea is as smooth as glass. Probably between 800 and 1,000 old and half bulls, with a sprinkling of bachelors, are hauled out on the sands of English Bay, extending from the little angle of the hauling ground, just below the reef of Zapadni, to the very angle of the flat sandy area at the north end of Tolstoi. I have never seen the whole beach covered before.

About 200 small bachelors are on English Bay hauling ground. This, like Lukanin, seems to be a favorite place for the yearlings and 2-year-olds. Three pups are among them. Many bachelors are playing in the immense bed of kelp washed up here. It has been rooted over much as if pigs had been in it. One might easily credit the pups and bachelors with having done the rooting if it were not for a flock of gulls which are hovering about.

#### THE SEAL'S POWER OF SCENT.

A few hundred yards down the sands of English Bay lies the blind gray bull which we saw on Upper Zapadni several weeks ago. He is blind in both eyes. They are completely gone and the lids shrunken in. It is not a case of "moon-eyed" blindness. The injury is not of recent date. The bull is in good physical condition. I approach very near to him on the windward side. Raises his head, but shows no fear or alarm. He simply knows that some object is near him. It seems to me that this is the final test of the powers of scent possessed by the fur seal. If this animal had eyes he would go into hysterics. As it is, he does not distinguish between a man and a seal. After passing him he shuffles off leisurely to the water. He holds his head down in the water for a long time, keeping his back out. Afterwards he rolls over and strikes out much as other seals do. Mr. Redpath says he will not die; that he will come back in the spring fat and healthy. He says the seals go by instinct and sense anyhow, not by sight, and he will get along all right. Will he?



Only a few holostiaki are to be seen on Middle Hill hauling ground. These animals are largely in the water. An occasional pup is seen swimming along in the surf of English Bay. Evidently not so frequent interchange occurs here as between Kitovi and Reef rookeries.

## TOLSTOI SAND FLAT.

The sandy flat of Tolstoi is deserted except for stragglers crossing it to and from the water. The rocky bowlders on the beach are black with pups, as is the water for some distance out. A few pups are under the edge of the cliff. Many are on the bowlders above. The number of dead pups has noticeably increased on the sandy flat, and there is a large number of starving pups. No other place apparently shows so many. Now that the sand flat is deserted, one can appreciate what a graveyard it is.

Not many of the oldest carcasses will be lost in the final count. A few bodies will be washed away by the higher surf of the approaching winter storms, but most of these it may be possible to catch on the sand beaches. It will, however, be absolutely necessary to count all bodies and deduct the earlier dead.

Bulls that drag their hind flippers must do it for convenience or amusement, as the small boy limps. Two bulls have dragged themselves across the sandy tract in this way and as soon as they came to the bowlders of the beach they straightened up in as good form as you could ask. A bull was seen to push himself down into the surf of English Bay on his throat and breast, not using his fore flippers. It was a peculiar performance. There was no way to determine whether anything was the matter with the animal or not. In the water he acted about as other seals would act.

Many yearlings are in the water playing with the pups. One extremely small one (probably a female) is seen. She is smaller than the 2 pups with which she is playing—a trifle slimmer and no longer. She has the proper color of the yearling, however.

Many fine bulls, in good condition, are still along the water front guarding young cows. Several are at the back of the sandy tract. It is strange if these cows are not yet to be fertilized. The bulls are quite as attentive as at the height of the season, and they are not young ones, either.

Passing through the harems on the rocky slope the seals show little fear and no tendency to stampede; they simply move out of the way.

One genuine case of copulation is seen. The bull is a young one and has a harem of three or four small cows. The cow is a 2-year-old. He is apparently entirely successful.

Another "prehistoric" burying ground lies at the back of Tolstoi, very much like the one above Zoltoi. Many bones scattered about. They can not be carcasses from drives. They are probably dead bulls that have hauled out there to die. A number of bulls on English Bay this afternoon are seen lying in out-of-the-way places sleeping. That they in some cases crawl away to die is evidenced by the fact that there are now 2 dead ones of this year. The sand has drifted over them, but the gulls are unearthing them. In a similar position are the bones of other animals in the spaces around the sand dunes where the wind has swept away the loose sand and laid them bare.

AUGUST 28.

Gorbateh and the Reef were visited.

## ROOKERY CHANGES.

The real "spreading" of the rookeries comes not at the close of the season but later, and is very different from the phenomenon of rookery expansion. More than two-thirds of the einder slope on Gorbateh is to-day covered with seals. The space formerly occupied by the harems is entirely bare. These seal harems have moved back within a day or two. Many of the pups and cows are in the water, but more of them have moved back far up on the slope. They have even overflowed on the flat above—pups, cows, bulls, and holostiaki mingled indiscriminately.

The hauling ground at the back of the Reef rookery is now vacant in the middle portion. One can walk down to the large rock pile at the head of the main runway. The bachelors still congregate in the extreme ends of the hauling ground.

From the rock pile a splendid view of the rookery is available. The appearance of things has changed in the past few days. The three great wedge-shaped patches which were the distinguishing feature of this rookery have now lost their form. The whole body of seals has moved back from the beach. The runways for bachelors are bridged over, and a continuous line of cows, pups, and half bulls extend right through from end to end. At no place is there an opening; at the two points where the great masses existed in July the line is much wider.

This line of seals has now Townsend's crosses in its middle, and in two cases the line is entirely above the crosses. For the most part the original rookery territory is bare. Some cows are nursing their pups among the bachelors on the hauling ground. The line of harems extends to the limit of the hauling, and the place where the virgin cows were shot is now covered with cows and pups.

## LATE HAREMS.

Just outside of the line of cows are a number of well-defined harems. The largest of these contains 23 cows and is in charge of a fine large bull. One or two pups are visible, but the majority of the cows are young. The bull lies stretched out on the ground surrounded by his cows. One would take it to be a well-regulated harem in the height of the season.

At a short distance on either side of this harem are 2 others and beyond them 2 more. These 5 harems are well defined and all in charge of good-sized bulls. The other harems number 12, 11, 20, and 20 cows, respectively. In the harem of 12 cows is one pup nursing. The harem of 14 cows seems to contain a single pup. One of the harems with 20 has 5 pups, the other 10. These harems are a short distance back of the line of pups and cows. About these and all along are the usual harems of 1 or 2 virgins with a young bull.

A young bull enters the largest of the harems and is promptly fired out by the master. No copulation is seen, though the bulls are very attentive. It must be, however, that many of these cows will yet be served.

The water along the Reef is full of swimming pups and holostiaki. The front of the rookery is bare and one could walk from end to end where the seals were massed in the breeding season without disturbing any seals.

Few, if any, dead pups are to be seen: none that seem fresh; few starving pups; all seem strong. The distance, however, is too great to make fine distinctions.

At the supper table this evening the conversation turned on the effect of thunder on seals. Mr. Redpath spoke of the time when a heavy thunderstorm occurred at night on St. George Island. He said that the next morning the seals were found scattered all over inland in out of way places and on all the beaches. It took them several days to get back to normal conditions. They had evidently been very greatly frightened.

He also told of some volcanic disturbance which turned the water about the island grayish white, as though mixed with ashes. The air was full of sulphur fumes, the white paint on the houses turned black, and the brass fixtures on the launch were tarnished.

#### AUGUST 29.

##### MR. LUCAS'S NOTES.

A moderate southeast gale is on with a little rain. There is a great surf running, but the largest seals play in the heaviest breakers and the pups go in pretty large rollers. The seals are less timid than usual of late: possibly the weather has something to do with it. As elsewhere on the Reef, the seals are well back from the water, and many young bulls paying attention to the cows. It seems as if 5 regular harems had been established at intervals among the seals, presided over by well-grown bulls. These were noticed for the first time last night by Mr. Clark.

There is more or less mixing of seals of all classes and the bachelors wander about at will. A pup wanders into a little group of bachelors and they start to teasing him. When the pup moves off, a bachelor pursues. The pup turns and faces him and snaps vigorously. The whole proceeding reminds one of several big boys tormenting a little one and preventing him from going home. A holostiak seizes the pup by the neck, just as the bulls have been seen to seize the cows, and runs off with him. Another bachelor seizes the pup by back and the first one lets go only to grasp pup again by nose. They try to pull the pup to pieces and finally drop him. The pup seems uninjured and starts to back off, afraid to turn tail. After a little backing the pup escapes among the cows and pups, principally owing to lack of continuity of purpose on part of the pursuing bachelors.

#### AUGUST 30.

##### MR. LUCAS'S NOTES.

The day is a fine warm one, sunny in the afternoon. After dinner I went to Zoltoi with Mr. Redpath, and afterwards to the Reef. There are more seals on Zoltoi than at any time since July, and the majority are old bulls. On the sands to the north of Zoltoi are at least 200: in the little cove below at least 150, assorted sizes; on Zoltoi bluffs about 400: and another 100 down by the water. A most remarkable display of bulls.

##### AGES OF THE SEALS.

Mr. Redpath points out seals of different ages, and I see that my tendency has been to underestimate the age of the smaller bulls. It is evident that the majority of

rookery bulls in the height of season are 8 years and upward. After eight or ten years it is difficult or impossible to tell anything about the age of bulls. Mr. Redpath thinks they live at least twenty years, and I should be inclined to say from twenty to thirty.

The bulls enjoy sleeping in the sun with hind flippers extending directly backward. This is a favorite attitude, and there is no indication of impotency or paralysis about it. Another favorite attitude for a good sleep is with flippers tucked up, fore flippers pointing backward, hind flippers pointing forward.

The little cove across from Zoltoï affords a fine opportunity to study variations in size and color. Bulls vary from light gray to dark brown. A gray bull starts for the water dragging his hind flippers, but a little later shows that he is playing off. The two killed some days ago were, however, not playing off, for one painfully dragged himself clear across Zoltoï. And yet when killed there was no apparent injury to account for the action.

A few years ago the steep slope of the little "cove" was dug away in order that seals might haul onto Zoltoï from the east. It has now been worn too steep, but a little labor would soon put it in shape so that seals could easily reach Zoltoï Bluff's from the east. At present they are limited to the little sand beach.

#### ARDIGUEN.

Going down by way of the Reef to Slide, I find there are now 7 dead pups in the gully. Three have been added since Friday, including one noted as sick. Even the recently dead pups look as if long dead, while two of them are flat and trampled. Two more are starving and are not long for this world. A wet cow sits on a stone and calls. Her pup comes, but can not possibly climb the stone, and says so. After about twenty minutes the cow gets down and meanders about a little. The pup follows eagerly and says he wishes to nurse. The cow lies down for about two minutes and then goes back to the stone, followed by the pup. The cow calls, but the pup can not climb the stone and finally lies down by it. I have watched them for three-fourths of an hour.

It is wonderful how the seals have spread about and how many there are on the gravel slope of Gorbateh. The heavy gale of yesterday has sent them ashore, as did the former gale.

#### MR. CLARK'S NOTES ON THE REEF.

The harems noted the past two days have been swallowed up in the backward movement of the seals, which seems to continue. Cows and pups are spread all over the width of the hauling ground. Another day's backward movement and they will be up on the parade grounds. It was necessary to chase a hundred or more seals from the edge of the rocky observation cliff. At the south of the cliff, where not more than a dozen cows and only 3 pups were seen on Saturday, are now 40 pups and almost as many cows, besides numerous holostiaki.

Among the bachelors, where two lone cows were nursing their pups on Friday, are 32 cows and 81 pups. At the edge of the group, and apparently in charge of 3 or 4 cows, is a young bull.

The gale of yesterday afternoon and evening has apparently driven many seals in. More are on the grounds to-day and they are scattered more widely.



A young bull at the foot of the cliff is teasing a pup, as observed yesterday. He acts to-day much the same, but a bull comes after him and spoils his fun.

The Reef was searched with a glass for freshly dead pups, or starving ones. None seen. All bulls that could be observed showed testes.

It is evident that this backward movement does not mean that the cows and pups have abandoned the water. Wet cows and pups are to be seen among the very farthest out, and they are coming and going all the time.

Two little foxes which have begun to be very attentive to travelers over the parade ground have followed me down to the rock pile. One lies on a stone on one side, the other on the other, watching every movement I make. The seals do not mind them.

The day is very bright and sunny. The seals are sprawling out on the ground, showing the effect of the heat.

#### AUGUST 31.

##### MR. LUCAS'S NOTES.

I stroll over toward Kitovi, but come upon the crippled seal seen during our first week here and turn back so as not to disturb him. The pups are having much sport by the "Round Tower" at the head of Black Bluffs. They bathe in the natural bath tubs in the rock and poke their heads in to seek for the bits of kelp with which they play. Around the corner the large band have a glorious time in the washed-up kelp, pulling up long pieces and shaking them vigorously; but I don't see them swallow any. Like children, they enjoy crawling in nooks and crannies, and to climb up high on the rocks. Here and there a yearling or 2-year-old plays with the pups or looks on much as a big girl plays with dolls long after her companions have put them aside. They "play bull" and bite and growl, and one in the water twists and turns and cuts up generally.

At another place a bull comes out of the water and gets within 25 feet of me. He seems suspicious and finally goes slowly off, although he does not show that he actually sees me.

The seals are very thick about Kitovi, having come in here, as elsewhere, on account of the high seas.

There are many starved and starving pups on Tolstoi. Those recently dead from starvation can, for the most part, be readily distinguished from those which died in the earlier part of the season. They are flatter, not swollen, and the heads seem larger. The large size of the head is especially characteristic of the starving pup, even when far from dead. The sands at Tolstoi are now practically bare. The females pass close to me in going to and from the water, but while I "shoo" them off I make no sudden movements and they do not take fright. They approach within 30 feet of me. There is a line of sleeping bulls from Zapadni Reef two-thirds of the way to Tolstoi, and a line of them up the base of Middle Hill. The bones of many pups lie in the sand to the east of Tolstoi Rookery.

##### MR. CLARK'S NOTES.

Mr. Redpath says that the seals have apparently never hauled out on certain beaches which seem to be quite as well adapted for rookery purposes as those now

occupied, as he supposes, because they go to the places in which they were born. Instead of seeking more room in other and new quarters they simply mass in the same areas year after year.

Regarding the disappearance of Spilki, he said that he did not know what had been the cause, but the desertion was a gradual one. The cows ceased first to come. The bulls hauled out on the rocks and waited for a time, but, no cows coming, they went away.

In the matter of preference between the islands, he said he thought the seals came simply to the island where they were born. He said, however, that the seals always hauled out on St. Paul first, although the ice and snow left St. George first. They came right by St. George on their way up. It was possible to always get a food drive on St. Paul before one could be got on St. George. Mr. Redpath did not believe that the seals interchanged between the islands.

#### THE CHUTE.

The afternoon was spent with three carpenters in rigging up a chute for experiments in culling seals. There are two ways in which the drives might be improved and re-driving stopped. One is by culling the seals near the hauling ground and driving only those to be killed. The other is to herd up the rejected seals in the lagoon and in certain lakes until the killing season is over, not allowing them to return to the hauling grounds.

#### SEPTEMBER 1.

The line of pups and cows below the observation rock on the Reef has thinned out since Sunday. Many of the cows are in the water. Three of the five harems are again well defined. The surrounding cows and pups have fallen away. One harem has 18 cows and 2 pups; another has 12 cows and 3 pups; another has 6 cows and 1 pup.

On the sandy flat just above the second pond there are 2 distinctly marked harems which were not there on Sunday. The cows are all lying out at full length; the bull is lying in their midst. The morning is bright and sunshiny and every animal on the rookery is stretched out and fanning.

A young bachelor at the foot of the rocky cliff on which I am sitting is worrying a pup. He looks like the same one seen on two previous occasions. He takes the pup up by the back of the neck and shakes it as a dog would a rat. The pup bites him when released and then runs until the bachelor overhauls him again. Pup escapes among the sleeping cows and they wake and drive off the bachelor.

#### COWS AND PUPS.

A wet cow has come up to the foot of the cliff. A pup with a peculiar voice is following her. She pays no attention to it for several minutes while it stands over a stone and calls to her. The wet bachelor comes up to the pup and smells of it. The cow immediately attacks the bachelor, driving him off. The mother then recognizes the pup and lets it nurse.

Wet cows and pups are seen in the outermost edge of the rookery. Two wet cows, each with a wet pup, are lying on the rocks below me. Looking about I see a very wet pup sucking a perfectly dry cow. She looks as though she had not been in the

water for a week. Evidently this pup must have come up from the water and found its mother.

A big cow is calling loudly for her pup. She is wet and has evidently come direct through from the sea. No pup appears and she bites a sleeping cow as though just for meanness. She goes about for a short time calling, then starts off in a straight line for a distant part of the rookery and lies down among a number of sleeping cows. Did she come to this point because she found her pup here last time; and not finding it, did she go back to her original harem?

I see a little starving pup below me. He is moving about and calling out and nosing about the breasts of sleeping cows. He has tried 3 and been driven off with a growl and snap from the waking cow. He wanders some distance. Comes up to a sleeping cow whose pup is either nursing or asleep with his nose at the nipple. The starveling takes hold and evidently nurses for some seconds. But the cow, as before, wakes and snaps at him with unwonted vigor. Her own pup has been asleep. Evidently she had been misled by the fact of his having recently been sucking. The starveling gives up and lies down.

#### NURSING OF PUPS.

A wet cow is near by who has just recognized her pup. The little fellow is beginning to nurse. It is now 10.55. At 11 o'clock another pup and cow are seen to recognize each other. At 11.10 the pup which began nursing at 10.55 has stopped and is sitting beside its mother. The other little fellow also stops. He calls over his sleeping mother's head. She does not open her eyes, but at once moves her body in such a way as to give him a chance at the nipples on the under side. He resumes his dinner. At 11.15 he quits and lies down to sleep by his mother. The other pup has gone to sleep, not resuming his meal. These are probably not representative cases, however, as there are three pups near by which were nursing when these began and are still at it. At 11.20 the pup that began at 11 o'clock is nursing again on the other side. At 11.30 the pup which began at 10.55 has resumed nursing. The other is still at it. At 11.35, when I leave, the latter is sleeping again while the former continues his nursing. These two pups have each nursed about half an hour, but they are likely to resume and continue indefinitely.

A little pup is in a hard way because his mother is lying between a rock and a sleeping cow, so that he has no room. He is standing with fore flippers on her and hind flippers on the rock, calling to her. She has her head up and is scolding the cow beside her as if trying to get her out of the way. They are both too lazy to move and the pup has to go off.

A pup dripping wet is hunting about among the cows for his mother. Evidently both parties hunt. It must depend upon the individual. If the mother comes in from an absence she may hunt for the pup. If the pup is hungry he will do the hunting.

#### AN ALEUT'S VIEWS.

In the afternoon Nickoli Krukof helped me complete the chute. Nickoli asked what it was for and was told that it was for separating the seals near the hauling ground to save driving. I said to save. He wanted to know what was the matter with driving them. He was told that some people claimed that driving and redriving

the seals injured them so that they did not breed well. He laughed and said, "Men have to work hard, too, sometimes."

When asked if it would not be better to kill the seals near the hauling grounds—for example, those from Tolstoi on the flat just back of the hauling ground and those from the Reef on the parade ground—he said the smell would drive the seals away. When asked why the seals from the Lagoon did not go away when the killing ground was just across the narrow channel or why the bulls did not abandon their favorite place on Zoltoi Sands within a few yards of the present village killing ground, he said they were only females and bulls and they did not care, but with holostiaki it was different. They were timid and would take to the water if the smell troubled them.

He then said what was the use of disturbing the seals all summer, as we were doing. He was told that the pelagic sealers would get all the seals anyhow unless something was done to stop them and that it was necessary to find out what could be done about it.

He did not seem to understand about or take much stock in pelagic sealing. Shortly afterwards he said that it was the running about the rookeries that made the seals scarce this year. He said that all the natives think much harm has been done this year by so many men running about. He said that the seals smell the track of a man as a dog does. Wherever one has been the bachelor will not come there again. In his estimation the holostiaki will be more scarce and timid next year. The men will have to go into the water to get the killable seals and keep them from running away.

When asked if he did not think that pelagic sealing had something to do with making the seals scarce he did not say anything to indicate that he understood what pelagic sealing meant, but talked always about the timidity of the bachelor seals and how they were getting more and more afraid of men. Evidently the ideas of the natives are purely local and of little value. The very fact that the bachelors return almost immediately to the hauling grounds from which they are driven is sufficient answer for all this.

#### MR. LUCAS'S NOTES ON GORBATCH.

Two more dead pups are on the "slide," making 10 which have died since August 15. The last 2 have died since Sunday, one of them being noted then as in a bad way. Two or 3 more pups are beginning to show signs of starvation, and will probably die within a week. Where there is so much travel back and forth as here the bodies rapidly take on a time-worn look. To day there are 140 living pups near the head of the "slide" in a space of about 10 by 120 feet.

From the scarcity of bachelors of late it would seem that now if ever the pelagic sealers should be obtaining the largest proportion of male seals.

#### TOLSTOI.

I visited Tolstoi in the afternoon. I dissected one starved pup and took his brain. Many starving pups lie about and the death rate from now on will be pretty large. I wake a starving pup and he coughs and is vicious as if fully fed. He runs away and in the first 50 feet falls four times. He does not open his eyes wide, nor do other starvelings. I think we will find many of these pups where the thick pods are now lying. A 2-year-old seal strays up into the road near Ice House Lake. Hurries away when he sees me, and two hours later is seen in the middle of the Lagoon.



In the afternoon H. M. S. *Pheasant* came to anchor off the village and landed Dr. Jordan, Professor Thompson, and Mr. Barrett-Hamilton, from the Commander Islands. They came on the *Satellite* direct to Unalaska and the *Pheasant* brought them up to St. Paul.

The *Corwin* arrived about the same time, bringing Colonel Murray from St. George Island. He has with him branding irons and reports that experiments made in branding at St. George proved successful. Sixty-two pups and 9 cows were branded on North Rookery.

#### THE COMMANDER ISLANDS.

Following are Dr. Jordan's field notes on the Commander Islands:

##### ITINERARY.

August 16.—Sailed from Lukaniu Bay on H. M. S. *Satellite*, Capt. Albert Clinton Allen commanding, having rough weather for two days with southeast wind, then fairly good weather. Sighted Cape Napropusk on Bering Island August 22, and anchored August 23 at 6 a. m. in Nikolski Bay and spent the day on shore looking about with Mr. Emil Kluge, returning to the ship at night. August 24 we sailed from Nikolski at 6 a. m. around Cape Stotchnoi, rounding the north end of Medni Island and reaching Preobrajenski at 9 p. m. August 25 we took Mr. Barrett-Hamilton on board. Sailed at 9.30 for Glinka, visiting Zapadni, Palata, and Zapalata rookeries. In the evening of August 25 left Glinka for Unalaska, arriving there on the afternoon of August 29, embarking at once in the *Pheasant* for St. Paul.

##### BERING ISLAND.

To the northward this island has irregular lakes and moors surrounded by rounded hills, abruptly flat and table-shaped on top. These are covered with moss and *Empetrum*, their sides ridged with many buried bowlders. Snow lies on all the northern slopes.

To the southward are higher hills, all rounded off, not rocky anywhere, capped with gray moss and topped in mist, the slopes green with moss down to high tide. The sea to-day is without a ripple. The hillsides look like a grassy lawn edging a pond.

Going south along Bering Island the hills rise 800 feet or more, with rounded tops covered with reindeer moss and with many snow banks down to the water's edge. Rocks are very rare, the slopes all soft and gently rounded, ending sometimes in cliffs at the sea, but those showing faint valleys extending well back to the interior. There is a little waterfall in the valley off Poludinnoye Point.

Mount Steller is a broad, stately peak with huge cliffs, perhaps 500 to 600 feet, at the seashore. From the northern view the peak is not specially impressive, being similar to the rest of the moss-covered, snow-strewn slopes. Along the bay farther south there are some green cliffs far higher than Mount Steller.

Lisinsky Bay is rather green and smiling, with scattering snow patches flecked with shadows of clouds mirrored on its surface this most charming Arctic summer day. Cape Stotchnoi is a very high, rocky, and precipitous headland, its rocks apparently gray and stratified. The outline is very striking, almost knife-like. The first seal we see is asleep opposite this cape.

The south end of Bering Island is wild, forbidding, and picturesque to the last degree. Enormous cliffs rise a thousand or more feet high at Stotchnoi, Tolstoi, and other projecting points. The coast is much more wall-like than the jagged slopes of Medni and its peaks quite as high.

*Nikolski.*—The houses of Nikolski village are of various—usually two—colors each, sky blue and pea green, yellow and pink, gray and brick red, dove color and green, pink and pale blue. The church is creamy pink, trimmed with sky blue; the roof is slate green, the dome and cross yellow, with sky blue ball at base of cross. Many handsome white skinned Russian children are to be seen in the village.

#### GENERAL NOTES.<sup>1</sup>

Severnoye or North rookery has yielded 5,350 skins to date; Polndimnoye or South rookery, 380 skins up to August 13. Drives are still being made on Bering Island; one occurred on August 22. The bulls are all gone.

There are a very few adult bulls on Bering Island, not enough to keep the holostaki off the rookeries even in breeding season. As a result for two years females, males, pups, and all are driven up. The level condition of the rookeries and driveways makes it possible to capture practically every available young male, and the escape of these into wigged age takes place very rarely. Probably not more than one or two bachelors each season so escape. It seems probable that the young males only herd separately because they are forced to do so by the bulls, and they cease to do so just as soon as the bulls leave or because too few to keep them off.

South rookery, on Bering Island, had only 3 bulls this season, and they went away early. Mr. Grebnitzi thinks this small number is enough to impregnate all the cows, and therefore fully enough for rookery purposes. Mr. Barrett Hamilton says that every adult cow on both the Bering Island rookeries has a pup.

No such close killing is even suggested as having ever occurred on St. Paul. It is not evident from conditions of Bering Island that it does any harm. The sole important function of the bull is reproduction, and if there are enough for this nothing further is needed. But such close killing should not be attempted without careful inspection and investigation of the question of how many bulls are necessary.

The bulls on St. Paul Island could never have been so closely killed as on Bering Island, where every one above 2 years old that hauls out and many 2-year-olds are taken. No available seal escapes, and no especial thought is given to the bulls except that the few that have in past years escaped have been and are sufficient. On St. Paul Island, Sivtch Rock, Otter Island, and Lagoon rookeries, which are not driven at all, would insure the escape of sufficient bulls if no other provision were made.

#### MEDNI ISLAND.

We reached Preobrajenski, on Medni Island, at 9 o'clock on the evening of August 24. It is a little wind-swept village on a grassy opening at the foot of cliffs, rising nearly 2,000 feet vertically like the crags of Norwegian fjords. Down the runways sweep the great wind storms in fitful gusts, the "willie waughs" of the sailors.

<sup>1</sup>Obtained in an interview with Emil Kluge, agent of the Russian Fur Company at Nikolski, on Bering Island.

On Medni Island conditions are very different from those on Bering. The rookeries here are so nearly inaccessible that many bulls escape, no matter how closely they are sought. This, with the reduction of females by pelagic sealing, gives a large surplus of bulls on Medni in spite of the close killing, every one that can be secured being taken.

It is not necessary to put forward the theory of different feeding grounds to account for this, though such a theory would be necessary to explain the alleged fact that Medni has declined much more rapidly than Bering, as shown by Stejneger's tables.

#### STARVING PUPS.

Mr. Barrett-Hamilton states that 172 surplus bulls have been killed this season for food and leather for the natives of Medni. He has noticed a number of weak pups with black feces, evidently starving ones, but he thinks there are few or no starving pups. Many are said to be killed by the surf. It is probable that if the rookeries can be got at starving pups will be found here as on St. Paul.

The authorities deny that the pups are dying. They do not seem to have tried to find out, however, and Mr. Grebnitzi says that Dr. Stejneger was mistaken in his observations on this subject. He says that the starving pups Stejneger saw were weak ones trampled or drowned. In any case, the number reported by him, in Grebnitzi's estimation, is greatly exaggerated.

Evidently the local directors have no interest in the truth and no knowledge of methods of finding out. So what they have not noticed or do not wish to notice does not exist. For this reason it is important that the rookeries should be closely inspected.

Mr. Barrett-Hamilton reports finding fish bones and squid beaks on the rookeries, and he is doubtless right in considering them the spewings of seals.

#### GLINKA.

We land at the village of Glinka at 1 p. m. on August 24. Met Maj. N. S. Wachsmuth, the intelligent and hospitable governor of Medni. A start was at once made for the rookeries with Mr. Barrett-Hamilton, Professor Thompson, Dr. Jerome Barry, ship's surgeon, and Sidney G. Haddock, chief engineer, Mr. Marrett, the photographer, a marine, and several Aleuts. Capt. Albert C. Allen and Major Wachsmuth accompanied us to the top of the hill.

We follow the Zapadni drive in reverse direction toward Zapadni rookery. We are ordered by the Aleut watchman to keep off the rookery, but a letter of explanation is sent by me to Major Wachsmuth, who gives permission to go on and we visit Zapadni rookery. We walk along the beach past Sabatcha Dira to Palata; then climb the slide of the Palata drive to the cliffs above Zapalata, Sikatchinskaya, and Gavarushkaya. We then walk along the beach over the Palata drive to Glinka, which we reach about 6 p. m. Immediately on our arrival the *Satellite* sails for Unalaska.

The waters of Bering Sea are full of small phosphorescent animals, to such a degree as to make it luminous at night.

## STARVED PUPS

It had been denied that the rookeries of the Commander Islands show a corresponding mortality due to starvation. On the rookeries at Glinka, on Medni Island, however, I found the conditions even worse than on St. Paul. Pelagic sealing is continued through July on the Russian side, and a larger percentage of the total number of females is destroyed.

Zapadni rookery, of Medni Island, is a stretch of coarse shingle and rounded rocks on a sloping beach at the foot of very high cliffs. In the sea are large rocks, on which the female seals are now mostly gathered. On the shore is a small pod of females and a number of groups of pups. No males, young or old, appear.

In the first little pod of 20 pups, 6 are evidently starving; 8 recently starved; dead ones lie there, and there are 4 dead ones of older date, but also emaciated.

Zapadni rookery seems not much larger than Little Polovina, of St. Paul. On the rookery ground are 11 fresh-starved pups, besides 14 which seem, some of them at least, to have been starved, but which are now largely decomposed.

There are many carcasses of dead seals on the beach nearly devoured, and dense swarms of small flesh flies abound, their maggots destroying a dead pup or dead seal carcass very quickly. Evidently of the very earliest pups only fragments remain. The air seems drier and warmer than on St. Paul, and a dead pup remains fresh only for a short time. Many which have not been more than a week dead have been reduced to skeletons and hair.

A pod of 46 pups on shore is examined. As a whole they seem much less active than Pribilof pups—smaller, sleepier, and more stupid. Seventeen of the number are evidently starving. Some look plump, but it is probable that nearly all of these land pups are really starving; the large and well fed ones have taken to the water.

Other pods show similar characteristics. In a group of some 200, about 80 are evidently starving. This is not a count, but a rough guess. The percentage in general holds for all groups examined.

In this record no effort was made to get full counts for lack of time. I have only noted what I saw. It is very clear that the starving pup is in fullest evidence on the Glinka rookeries. On these rookeries trampled pups must stand at a very minimum, because the rookeries are narrow and rocky, preventing massing, and bulls are few. There is little chance of drowning.

One pup in the water has crawled upon a rock about 10 feet from the shore to die. The rising tide will drown him if he doesn't starve first.

On the edge of the slide at Palata is a little brook which has worn a small gully, and which is doubtless responsible for the slide itself. In the brook were 4 dead starved pups, and in a pod of 150 lying near it at least 50 more are starving.

The governor of Medni Island seemed rather sensitive on the subject of dead pups, as though he felt that he might be taken to task for it. He spoke of the trampling of bulls as the cause. I tried to throw the blame on the pelagic sealers, and expressed my hope that wise arrangements might put a stop to the loss. But it would seem that the authorities think the less said the better on the subject.

It is probable that most of the pods of pups along the beach are made up of starving ones, the strong ones being in the water and on the bare outlying reef. Even a fairly plump one seemed dull and dwarfish, while among the others are all stages of emaciation. The excessively numerous beach flies make quick work of the bodies.



## PALATA.

Separating Palata from Zapalata is a huge wall of cliff, at the foot of which, on the Zapalata side, is a number of parallel or knife-like reefs which extend well out to sea, bare at low tide, and now black with seals and pups, the females almost as dark as the young. The pups find excellent places for swimming between the reefs. A good many are scattered about over the slide which forms the rookery, mostly asleep, while many are crowded on the beach below.

On the detached north end of Palata 42 dead starved pups were noticed, with 24 other dead ones mostly showing emaciation, but more than a week old, so that they can not be investigated. This rookery, like the others, is one on which very few pups would be trampled.

One fresh pup, not emaciated, at the edge of the sea, has apparently drowned. This is the only pup seen in condition to be examined in which the death was obviously not due to starving.

## AUTOPSIES ON MEDNI ISLAND.

The following autopsies were made:

1. *Zapadni*.—Young male pup cast up by waves. Perfectly fresh; no trace of subcutaneous fat; lungs greatly congested, crepitate; no trace of water in him; heart normal, with some unclotted blood; liver very dark red; spleen purplish; stomach and intestines empty, except the lower part, which contains the dark-green tarry matter; gall bladder nearly empty; kidneys deeply congested, the left most so; evidently starved, not drowned.

2. *Zapadni*.—Female; wholly devoid of subcutaneous fat; vent foul with black tarry matter; lungs deeply congested, not crepitating; intestines pale, empty, except for fluid brown bile; stomach empty, with mucus and bile; kidneys slightly congested, the left most.

3. *Sabatcha Dira*.—Male; no subcutaneous fat; lungs excessively congested, almost black, not crepitating at all; heart normal, with some blood; liver very black; left kidney much congested, the right a little; intestines with tarry bile and slime in lower part only.

4. *Sabatcha Dira*.—Male; lungs greatly congested, crepitate; no fat; liver dark; black matter in lower intestines as usual, the alimentary canal otherwise empty; kidneys congested, the right most so; heart normal, with some blood.

These four pups exhibit the same characteristics as the starving pups on St. Paul. Many others in external features corresponding closely to these were seen but were not dissected.

## DRIVEWAYS ON MEDNI.

On August 25 we traversed the driveways of Zapadni and Palata rookeries.

## ZAPADNI DRIVEWAY.

The drive from Zapadni goes up from the stony beach between two towers of rocks, climbing the gorge of a little brook which ents into the bowlders and clay of the hillside, an excessively hard, rough little gully, very difficult for a man to climb, there being small cascades and wet clay in its course. The way is marked by road skeletons.

After an ascent over ground of this sort for 300 or 400 feet, more or less, the drive goes up through steep grassy slopes, some of them of soft clay, somewhat ent into

rough steps by men's boots. The general character of the ground is unrelieved, although more or less broken by cross gullies and ridges. The final ridge is 760 feet above the sea.

On the Glinka side is a long slope, at first quite steep, everywhere grassy and rather easy, but marked with road skeletons, as it is very long. The rye grass grows longer below, and a little stream has deep depressions, which serve as death traps, as the skeletons show, when the seals fall in piles one over another. Above Glinka is a steep slide of yellow clay, from which the village is said to have received its name. This slide must be a hard place for the seals. The seals (few in number) that are released because too young or too old are allowed to go down to the sea, whence they go back to the west side again.

#### PALATA DRIVEWAY.

The drive from Palata is now rarely made, as the seals have become so few. They are killed all along the beach, and the myriads of flies about the decaying carcasses must be the source of great annoyance to breeding seals.

The drive ascends from the parade ground on the top of the landslide. This was formerly occupied by bachelors. But there are no separate droves of bachelors now. They are scattered in little clumps about and between the rookeries.

The drive then for about 100 feet ascends a grassy cliff so steep that steps have been dug in it to facilitate climbing. Then follows some 700 feet of irregular but very steep slope, in which the easiest depressions are sought, though the hill is everywhere about as steep as a man can climb, and one who goes up it must cling to the grass. Above this slope the drive reaches the back of the knife like ridge that separates Palata from Zapalata. This widens out into an easy level plateau for about 20 rods, marked with road skeletons. The elevation is 850 feet by Dr. Stejneger's map.

Then follows a steep climb up gravel and clay, with scanty grass and heather, worn into steps, the driveway bounded on the southwest by a slanting precipice that lies above Sabatcha Dira. A steep shoulder of heather and small plants is followed by a final climb into the clouds to the summit of the pass, 1,220 feet above the sea.

From the summit an abrupt descent leads down a distance of 500 feet by a zigzag trail as steep as a horse could pass over, strewn with gravel and covered with low flowers, to the bed of a swift little brook. This stream flows down into a grassy basin, the slope becoming less and less, the rye grass and puteliki growing taller. At the junction of this stream flowing into the little brook to the west this drive merges into the one from Zapadni.

The drive from Palata is not in any place so difficult as the gully just above Zapadni, but it is half higher and twice as long—a trip one could not take on horseback, nor would it be easy to lead a horse over it. Comparing it with conditions on St. Paul, the Palata Pass is as steep as the cone of Bogoslof, twice as high, and is without water. Compared with the severest drive on St. Paul, it would stand as the ascent of Mount Blanc to a walk in the park. It is a very fatiguing trip for a man. It took me, walking rapidly, thirty eight minutes (deducting stops) from Palata to the grassy level 860 feet; thence twenty-eight minutes to the top, 1,220 feet; fifteen minutes down the upper slope, and fifteen more to Glinka.

And yet, notwithstanding the severity of the drives of the Commander Islands, no harm has resulted to the breeding herds of these islands from this cause.

## COMPARISON OF COMMANDER AND PRIBILOF SEALS.

The rookeries of Medni Island look decidedly unfamiliar and the cows very much unlike those of St. Paul. The cows are evidently much darker in color, though the shades vary from pale to dark, as on St. Paul. But there is still very little of silvery gray, cinnamon color, or warm browns. Sooty shades, light and dark, prevail, and brownish or reddish wholly wanting; they are not at all rusty.

Compared with the St. Paul seals the head and neck of the Commander Island cows are smaller and slenderer, the snout sharper, the neck more crane-like compared with the stout body. As to the bulls, not enough are left to show the difference, if such exists.

There is no doubt that the Pribilof seals will prove to be a different subspecies from *Callorhinus ursinus*.

## SABATCHA DIRA AND PALATA.

Sabatcha Dira, meaning the Dog's Hole, is a projecting ridge of rock which has a small rookery; some 75 pups are on the rock, a few starving. One yearling female is among them, very small; not over 30 pounds. She is very dark; darker than any adult on the Pribilofs.

Palata rookery, which comes next to the southwest, lies on a steep landslide, mostly of gray clay, with some smaller stones. Roughly speaking, it is about the size of Polovina rookery of St. Paul. Its location is exceedingly picturesque. It extends a hundred feet or more in height from the sea, making a steep slide. Dr. Stejneger says (p. 45) in his report for 1895 that numerous seals were buried here under the slide which occurred in 1849. He also notes that another slide occurred in 1893 above the old one. The broken sod above the rookery shows more landslides are likely to follow.

Along the side next the cliff is a little brook which has worn out a gully of narrow width, in which the seals run and in which dead pups lie. The water from this stream is the cause of the collapse of the side of the hill.

About 12 males, 4 or 5 years old, were seen on Palata. These formed harems chiefly among 2-year-old cows, which are present in small numbers, in the back part of the rookery. The young cows are dusky, like the old. The bulls playing beach master are young themselves and seem perfectly contented. Mr. Grebuitzi thinks that even 3-year-old bulls can impregnate cows.

## ZAPALATA.

Zapalata lies to the south of the point and near Palata. It is a most surprising place—a crescent-shaped bight, with smooth, curved, gently-sloping beach of round, gray granite boulders. It is bounded on every side except that next the sea by vertical cliffs about 800 feet high. These cliffs form a narrow cone between this bight and Palata on the north and Sikatchinskaya on the southwest. Wall-like reefs stand up from the water in and about the bay, making it a good place for the pups to swim and hard for the boats to enter. No drive is possible, but men can scramble down some one of the gullies to the beach, and boats can enter in very fair weather.

Sikatchinskaya is a smaller bight just beyond, very similar in shape and accessible only by boats.

Gavarushkaya, the next bight, is still more closely walled in, accessible only from water and then under great difficulties.

In these rookeries young males grow up to make good the loss from the extremely close killing of the accessible ones. It seems to me that the existence of these coves explains the comparative abundance of bulls on Medni in spite of the fact that everything killable is taken and the rookeries scraped closely. It would seem that no bands of bachelors haul out separately anywhere.

The reefs at Zapalata are black with pups, but there are few on the beach. They are too far down for us to see the dead ones.

The green water and foam of the surf make the view down on Zapalata a wonderfully interesting picture, the most striking one on any of the seal islands. The climb from Zapalata to the cliff over Sikatchinskaya is a giddy one. The narrow ridge is covered with slippery grass and heather, and the ascent is made on rough steps worn in the soil by previous travelers.

The season for killing is now regarded as over at Medni Island, but it continues at Bering. Something over 6,000 are said to have been taken on Medni.

Mr. Barrett-Hamilton came in a boat to Zapalata about August 15, but found no dead pups there. The seals on the Medni rookeries spew up remains of a small squid, which is very abundant about this island. I have not seen it at St. Paul.

#### ESTIMATE OF THE SEALS OF THE COMMANDER ISLANDS.

A very rough estimate of the seals for the rookeries of Medni and Bering islands would be as follows, based upon Dr. Stejneger's report and my own inspection of certain rookeries:

Medni Island:	
Glinka—	
Palata .....	5,400
Zapalata .....	4,000
Sikatchinskaya .....	2,300
Gavarushkaya .....	1,200
Sabateha Dira .....	350
Zapadni .....	1,900
Urili, etc .....	2,400
	17,550
Karabelni rookeries .....	8,500
Bering Island:	
Severnoye .....	23,000
Poludinnoye .....	1,250
	24,250
Total .....	50,300

This estimate is probably over rather than under the facts.

#### SEPTEMBER 2.

Dr. Jordan, Mr. Lucas, Colonel Murray, and Mr. Clark went this morning to Lukanin rookery to experiment in the branding of pups. Mr. Barrett-Hamilton, Professor Thompson, Dr. Voss, and Treasury Agent Crowley were present.

The work of branding was directly under charge of Colonel Murray, assisted by a force of natives.



## BRANDING OF PUPS.

The apparatus consisted of three branding irons, a portable forge, and a pail of salve. The brand consisted of an iron rod about 3 feet in length, to the end of which was attached a flat piece of iron about 6 inches long by an inch thick and wide. This crosspiece was applied red-hot to the back of the animal. A salve made of a mixture of lard, honey, beeswax, resin, and turpentine was provided for application to the burn.

The pups were driven up in pods of 50 to 100 and the females sorted from the males, the latter being allowed to return to the water. The pups as they were branded were held flat on the ground by two men, one holding the hind flippers and the other the head. The pups proved very awkward animals to handle at first, though with experience the natives were able to manage them singly by holding one hand on the head and the other on the hind flippers.

The pups seemed not to mind the branding or to suffer any pain as a result of it, uttering no sound and in most cases making no effort to escape. The work of driving and culling proved harder than the branding itself.

The iron was applied in four places, one just forward of the shoulders, a second in the middle of the back, a crossbar lengthwise of the back across these two, and a fourth bar on the back over the loins. The fur was first burned off the width of the iron and the final burning, intended to produce the sear, was made with the corner of the iron.

The crossbar was put on the St. Paul pups to distinguish them from those branded on St. George, which received only the 3 straight bars.

After branding, the pups were all allowed to make their way down to the water or back to the rookery. They usually lay down on the grass for some minutes unless urged, showing evidence of exhaustion from the handling and confinement. None were seen to try to inspect the burns or lick them, but some on reaching the beach, before going into the water, sat scratching their backs with the flipper, the irritation being caused probably by the salve. Attempts to hurry the pups off were unavailing, as they would fight stubbornly and charge at the person disturbing them instead of running away.

When the pups got into the water, they swam off much as usual, except that they evidently made a straight line for somewhere, probably back to their places on the rookery, the branding being done at some distance away to avoid disturbance. Occasionally a pup would remain swimming about with the others in the bay.

Two little pups spent ten minutes in getting down through the grass to the beach. They reached the beach at the same time, playing together.

Unfortunately 2 pups which were in the first stages of starvation were branded. All other pups weak or undersized were released. It is difficult in handling pups stretched out as they are to distinguish the starving ones.

## THE TIME FOR BRANDING.

It, of course, must be remembered that some of these pups are likely to die yet of starvation. If the mother of a pup branded to-day should within a week be killed at sea, her pup would undoubtedly die before October 1. It is therefore important that if branding is to be practiced extensively the date should be placed as late as

possible. Pups branded in the middle of October would run no risk of dying of starvation. They would be stronger at that time and better able to stand the handling. On the other hand, the pup will then be getting his gray hair, and the hair burned off in branding would leave him bare all winter. Further, the weather is severer and the time shorter for his recovery from any temporary effects of the burning. If the brand is applied before the gray hair comes in, all hair merely burned off would be replaced by the new coat and the scar would be only a small matter.

Two 2-year-old females were caught in one pod of pups and branded. They proved difficult to manage. A noose attached to a pole was placed about their heads and twisted tight, the pole being pointed and held into the ground. This controlled the animal's head. Another man held the hind flippers. The seals, however, bit the pole viciously and cut their mouths, making them bleed profusely. The branding of the older seals does not seem to be a very feasible thing, at least with present appliances, and the beast is an extremely hard one to manage.

#### SORTING THE PUPS.

The seat of operations was moved at noon to a more convenient place above the cliffs at Lukanin. The greatest difficulty is experienced in driving up the pups. They hide under the stones and can not be got out except one by one by the flippers. When in the open ground they all endeavor to get into the same place at the same time, causing danger of smothering. When one starts all start. Apparently none have been injured thus far.

When the male pups are separated from the pod they persist in coming back to it, and bite so savagely that they are constantly putting the natives to rout, who have a wholesome dread of their teeth. An improvement in handling the pups would be a small portable yard that could be thrown about the pod, with a stone in the middle about which they could crowd without crowding on one another. Then when a pup was taken out he could not get back. But of course if branding is to be done on a large scale it will be necessary to provide more elaborate apparatus. Judging from the difficulties in handling these few pups, one wonders what was the result when the 5,000 pups were annually sorted out for natives' food. The very fact that these were so handled, however, shows that there is no insurmountable obstacle in the way.

From the edge of Lukanin Cliff 4 of the branded pups in the earliest pods can be seen on the rocks, where they have come out after swimming around the point, a distance of about a third of a mile. One of the branded 2-year-olds is lying beside them. She is evidently out of sorts with herself.

The pups branded on the top of the cliff have been driven from a runway leading up from the beach below. The first 4 released from branding go directly down to the water on the other side of the cliff. The next 2 return to the place from which they came and lie down in a pod of pups that could not be routed out from among the rocks. One little fellow goes to the point of the cliff and acts as if he would walk right over. He stops and turns round. Afterwards he becomes frightened and backs over the cliff, dropping to the hard ground below, from which he rebounds like a ball. Without any ado he goes off to the water.

In the afternoon Colonel Murray, with the natives, continues the branding, making a total of 124 for morning and afternoon.

The *Rush* came to anchor off the village, and immediately after dinner Mr. Lucas and Mr. Barrett-Hamilton went on board for a cruise among the sealing schooners.

#### SEPTEMBER 3.

The weather is particularly fine to-day. Sky entirely clear in the early forenoon; afterwards slightly overcast with clouds.

#### REEF DRIVEWAY.

Mr. Clark went over the course of Reef drive with a view of getting photographs of typical features of the drive. Five plates were taken.<sup>1</sup> The first view was taken at a point just back and up from the hauling ground of the Reef. It is here that the different pods from the various points are rounded up and the drive begins. This view is a general one, looking in the direction of the drive across the grassy parade ground and over the boulder-strewn area beyond leading up to the grassy flat among the sand dunes.

Plate 2 is taken about 100 feet within the boulder area and shows the passage-way of the drive to the right of the middle of the cliffs. In the background of the picture can be seen the hollow between the sand dunes. To the right of the background is a high grass-covered sand dune.

Plate 3 is taken at the foot of this dune, looking forward to the Black Bluff, with Polovina Hill in the distance. It shows the length of the grassy valley along which the drive now takes its course.

Plate 4 is taken at the edge of this plain where it drops down over a low cliff to the boulder area above Zoltoi sands, showing the village to the left, the village killing ground, and the length of Zoltoi sands in front.

Plate 5 is taken at the foot of the large sand dune back of Zoltoi sands, and beside which the drive takes its course. It faces Zoltoi bluffs and shows bull seals hauled out among the rocks. It looks back over the drive to the grassy plain above, and is the reverse view of plate 4.

Plate 6 is taken from the little grassy knoll at the farther end of the sands and where the drive rises to the level grassy killing ground by East Landing. The photograph looks back over the drive, with Zoltoi sands in the foreground, and showing the boulder slope of Zoltoi bluffs, a nearer view of which was contained in the background of photograph 6.

Plate 7 is taken from practically the same point, but looking in the opposite direction and showing the extent of the village killing ground.

#### REEF.

Dr. Jordan visited the Reef this morning with Professor Thompson and made the following notes:

There is every reason to believe that sex exhaustion in overworked bulls is imaginary. In general old bulls that have had 40 or more cows in their harems are quite as active and their sex force and pugnacity lasts quite as long as with the bulls

<sup>1</sup> Unfortunately these undeveloped negatives were damaged in transit to San Francisco.

who have served but one or two cows. The decline of sex is probably seasonal, the young bulls holding desire later because it is imperfectly differentiated.<sup>1</sup>

#### CONTRAST WITH COMMANDER ROOKERIES.

Looking at our seals again after returning from Medni Island, I notice these differences: The color as noted, also form. In addition the pups are larger and stronger here. There is here a very much smaller number of starving and starved ones, and those which are starving are larger in size because they are older when they begin to starve. This is because there is no close season at Komandorski. The bulls, both young and old, are much more numerous on St. Paul. There are many young bulls still here, and rookery affairs are still going on under charge of these young fellows. I only saw about 15 males altogether on Palata and Zapalata rookeries. There are probably hundreds on Kitovi and Lukanin, there being fairly constituted harems everywhere. The females seem more fierce and disposed to resent approach than early in the season. They will not drive easily, and often move directly toward any person standing between them and the sea.

The young 4, 5, and 6 year old bulls on the Reef seem now full of activity, and while more cowardly, show all the qualities of males in the spring. They hold cows back from the sea, fight each other, growl, snort, and shake their heads just like old bulls. They seem to have well-ordered harems. Very few of the old bulls remain, but the young ones thoroughly take their places.

Some 6-year-olds seem very capable and in good physical condition. Perhaps they are late arrivals. Perhaps they have been away to feed and have returned. The cows show less respect for the brevet bulls, often snarling at them and at each other. Cows seem more snappish now than earlier in the season.

Evidently the pup, not the bull, determines the location of the cow. A bull tries ineffectively to round up his cows, but extends his attempts over the entire neighborhood, since the original harems are broken up.

#### ARDIGUEN.

A's place is vacant; in it are 3 cows and many pups; all asleep. In B's place is a young bull asleep, with no cows. Behind A's place is a sleeping black bull, probably one from behind; no cows. C has no bull; 8 old cows; many pups; no young cows about. The pups are plump and large.

The gully is full of old cows with pups. Three freshly dead pups are now to be seen; a few more are starving; but most are very plump. About half the pups are wet; no wet cows. No bulls below except wet fellows by the sea. Some wet cows come in; they move very slowly. One cow floods the place with urine.

A young bull with 6 young cows lies well back from the mouth of the slide on the plain. Another bull is behind him. There is much excrement of cows and bull on the rookeries. A wet cow climbs to C; she calls loudly and pup comes at once. The rear edge of the whole Reef rookery is now lined with hundreds of yearling cows more

<sup>1</sup> Later observations contradict this. When the bulls returned at intervals during the latter part of September and in October, as many of them did, to the breeding grounds, they gave every evidence of sexual vigor, and were not only able but willing to serve cows. Live spermatozoa were found in one of these bulls killed late in October.



or less associated with harems of 2-year-olds, which are guarded by young bulls. This all seems to be mimic, not real, rookery life. The rookery extends far back from the sea. The starving pups are all game to the last. Some starving ones are grouped about, good for a week or so yet. Some starved dead ones are also to be seen; but these are not numerous as yet on the Reef.

On the Reef are a great number of starving pups (100 or more) bunched together at the southwest side of the large pond. Only a few are dead yet. These are at a distance from the breeding ground. Some gray pups are very pretty. The old rookery ground here is wholly abandoned.

#### LUKANIN.

In the afternoon Dr. Jordan and Mr. Clark visited Lukanin to look up the branded pups. Cows, bulls, and pups on this rookery seem very sensitive to-day, many taking to the water as soon as we become visible. But they soon quiet down and ignore us when we are seated.

One of the branded cows is lying on the stones below the cliff among the other seals and pups. Succeeded in rousing her up by throwing pebbles at her. She seems to be out of sorts with herself and uncomfortable, though her movements do not indicate any serious trouble.

Four of the branded pups are on the rocks at the water's edge. Two others are in the runway, one nursing and the other lying beside its mother.

A large cow with a scar of a peculiar kind across the top of her head comes out of the water; she has also stogy patches of fur on her side, giving her altogether a ragged appearance. A number of cows with imperfect fur have been seen and not a few bachelors have been rejected on this account at the killings.

Many pups are in the water playing with the kelp, diving for it, shaking it above their heads and playing with it as a dog might a bone. All these movements are probably the outcropping of the instinct for catching fish.

#### KITOVI.

From the crest of Lukanin Hill we can see a branded pup asleep on a rock near the boundary with Kitovi. As the branding was done at the other end of the rookery he has wandered some distance or had wandered some distance when picked up for branding.

In the Amphitheater of Kitovi a little starving pup is seen going about nosing the bellies of his sleeping companions. He goes over three while we watch him. Some do not mind him; others wake up as if to know what is wanted.

A very small cow with a very small pup is present. She must be a late 3-year-old with a very young pup. There are an unusual number of small pups here. Not all are small because starving, for many of them are very plump. These must be late pups.

The pups are this afternoon in evidence all along the shore down by East Landing and toward the Reef. The rocks off Kitovi Bay are covered with them. As usual, many yearlings are among them, both in the water and on the rocks. Many pups are hauled up and sleeping on the rock at the little tower on the point between Kitovi Bay and Black Bluff. There seem to be several cows asleep among them. One is sleeping with a pup beside her.

## MR. LUCAS'S NOTES.

At sea on the *Rush*. We boarded the *Zillah May*. She reports 625 seals—314 males, 311 females. Up to August 12 she had taken 352, as follows: 134 males, 218 females. This preponderance of males over females in the recent catch is what might theoretically have been expected from the dearth of bachelors on the hauling grounds of late.

In afternoon we picked up Mr. Halkett, Canadian commissioner, and obtained 28 seals from the *Dora Siewerd*, 26 females, 2 males; only 1 young one. After dinner dissected 13 seals, 12 females and 1 male. With the exception of one specimen, which had a single fish vertebra, all females contained food, mostly pollock, but some other fishes were represented, quite a different state of affairs from what was found on last trip, when seals had been sleeping rather than eating.

Mr. Halkett has found living spermatozoa in a 3-year-old seal. Spermatozoa from a 5-year-old (?) were apparently dead, but this might have been due to length of time between capture and examination or to the fact that the season's work was over. The scars, recent, on some of the ovaries examined now show indubitably as scars of impregnation, being much larger than those examined in August. There is a decided difference in size between the ovary impregnated last year and the one recently impregnated, the latter naturally being the larger. In some cases the impregnated branch of the uterus has begun to swell, but a casual examination shows no trace of an embryo. It is interesting to note that the Graafian follicles are highly developed in the functional ovary and scarcely apparent in the nonfunctional. In some cases there are several very large Graafian follicles present, indicating more than one chance for impregnation.

After impregnation the Graafian follicles undergo a process of degeneration, and I believe that these degenerate follicles are what Dr. Shubin considered to be the marks of past impregnations. With one exception it has so far been impossible to find more than one scar on an ovary; the exceptions showed two scars. Practically, then, in the case of the fur seal, ovulation may be considered as synonymous with impregnation, since neither Mr. Townsend nor myself have found more than one recent scar on an ovary.

In the evening we returned to St. Paul.

## SEPTEMBER 4.

The morning being favorable for driving seals it was decided to try the chute. A drive of about 3,000 seals, chiefly from Middle Hill, English Bay, and Lukanin, were brought in.

Professor Thompson, Mr. Macoun, Judge Crowley, Colonel Murray, and Mr. Redpath were present.

## THE CHUTE.

The chute was located at the head of the lagoon in a small valley opening into the water. It consisted of a narrow passageway about 4 feet wide and 20 feet long, sufficiently large for the passage of a good-sized bull seal, wings extending out into the rear to gather in the seals. At the outlet were two gates hinged from above and arranged with pulleys so that they could be readily lifted. These gates formed

a V-shaped extension of the chute and each one constituted an opening as great as the width of the passage itself. The design was to open the gates alternately, letting out killable seals at one side and nonkillable ones at the other.

The seals were driven up to the chute in pods of 40 to 50, as they would be at a killing. At first they were allowed to pass through with both gates open in order to determine whether they would pass through. They did this fairly well. Occasionally there was difficulty arising from the tendency of the leader to turn about on coming close to the frame of the gates, stopping up the way and causing the seals to pile one on another. The post dividing one gateway from the other proved an insuperable obstacle to the animals, many of them running their noses into it point blank.

One gateway was then closed and the seals allowed to pass out of one side only. When a break occurred in the line of seals the gates were reversed. This made no difference to the seals: they would go out of either side readily enough. But the difficulty arose when it was necessary to reverse the gates at close range. When the leading seal started, all the others rushed after pell mell, making it impossible to shut the gate when once the line started through.

This tendency on the part of the seal not to go at all until he feels like it and then to go in a mad rush, soon demonstrated the impossibility of ever culling the killable from the nonkillable seals in this way. With more finely adjusted machinery better success might be had. The present apparatus is crude, but it seems sufficient to demonstrate the impracticability of the plan.

The seals are stupid, awkward, and withal dangerous beasts to handle at short range. They bunch together and try and see how many deep they can pile on one another. When one on the outside decides to start in any direction, the whole lot follows in a mass. The present way of culling out the killables by knocking them down and allowing those with which they are mixed to escape seems to be the best method of handling them.

The seals operated upon this morning were for the most part old bulls and half bulls, with occasional holostiaki mixed in. These animals are much more easily managed than the little fellows, the yearlings and 2-year-olds, as the former are somewhat afraid of each other.

#### HERDING IN THE LAGOON.

The seals on being released from the chute were then turned in the Lagoon, in order to experiment with the idea of herding up rejected seals so that they need not again appear on the hauling grounds until after the season is over.

The Lagoon is a body of salt water containing about 300 acres of space. It is cut off from the sea, except for a narrow channel, by a rocky spit. Having direct connection with the sea it therefore seems likely that the bachelor seals could be kept there during the month of July without any inconvenience to them. The Lagoon is easily accessible for the Reef, Gorbateh, Lukanin, Kitovi, Tolstoi, and Zapadni rookeries. It would not be a very long or hard drive to bring to it the seals from Polovina, and judging from the appearance that 3,000 seals make the place might easily contain 50,000.

After the killings on the respective grounds of these rookeries the rejected seals might be rounded up and driven very carefully and slowly to the Lagoon and kept there until the season for killing was over. This closes about July 25. They could

then be turned out to sea, if such a thing seemed necessary, and allowed to remain there for a time, when they could again be rounded up from their hauling grounds and kept out of reach of pelagic sealers during the month of August. Judging by the capacity of the bulls to fast four months, a fast of a month would seem not to be impossible for the younger seals.

The Lagoon could take care of all the rookeries except those of Northeast Point. Near the killing grounds at this place is Webster Lake, a considerable body of water, which might be utilized for a similar purpose.

To carry out these plans it would be necessary to fence the Lagoon and put in a row of palings across the channel; also to fence Webster Lake. As, however, the sealers take a considerable number of males, the shutting off of the supply would do much toward rendering the business unprofitable, and the seals saved to the United States would more than repay the outlay in fencing and caring for seals.

As there is no fence about the Lagoon it was necessary to station native guards about it at intervals of an eighth of a mile to keep the seals from making their way out. Boats with men in them were anchored in the channel to guard the way to the sea. They at once showed a tendency to get over the bowlder spit at the point where it joins the rocky cliff. Evidently many of them know the way out here from experience in former drives. As soon as the tide began to set in through the channel many showed a disposition to follow its course out. In the channel the seals were rather difficult to manage; they kept up their efforts to escape in this direction persistently all the afternoon, but the men had no difficulty in frightening them back. On land, of course, the men had no difficulty. Each native set up such pieces of driftwood as he could find on his beat and referred to them as his helpers. They seemed quite effective in driving back the seals.

The seals were put in at 9 o'clock in the morning and held until 9 o'clock at night. The weather was extremely unpleasant, being windy, rainy, and cold, and developing into a gale at night.

The natives, when they found that they were to guard the seals in the Lagoon over night, stipulated that a member of the commission should be detailed to watch with them, as they claimed the seals could not be held at night and they did not want to be blamed if they escaped.

#### THE HERDED SEALS.

During the afternoon for four consecutive hours the movements of the seals were watched. They spread over the entire surface of the lagoon. At three points they made constant efforts to escape, viz, through the channel, over and at the angle of the cliff, and across the country in the direction of Tolstoi. It was, however, only small bands of seals that made trouble. For the most part the seals swam about, played, and slept just as they do in the water off the rookeries.

At 3.30 o'clock the seals were stretched out in a long line from one end of the lagoon to the other. For half an hour there was little change. Then they began to bunch in certain parts and to sleep. A pod of about 50 approached the narrow sandy beach toward Tolstoi and for some reason took fright, plunging back into the water. At intervals of five minutes they continue to do this for half an hour. On going round to the sand beach it was found that a walking stick stuck up in the sand had been the cause of the fright of the seals.



After a while the seals try the beach at a point beyond the stick and are allowed to go to see what they will do. Every few rods one drops out and returns to the water. Other bands of seals swim in, and in course of half an hour there are a hundred seals sitting on the bank in the shallow water. They are growling and fighting in mock fashion among themselves. They are nearly all old bulls. Occasionally a little pod of three or four fellows set out on the trail of those going up the slope. Most of them come back after a few rods. Then all those on the shore start, but the boy drives them back. They all swim down the lagoon, but in ten minutes are back in the shallow water again. They act exactly like a flock of sheep would if herded near a wheat field by a boy.

The natives say the seals can smell the sea from Tolstoi, which is to the windward, and that is the reason why they want to get out there.

Going back along the course of the drive I find 2 old bulls that dropped out of the flock and hid in the grass. They are lying sleeping, but on my approach they rouse up and show fight. Try to drive one on the lagoon side into the water, but he will not go. He charges at me very fiercely. The other fellow simply lies low and growls.

Up the side of Telegraph Hill is a big bull making a zigzag track. He is halfway up. The grass is very tall, but he is making good progress. He, too, is making for Tolstoi, but is going directly away from the lagoon. He toils on and finally disappears over the summit. It is seal fashion to take the absurd course he has chosen.

Everything seems to indicate the entire feasibility of keeping the seals indefinitely in the lagoon, but the Aleuts continue to insist that it can not be done overnight. Nickoli Krukot, one of the most intelligent natives guarding the seals, says the animals can not be held. He says they have to go into the sea, and no man can stop them. Thinking the dislike of guarding the seals may affect his opinion, I told him that if the natives continued to insist that the seals could not be held, it would be necessary, in order to prove it, to keep them there night and day. It was explained, however, that, if next year it was thought best to so herd the seals, the lagoon would be fenced and the Aleuts would not have to guard.

This settled Nickoli at once. He declared that with a fence there was no question about holding the seals.

#### SEPTEMBER 5.

#### THE HERDED SEALS.

Very rainy and disagreeable. Mr. Clark went out at noon to see how the seals in the lagoon were getting on. There are 300 swimming about in the water under the lee of the bluffs toward Tolstoi. None are seen to attempt to get out by way of the channel. Some could be heard growling and snorting on the rocks under the cliffs on the other side, showing that they have landed there.

At the sand beach toward Tolstoi about 100 were hauled out on the shore. As many as a dozen separate trails ran in the direction of Tolstoi, clearly marked in the long grass, showing where as many bands of seals had traveled off toward Tolstoi. Some of the trails merge together, but for the most part they are distinct throughout their entire course. They evidently did not propose to follow in one another's tracks, which is true seal style.

A band of about a dozen seals are perched on top of a sand dune overlooking Tolstoi Sands. It is, doubtless, too steep on the other side for the seals to descend. The seals on the beach and in the lagoon are apparently content.

On looking for the 2 bulls hauled out yesterday from the drive, they were found to have wandered about for considerable distances among the sand dunes, one of them still lying in a hollow back from the lagoon.

#### CLASSIFICATION OF DEAD PUPS.

The following is a tentative classification of dead pups, with causes of death, August 1 to 10:

Fell from cliff.....	3	Cut scalp with pus.....	2
Under falling rocks.....	3	Kidneys swollen.....	1
Inflammation of bowels.....	2	Drowned (6 on Tolstoi).....	12
Skull fractured.....	2	Inflammation of lungs.....	1
Large pups, trampled on, congested lungs.....	36	Bitten by cow or bull.....	2
Starved and trampled.....	11		
Starved.....	25	Total.....	108
Cause uncertain.....	8		

Of this number 55 were males, 51 females. In two cases the sex was not determined.

These pups were all dissected and the number represents about one-third of all the pups on the rookeries fresh enough to be handled.

Very young pups drowned on places like Sea Lion Neck are washed into the sea by the surf. But very few of these. The deadly surf nip is a myth invented to account for the dead pups on Tolstoi Sands, washed by the surf from the rookery front.

Many of the early starved pups which die between August 8 and 15 are the victims of pelagic sealing. A mother might be returning from a week's absence on the feeding ground when taken by a schooner on August 1.

Mr. Lucas suggests the possibility of using a galvanic cauterizing instrument for branding. It might make a scar with less effort.

Mr. Lucas reports that Mr. Barrett-Hamilton examined a bull from Zoltoi killed for Professor Thompson. There was no sign of scrotum, testes being withdrawn into the body. A testicle examined was shrunken and hard, yielding practically no liquid, and thus showed no trace of spermatozoa when seen under microscope.<sup>1</sup>

It would seem that in the fourth, exceptionally in the third year, the testes descend into the scrotum, and that in the old bulls at least they are retracted at the close of the season's work.

#### BRANDED PUPS.

Mr. Clark visited Lukanin rookery in the afternoon to look after the branded pups. Twenty-six of them are to be seen along the water front, doing much as the other pups are doing. Some are going into the water, others coming out. One is nursing.

<sup>1</sup>The absence of testes in the scrotum was characteristic of all bulls killed and was due to the fact that in traveling the animal draws the testes into the body. In a bull killed on Zapadni in October the same phenomenon was observed, but pressure on the abdomen caused the testes to appear, and they could be forced back by pressure. See notes for October 11 and 17.

## SEPTEMBER 6.

Dr. Jordan, Mr. Lucas, Mr. Barrett-Hamilton, and Mr. Clark visit Gorbatch in the afternoon.

## GORBATCH.

The usual number of hair seals are out on the rocks at the point.

Mr. Lucas counts 4 additional starved pups, making in all 15 to the present time. These have died within a week.

A wet cow is seen to recognize a pup which looks as if he were half starved. He is very eager, but his mother is slow to give him a chance to nurse. The little fellow seems almost ready to eat her up. He fights off the other pups in the way and keeps shaking his head and calling to his mother. Two other pups, plainly starving, are following the cow. These she drives off. This cow has probably been an unusually long time away. At last she climbs to a flat rock near the head of the cliff, pushes a pod of sleeping pups off from it, and, after much delay, she nurses her own.

There are many starving pups in the "slide." The old bull in A's position still holds his ground.

## LUKANIN.

After returning home Mr. Lucas and Mr. Clark went over to Lukanin rookery to see the branded pups. Sixty-six of the 124 are counted from the top of the cliff without disturbing the seals. A close count was not attempted.

One branded pup is seen out in the water swimming among the others. He is apparently enjoying himself quite as well as his fellows. Three are seen to land from a swim within a few minutes. Two are seen to swim out. One is nursing. His mother lies on a rock and the pup stands on his hind flippers, showing the branded back to good advantage. The pups seen are, in general, doing just what the other pups are doing. None seem to feel any bad effects, though the inspection is not close.

On the west side of the hauling ground on Lukanin Hill there is a bright, fresh green strip of grass which fringes the entire west side and rear end of the hauling ground. Beyond it is a much wider strip of the yellow seal grass which marks the shrinkage area of the rookeries. The green strip on the west side is 15 feet wide; the yellowish strip beyond is 65 feet. Distributed through the abandoned area are boulders similar to those on the hauling grounds. The seals once occupied the entire width of this strip of 80 feet, and the fresh young grass probably marks the area abandoned this present year, showing that the hauling grounds shrink away toward the rookery. This is but natural, as the bachelors try to get as close as possible and are kept away by the bulls. They always keep as close to the harems as possible, and therefore any shrinkage must be visible on the outer side, or away from the rookery.

## INTERVIEW WITH ARTIMONOF.

In the afternoon Dr. Jordan had an interview with Kerik Artimonof, at which Apollon, the native chief, acted as interpreter, with a view to obtaining information regarding the old rookery said to have once existed on the North Shore.

Artimonof said in substance:

"I am the oldest man on the island, and was chief for eighteen years during the time when Dr. McIntyre was superintendent of the company. Marunichen was a small

rookery when I was a boy, about seventy-five years ago. In those days a small body of seals gathered on the rocks of the point south of North Shore. There was a little hauling ground behind and another farther east on the next point and on the island adjoining it offshore. The rookery was smaller than Little Polovina is to day. I never saw a drive from there, but heard the men talking about it. They used to kill the seals there and carry the skins to the village at Northeast Point."

Artimonof continued and said:

"At Northeast Point, you would not believe it, but the seals, cows and bachelors, covered the whole point as far south as Webster Lake and in from the east shore to where the present salt house stands. The beach all around was one continuous rookery.

"Thirty-four years ago (probably in 1834) the summer was late, so that all around the island was piled up with snow and ice, so that the seals could not land. Thousands of them were killed under the ice, and after that there were very few seals on the island, so that only 100 bachelors a year were killed for several years. They never killed cows. After that time the rookeries were very small for a long time. There were only 2 bulls on the Lagoon; only 7 bulls were left on Gorbatch, and all the rookeries, Northeast Point and all, were very much smaller than now.

"In later days they killed 3,000 male pups for food each winter, but the seals went on increasing just the same. They did not kill female pups. They took the pups up and examined them, letting the matkas go.

"At that time they used to kill half bulls (4 and 5 year olds) to make strings and cords to tie up the bundles of skins with.

"There has not been any more killing of the seals under the ice since 1834. The natives always go now and break roads through the ice to let the seals land.

"One thing you ought to know is that the cow seal never lets any pup suck except her own; they never feed other pups. The matka comes on shore and feeds her pup and then she goes off 60 miles or more to eat. She can't lie around on the rookeries like the bachelors and have milk for her pup."

#### GENERAL NOTES.

Mr. Redpath says that the killing of seals by the blocking of the ice was formerly well known among the natives. The most disastrous season was somewhere about 1834.

The natives have several times in the spring dug away the ice so that the seals could haul out. The earliest drives of bachelors are for food, and the natives are anxious to get fresh seal meat as soon as possible, so they see to it that every obstruction is removed.

The rookery of Spilki, according to Mr. Redpath, gradually disappeared. The cows seemed to go first. The bulls would haul out, but finding few or no females, after a time they went away, probably going over to the Lagoon. It was thought that the running of the steam launch close to the foot of the rookery in the spring while unloading the company's vessel had something to do with the disappearance of the rookery. There was no hauling ground of any consequence connected with the rookery. Its extent was between the present landing and the cliffs under the hill. Its former extent and outline are marked by the usual seal grass.



Mr. Redpath says that Lagoon rookery was larger at the time of his coming than it is now. It has been permanent, like the others.

Of the 24,000 skins obtained this year on St. Paul, Mr. Redpath thinks that 1,000, more or less, were long 2-year-olds and almost as many were short 4-year-olds. The skins of the latter would weigh about 10 pounds, those of the former 6 pounds or even less. The number of 2-year-olds taken this year is greater than usual of late years.

Judge Crowley reports that while at East Landing, on August 30, he saw about 200 pups in the surf diving for and playing with jelly fishes which were floating in the surf. They would tear a jelly fish by shaking it in their mouths. He could not tell whether they ate any of the fish or not.

#### SEPTEMBER 7.

##### LUKANIN.

Dr. Jordan visited Lukanin this morning to see the branded pups. One was examined and found to have pus in the anterior cross bar. It is best not to have two bars cross each other. The mark on the pups need not be so broad, and perhaps not so deep. One scar would be enough. One branded pup was scratching his back. Another showed the third bar raw and festering.

A great number of cows and pups are sleeping among the rocks in the sun at Lukanin. I creep up slowly and sit down at the edge of the mass. Only a few notice me, sleepily. As I cease to move, no attention is paid to me. A young cow 6 feet away lies on a rock. She turns sleepily toward me from time to time. The seals are not afraid of man. A bachelor would stampede them as quickly. One gray pup sees me and creeps off quickly. I go up within 4 feet of the cow; she remains half asleep watching me, showing no fear. Only the gray pup has become frightened. He does not stop till he gets to the water. I whistle to the cow; she pays no attention. I go quietly away; she does not move. The gray pup is the only one that has shown any inclination to run from me.

There are a considerable number of starving pups and some dead ones in every pod on Lukanin.

##### TOLSTOI.

Dr. Jordan and Mr. Clark went to Tolstoi this afternoon.

In going by the Lagoon we could see where the seals had climbed over the cliff on the opposite side and made their way back to Tolstoi from the top of the hill. We followed out the tracks from the head of the Lagoon to where the seals entered the water off English Bay sands. Most of them evidently went out this way. They have an idea of locality even on land.

The area of the sandy tract was measured and found to be 165 feet wide to the foot of the green cliff and 720 feet long.

The pups are rapidly turning gray. Not a single dead pup not emaciated has been added since our count of August 12. Many emaciated ones have been added and many are just about dead.

## SEPTEMBER 8.

Mr. Lucas went this morning to Kitovi to get some specimens of starving pups to take home in alcohol. Following are his notes:

"I found a very large and old starved gray pup almost as big as a yearling. There is no time to investigate its stomach, but if pups are able to take their own food in September this pup was certainly old enough and strong enough to have obtained food and certainly would not have starved. He is much larger than any pup yet seen by me, and must have been born early in June. His teeth are well developed and seemingly good enough to catch any small fish with.

"A large bull on Kitovi is very loud and active in rounding up 3 2-year-old cows who are alarmed by my presence, and 3 young bulls are fairly bold for this season, standing their ground pretty well. Altogether this corner is more suggestive of July than anything that I have seen of late. The pups sleep soundly, and I am obliged to awaken several of them in order to recover the gray pup."

## THE MOVEMENTS OF THE COMMISSION.

At 10 o'clock, the *Rush* anchored off the village, and, as the landing seemed not likely to remain good long, Dr. Jordan, Professor Thompson, and Mr. Lucas went on board at once. The *Rush* is to take them to Sitka, and from there they expect to reach the Sound on the steamer *Topoka*.

Colonel Murray expects to get away on the *Corwin* about September 20. Messrs. Clark, Macoun, and Barrett Hamilton remain to count the dead starved pups about the first week in October, the *Grant* being detailed to wait and take them off when the work is done.

OBSERVATIONS ON THE PUPS.<sup>1</sup>

In the afternoon Mr. Clark spent an hour watching the pups in the water at the northern end of Black Bluff. The top of the towerlike rock serves as an excellent observation point.

Watching the various movements of the hundreds of pups in the water one can not help thinking that they are getting ready for their descent upon the fishes. One little fellow has a small round object. It might be a cork or a tunicate. It floats nicely. He dives and comes up exactly under it so that it falls into his mouth. He takes it down with him, releases it, and follows it up, catching it the instant it appears on the surface. Then he shakes it, letting it fly out of his mouth, leaping after it and coming down on it with open mouth, taking it with him. This performance he repeats over and over.

Another pup is playing with something like a piece of jelly-fish, but the distance is too great to make it certain. He comes up with it in his mouth, shakes it and dives after it, always recovering it and bringing it up, although it sinks readily. He finally lands on the rock and lays down the object which is certainly a part of a jelly-fish. A wave washes it off the rock. He dives and brings it back. Leaving it, he goes out among the other pups, playing and diving as before.

The flat rocks all about the foot of the tower are covered with sleeping pups. Occasionally one goes into the water; others come out and lie down. Among the pups

<sup>1</sup> From this date until October 20 the record is the work of Mr. Clark.

are a lot of yearlings. There are probably 200 pups on the rocks, and of this number there are about 35 yearlings. There are many yearlings also playing among the swimming pups. There is no difficulty at all in accounting for 15,000 or 20,000 of these little fellows from the number of them daily to be seen in the water and on the rookeries and hauling grounds.

One 2-year-old on the rock below me is playing bull with the little pups, rounding them up, imitating perfectly the movements and sounds of the old bull on the harem ground. Near him is a little yearling doing exactly the same thing. They keep the fussing up right along, though the pups are sleepy and cross.

The water here is quite deep, but has a bottom of light-colored rocks, so that you can see all the motions of the swimming pups. They dive to the bottom and go along with their noses on the rocks as if feeling for something until their breath gives out. Then they come up for air and go down again. They dart hither and thither in the water like fish. One could easily suppose that a little fish in this water would have a hard time of it. But the pups, while quick to catch the object with which they are playing, do not so quickly take up with a new object. I threw a stalk of arctic wheat in the water just now. It was a moment before any pup noticed it. Then one came up and cautiously put his nose to it, later taking hold of it and biting it. Then he took it by the middle, diving with it and going through all the motions before observed with other objects.

A dozen other straws thrown in are quickly appropriated by as many apparently delighted pups. Many pups are playing with pieces of seaweed. One little fellow has a small feather. This seems to please him very greatly. He carries it down with him and catches it from below with unerring precision. From the way in which they play they apparently never take their eyes off the object. When other swimming pups come along they sometimes plump into the playing pup, who pays no attention, or at least does not allow his attention to be diverted to such an extent as to lose his plaything. The pups, as a rule, do not attempt to interfere with one another.

Judging from the motions of two little pups in the water, one can not help thinking that those who have seen copulation in the water have mistaken this play for the act. These little pups have their noses together and their front flippers wrapped about one another and are rolling over and over, having a jolly time. Then they break away and chase one another. Bachelors have been seen playing in a similar manner.

There is a little pup in the water marked in a peculiar fashion. The tips of his fore flippers are pink inside and out at the tips. It looks as though the flippers had been shaved down so that the flesh showed. Both flippers are marked in the same way. It does not seem to incommode the little fellow as he is playing as lively as one could expect.

A little fellow is swimming in from some distance out with about a yard of kelp balanced in his mouth and streaming out behind. He goes out of sight under the projecting rock.

#### SEPTEMBER 9.

Mr. Macom and Mr. Barrett-Hamilton went on a collecting trip to Southwest Bay and Bogoslof. In the forenoon I went over to take a look at the Reef.

## ZOLTOL.

On the way a little band of about 75 pups were noticed out on the rocks on this side of Zoltol Sands and under the village cliff. The water of the bay is full of swimming pups.

There is an unusually large number of bulls and half bulls on Zoltol Sands and bluffs. Among them are more bachelors than have been seen there for a long time. Many, evidently, have recently returned from the water. The usual number of bulls are sleeping on the sands and in the little cove on the other side of the neck.

The testes in a large number of bulls were observed. Some show them plainly, others less distinctly, while others show no trace at all.

## REEF.

The pups in going into the water probably do so for the sport and enjoyment there is in swimming. Their inherited instinct for catching fish prompts them to pick up and toss about any object, stick, shell, feather, or whatever may come within their reach. They do not need to eat, because they are still nursing.

The cow evidently knows her pup's voice. A little wet dripping pup calling loudly is making his way up through the crowd of sleeping cows and pups to the bunch by the rock on which I am sitting. A cow suddenly sits up and answers him. He comes directly toward her, is recognized, and begins nursing. The cow was apparently awakened from sleep by the voice of the pup. She was perfectly dry, and the pup had been swimming. This is back at least one eighth of a mile from the shore.

I get down from the rock and make my way slowly through the sleeping crowd of cows and pups. A young bull awakened suddenly is very much frightened and causes a stampede by his running. I hide behind a rock and the seals quiet down. In a few minutes I make my way through the line to the bare space between it and the beach. A few only of the cows make their way to the water, the great mass keep their places.

The "spreading" is more marked to day because there are more cows on shore. On account of the steep slant of the bowlder beach one can walk along here entirely out of view of the cows above. There are many pups, cows, bulls, and yearlings at the water's edge, and the water is full offshore.

Twenty little yearlings are counted here on the stones of the beach in a space of 100 feet. There seems to be about the same number of 2-year olds. The reef has a length of about 5,000 feet. Here would be 1,000 of these yearlings on the rocks of this rookery alone. In the water the yearlings seem to bear about the same proportion, and they are to be found on shore wherever the pups are. Adding to the 1,000 on the rocks, a like number for the water, and an equal number for those scattered among the sleeping cows and pups, you have 3,000 yearlings for this rookery alone. Reef rookery has about one-tenth the number of seals. Here would, therefore, be 30,000 yearlings. This kind of calculation is not worth much. But one can easily see that a large number of these little seals may be scattered over the rookeries, and it is not at all necessary to suppose that any of them do not come to the islands.

There are many deaths due to starvation along the shore, and many pups are dying in out-of-the-way places among the rocks. It will be necessary to look sharply if all are counted. Some of the older dead are bound to be lost, especially those dead in runways of bachelors and other places where there has been much moving about over the bodies. The skulls of two dead gray pups are taken.



As I pass the "slide" hastily I note that the two old bulls that belong under the cliff on the shelf are gone, and in their place is a fine-looking young gray bull which I have not seen before. The outlying harems are all gone.

## BLACK BLUFF.

In the afternoon a visit is made to the pinnacle of rock off Black Bluff. Took a fresh sculpin about 15 inches long, tied it to a short stick of wood to keep it afloat and dropped it off into the water among the swimming pups. The splash scattered them for an instant, but presently four of the pups came to inspect the fish. They dove under it, coming up rubbing their backs against it. One of them took it by the tail and pulled it down into the water. Another took the stick and swam away with fish and all, followed by the others. For an hour they played with it until it drifted out of range down toward East Landing. By this time the fish was torn to shreds. I could not see that any of it was eaten. They treated the fish as they might have treated a piece of cloth.

Below me, on the rocks of the point, are 2 of the branded pups from Lukanin. They are both sleeping. One is dry, the other has not long been out of the water. To get to this point from where they were branded these pups must have swam more than a mile.

## BRANDED PUPS.

In going up to Lukanin I find another of the branded pups in the Amphitheater of Kitovi. It lies on a stone the farthest back of any pup. It must have made an unfortunate visit to Lukanin on the morning of the branding, or else it is making a visit to-day.

Below the Amphitheater on the beach lies a long slender piece of wood, the branch of a tree. Four pups are apparently trying to get it out in the water. It is half in and half out. They take hold of it with their teeth, one at each end and two in the middle. They were probably playing with it in the water when it was washed ashore and they want to get it in again. At least, one could easily imagine so from their actions.

Under the brow of Lukanin hill is a pup which was badly burned in the branding. The three bars through their center length are raw and inflamed, and the pup is evidently uneasy. Two other pups are seen with inflammation in one or more bars. All others seen are apparently doing well.

## SEPTEMBER 11.

The storm of yesterday prevented going anywhere.

## BRANDING ON KITOVI.

Colonel Murray, Mr. Clark, and Judge Crowley, with 12 natives, went to Kitovi rookery for the purpose of branding more pups. Mr. Macoun and Mr. Barrett-Hamilton were also present. It was decided to put just one brand across the shoulders.

On passing the Amphitheater of Kitovi the triple-branded pup, which was seen two days ago, was found still there near its former position. It seems in good health and spirits. This must be its home.

The scene of the branding operations this morning is on the flat just above and back from the middle of Kitovi rookery.

Two large pods, cows and all, are driven up. There are an unusual number of cows in this morning, as the sea is wild from the storm of yesterday. As many of the cows as possible are worked out as the pods are driven up. When the drove of waiting animals grows small the cows are noosed and dragged out. The pups are examined for sex and culled for weak and starving ones. The work goes along quickly this morning. In less than two hours Colonel Murray had 191 pups branded. Toward the end time was kept, and it was found that 9 pups were branded in a minute and a half. There is a little inclination on the part of the men to throw the pups about unnecessarily. Though spoken to frequently they seem to forget readily, or, what is more likely, they dislike the work. They evidently look with strong disfavor on branding, and are more or less sullen. If branding is done on a large scale it will need to be carefully supervised.<sup>1</sup>

The presence of cows in the pods is hard on the pups. In dragging out the cows from one pod a large male pup is smothered. He will be taken home for experiment in castration and for examination of stomach contents.

In searching for freshly dead pups on the rookery one was found gasping and nearly dead. It could just raise its head, but could not get up. Fifteen minutes later it was found to be dead. A quantity of black, tarry excrement had been voided in the death struggle, which seems to be a common occurrence. The animal's mouth was wide open and pressed to the ground, just as was the case with the experimental pup.

#### EXPERIMENTS IN CASTRATION.

The dead pup brought home for experiment in castration and examination weighed 19 $\frac{3}{4}$  pounds. It was in very good condition. It has begun to shed; the fur shows brown. Judge Crowley says that it is the water hair which comes out through the new fur that gives the gray color to the pups.

Dr. Voss operated on the dead pup and thinks it will not be a difficult thing to castrate a living pup. The testes were found near the surface and within easy reach. He is willing to try a live pup later.

The stomach of the pup was empty save for a little mucus and a dozen or more small, jagged pebbles. Either the pup was beginning to starve or else his mother had been absent for some time. It is, however, not likely that an empty stomach necessarily indicates a starving pup if the animal is otherwise in good condition.

In the afternoon I visited Reef rookery. As on Kitovi, an unusually large number of cows are on shore. The water for the usual distance out from shore is full of pups and yearlings. They play in the tremendous surf without fear; they have now learned to dive under to avoid the curl of the big white breakers.

#### ARDIGUEN.

There are at least 3 freshly dead pups since our visit of September 7. Two young bulls which were not there day before yesterday are on the level at the south side, each

<sup>1</sup>It became evident later on that the natives believed that the pups so branded would all die anyhow. An opportunity to correct this notion was found later on. When the pups had fully recovered the chief and some of the old men were allowed to inspect them.

with a small harem. The gray bull seen two days ago was probably one of these. The bull of late stationed under the cliff on the shelf has withdrawn back about 100 feet under the cliff leading up to the parade ground. He has 7 cows and 2 pups sleeping about him.

Coming home I paced the Reef drive with a view to giving the area of the different typical portions of the drive, finding it to be roughly 5,031 feet long from its beginning in the edge of the parade ground to the killing field at East Landing.

#### SEPTEMBER 12.

A big storm is on hand this morning, with high wind blowing from the east and thick fog. Remained indoors and copied extracts from the Government agent's log.

In the afternoon I went over to Lukanin and Kitovi rookeries, stopping for a moment at the observation point on Black Bluff. No pups are in water about the point, but in the shelter of the rocks are about 100 pups and 2 or 3 bachelors sleeping out of the reach of the surf. Among these pups are 3 of those branded yesterday morning. They seem in good spirits.

The surf breaking over Kitovi bight is something terrific, nevertheless pups are everywhere in it, swimming, playing, ducking under each white breaker as it comes in and coming up in its rear. In the center of the bight where the little seaweed beach is, the water out for a considerable distance is full of seaweed. Out about three breakers from the shore are about 100 pups in a pod, diving and sporting in this seaweed. Many of them are shaking pieces of it about, and on the whole they are acting just as they might if the sea were calm. They show a surprising amount of watchfulness in keeping out of the way of the breakers. One could imagine that it would be the last of a pup if he got caught on the crest. Though watched for half an hour nothing happened to any of them. They seem well able to care for themselves. No bachelors or old seals are in sight in the water.

It would seem that the pups under the cliffs at the point of Black Bluff stay there all the time. There seem to be about the same number there every day. But they evidently come and go, as is shown by the presence of the newly branded ones.

An unusually large number of cows are on shore to-day; the storm has driven them in. Many bulls are out on Zoltoi and Lukanin beaches.

#### SEPTEMBER 13.

The storm is still on, with thick fog and heavy surf off the east side.

In the afternoon I walked out past Lukanin. No seals were on the hauling ground. Many cows were on land, driven by the storm. Cows and pups look uncomfortable; all perched on stones where possible.

#### LUKANIN BEACH.

On Lukanin beach one pup, freshly dead, is washed up. It looks as if the pup might have been drowned. Very emaciated, doubtless washed over from Lukanin; possibly drowned in a weakened condition. Beside it is another pup denuded of hair, evidently also washed from Lukanin.

There are 150 old bulls on Lukanin beach and among the sand dunes behind. A very few bachelors are among them. The old bulls leave the rookeries, but they have

evidently not left the island. There are about 600 of them on Zoltoi bluff's sands, and in the cove at the east side and at the hauling ground beyond it toward East Landing.

I cross Telegraph Hill to Middle Hill. Many bulls and a few bachelors are on the hauling ground. The beach of English Bay is thickly lined as far as can be seen in the fog with old bulls. They, like the bachelors, are becoming more numerous within the past few days. Has the storm driven them in or are they returning from feeding? They are fine-looking fellows, apparently entirely recovered from their emaciation.

#### TOLSTOI.

The sand flat of Tolstoi is wholly deserted except for a few cows and 2 small pods of pups under the green cliff. All are far up in the rocks on the hillside. The reason for their abandoning the sandy area is evident. The rain of the past few days has cut it up into gullies where the little streams have run down. The dead pups are being used up fast. The prospects for getting them all in a count are not good. The whole thing has changed since Dr. Jordan and I were here on September 7. Sand is washed over and covers many of the pups longest dead. Here and there over the tract as you walk a pup supposed to be freshly dead will start up and run away with a piteous cry. These are the phantom-like starving pups.

It is a question whether it will not be just as well to begin counting the pups a week earlier. We are sure to lose many by the high surf, and these beating storms will play the mischief with those long dead. The early dead ones show more disintegration as a result of the past few days of storm than during the whole of August.

#### SEPTEMBER 14.

I went this morning with a mule team and several natives to Lukanin to get some pups for experiment in castration. Mr. Barrett-Hamilton and Colonel Murray went along. A drive of 24 pups was made to the edge of the hauling ground. Picking the twelve biggest they all proved males. Did not examine the sex of the small ones.

The pups were brought home in the wagon. A dead cow was found lying a little above high-water mark. She was fresh and bleeding at the month. No external evidence of injury beyond the bleeding. She was brought home also. Mr. Barrett-Hamilton wants her skin.

#### THE CASTRATION OF A PUP.

Dr. Voss proceeded to castrate one of the pups. For some reason the testes were very difficult to find, necessitating a deep incision and very careful dissection to secure them. After the organs had been drawn out preparatory to cutting them off, the pup drew them back into the body cavity. It took nearly half an hour to perform the operation and stitch up the two incisions to prevent the intrusion of sand. Doubtless more care was taken than absolutely necessary.

The work was done by Dr. Voss, the island physician. The difficulty attendant upon it and the length of time required seemed to indicate the impracticability of castration on a large scale, and it was decided not to experiment on the other 11 pups. The castrated pup was then branded across the crown of the head and put back with his companions and returned to Lukanin. He did not seem to mind the treatment he



had received, when the operation was over, though, he manifested a good deal of sensitiveness under the knife. The difficulty in the way of castration lies in the fact that the testes can evidently be drawn up into the body cavity at will by the animals. There they lie beneath muscles and in close proximity to organs that must be avoided.

It is probable that it would be equally if not more difficult to castrate a yearling, and doubtless also a 2-year-old, as the testes seem not to appear in the scrotum until about the fourth year, and it is likely that they can be withdrawn at will even after they come down. Many of the old bulls show no trace of them in the scrotum, while others do. The pup can be handled with some degree of safety, but a yearling or 2-year-old would be an exceedingly difficult animal to control during the operation.

#### THE DEAD COW.

The dead cow was examined while being skinned. No trace of injury appeared under the skin. There was milk in the mammary glands, though it seemed to be drying up. The lungs were very deeply congested, pointing to the possibility of drowning. The heart and other organs were apparently normal. The stomach was found to be full of black clotted blood. One ovary shows the presence of a scar, and the horn of the uterus attached showed inflammation, as though recently impregnated. The other ovary was free from scar; its horn of the uterus enlarged as if not fully recovered yet from the birth of the present season's pup. Uterus and ovaries saved in formalin for Mr. Lucas.

By accident it was discovered that a vicious fish bone was found sticking in the animal's throat. It had pierced the veins of the neck and was doubtless the remote if not the immediate cause of death. The throat, fish bone and all, saved in formalin for examination.

In the evening I went to see the pups at the point of Black Bluff. The little colony of about 100 is still in a sheltered place under the cliff. They seem to make this a permanent home. Three of the recently branded pups from Kitovi are here. Another is swimming in the surf a short distance out. The pups in the surf are perfectly reckless, but apparently know what they are about, as none are seen to get into trouble. There are among the pups gray ones and black ones, small ones and large ones, fat ones and lean. Some look as though they are beginning to starve, but all are strong and active. One or two gray pups already show the brown belly of the yearling.

#### SEPTEMBER 15.

The stormy weather of the past few days has moderated. The surf is down, but it is still foggy.

#### OBSERVATIONS ON PUPS.

I watched the pups from the point of Black Bluff. The heavy surf has filled the water along Kitovi Bay with seaweed. Every pup is happy because he has something to play with.

Five of the single-branded pups are to-day on the rocks in the shelter of the cliff. Three go off into the water for a swim. They all seem as lively and playful as their companions. The single brand is quite as distinctive and much less hard on the pup. It does not mar the skin so much, perhaps, but must damage it considerably.

Nearly every pup in the water is playing with seaweed. It may be noted that as far as this goes every one of the hundred or more pups on the rocks who is awake is in much the same manner chewing and shaking his neighbor pup. Pups have been watched on many occasions playing with seaweed and never has anything been seen that would lead one to suppose for a moment that they ate it.

A pup is playing with an oyster shell. He shows great skill in diving for it and finding it in the water. Among the pups before me is one of the 3 brand pups from Lukanin. The brands look pink and raw throughout their length and breadth, but the pup is lively, playing and diving with his companions. He soon passes along out of sight in the direction of the Reef.

Eight of the single-brand pups from Kitovi are under the ledge at the head of Black Bluff in another place. This makes 13 in all. One strong lively pup has a gash about 2 inches long in his side. The wound is fresh. He sees me and takes to the water.

Passing slowly along the beach the little pups, of which there are 200 or 300 on the rocky ledge projecting into Kitovi Bay, allow me to approach in full view of them. I count 11 more of the single-brand pups. One of the triple-brand pups from Lukanin is here also.

Creeping up to the ledge over the place on Kitovi where the pups were driven for the last branding, I find 12 of them sleeping within a short space. Three are lying beside their mothers on flat stones.

#### THE AMPHITHEATER.

The little triple-brand pup is still in the Amphitheater of Kitovi. This is evidently its home, and it probably regrets its expedition of that unfortunate morning when the first branding was done from the distant end of Lukanin. It looks very uncomfortable to-day.

The cows, pups, bachelors, and young bulls have overflowed from the Amphitheater to the flat above. The space below is fuller than I have seen it. The cows are seemingly in on account of the gale.

A bull at the water's edge seizes a pup as it passes him. The little fellow fixes his teeth in the bull's throat. The bull drops him and the pup hurries away. These little fellows are absolutely fearless. They would just as soon tackle a bull as a fellow pup. A human being can't make them run.

The cows have a fashion when lying on their sides of folding their flippers carefully over their nipples. It seems as if intended to shut out strange pups. Occasionally one is seen to attempt to nurse a sleeping cow. One is trying it now, but the cow wakes and snaps viciously.

Four pups on the brow of Lukanin Hill have very badly inflamed backs, the 3 brands showing raw. One cow seems unwilling to nurse her branded pup, though she recognizes him. She moves about uneasily. She eats pebbles as the pups do. At last she lies down and lets the pup nurse.

#### REEF.

In the afternoon a visit is paid to the Reef with Colonel Murray. The same rounding up and fussing over cows by young bulls is still visible. We have seen no copulation result.

It is surprising how few starving pups are visible. It seems impossible that we should find anything like 25,000 or 30,000 of them. We are not likely to get many more starved pups than trampled ones. However, it may be that, as in the case of the trampled pups, a close inspection will show very different results.

#### SEPTEMBER 16.

The gale from the southeast, with thick fog, is still on. A visit is made to the point of Black Bluff to watch the pups. Four of the branded pups are in sight here and are doing well; at least they show no inflammation in the scars.

On the rocky reef in Kitovi Bay is one of the triple-brand pups. His back is quite sore.

Under the brow of Lukanin Hill are 8 pups of the branding of the afternoon of the first day that are in very bad shape. The marks of the brand throughout their length and breadth are raw and inflamed. In only one, however, is there trace of pus. This pup looks as though it might not survive. Along the edge of the brand the skin has turned up and there is a line of pus. The other pups look uncomfortable, but are active and seem in no danger of dying as a result of the branding.

This much is certain: If they survive this branding no one can deny that they will stand without murmur such a moderate brand as will answer the purpose, a brand like the one on the second day across the shoulders, or even three brands as deftly put on.

For some reason almost all the badly burned pups are just under Lukanin Hill, where the branding was done on the afternoon of the first day. Colonel Murray says that the fur of those pups seemed sticky and hard to burn.

#### SEPTEMBER 18.

The weather has moderated some to-day, but surf and wind are still high. On account of the gale yesterday I did not go out, but spent the time making extracts from the log.

Just before lunch I went out to Lukanin to take a look at the branded pups. The pups still continue to congregate under the cliffs at the point of Black Bluff.

On the little reef that points out into Kitovi Bay are hundreds of pups and yearlings. One of the single-brand pups here shows his scar inflamed. This is the first seen. It is evident that it takes at least a week to make the burn show. Then the skin peels off under the action of the water. It is, however, much less uncomfortable than if its back had the flaying which triple-brand pups received.

Among these pups is a cow nursing her pup. A number of other animals look like cows. Some of these little fools probably persist in staying away from home and their mothers must needs come to them.

Under the brow of Lukanin hill are 4 of the badly burned pups. They look in about the same condition. One little fellow, probably the worst one of the lot, is nursing his mother contentedly and looks quite comfortable. She does not seem to mind his back. The difficulty with these pups is that the water washes out the scab and then the new skin growing underneath cracks as it dries. The little fellows stand with backs bowed up as if it pained them, as it probably does, to move.

The cove in front of the warehouse is full of pups. Three of them are on the platform of the warehouse among the boats. Half a dozen are tugging at the end of a big rope that hangs from a wharf. I do not see why animals that act this way when young can not be domesticated.

#### ZOLTOI.

I visited the Reef in the afternoon. Zoltoi Bluffs has an unusually large number of fine-looking old bulls out on its slope. Among them also are an increased number of bachelors. The bluffs look very much as they used to look when we first arrived and when drives were still being made.

Unusual to-day was the fact that the bulls and bachelors extended diagonally across between the sand dunes connecting with the drove hauled up on the other side of the neck. It was necessary to go in at the angle to-day, as hundreds of bulls would have been routed out by attempting to go across and along the brow of the cliff toward the east.

Contrary to what has been the case for some time past, the majority of the bulls and bachelors were up and stirring, playing, and in some cases fighting, in the manner of the earlier days. The storm, which has been continuous for a week, has probably driven most of these animals in.

Under the brow of the cliffs back from the sands there are hundreds of fine-looking pups, many of them in their gray coats. Among the pups are many bachelors, giving to this place which was formerly the "hospital" of Gorbatch all the appearance of a rookery. There were no harems whatever on this ground in the breeding season. Mr. Tingle, who, according to the log, estimated a rookery of 10,000 seals here, must have based it upon some such scene as this. The natives say that there never was a rookery here. Pups are out in the same way along the foot of the cliffs back from the village.

#### GORBATCH.

There are an unusual number of cows out all along the cliff portion of Gorbatch. The old bulls, too, are thickly strewn about the bases and in the angles of the sand dunes, much as in the earlier part of the season. They look like the same animals returned from feeding.

On reaching the parade ground it becomes necessary to keep in the middle of it, as the seals from Gorbatch have overflowed on that side and the population of the Reef is steadily pulling back into it from the other. For the past three weeks there has been a fringe of bachelors in the grass just back of the boulder beach to the east. These have now pulled back at least 100 yards to the scattered rocks. It is a continuous line from here to the end of the Reef hauling ground.

#### REEF.

Going up on the rock castle back of the Reef hauling ground the view of the Reef rookery becomes very interesting. The hauling ground has filled up with bachelors, among which are many cows and pups. Three and 4 year old bachelors are going through all the motions in play of the bulls in the breeding season. They brace and push like football players, catching one another in the throat or snapping viciously at



the bare shank of the fore flipper, which they seem to understand to be the weak spot in their adversary. By twos and threes they are in constant motion.

A few of the half bulls are rounding up imaginary harems of younger bachelors, but the business does not seem so real. There are still a number of fine-looking old bulls lying among the cows. A dozen can be counted within easy range.

The cows are lying in all manner of positions on the flat stones because of the mud. An unusual number are in. I can not see any starving pups here, though many were seen the other day at the water's edge. It is probable that the starving ones do not come so far back.

The original rookery ground is still deserted, and the main body of the seals lies back of Townsend's Crosses. Spread out as they are—cows, pups, and bachelors—one could easily make wild guesses about the number. There seem to be double the number present to-day that have been seen at any other time this season.

On the flat plain above connecting with the brow of the cinder slope are straggling groups of bachelors. A greater number than usual are on the flat just above the cinder slope. Probably the rain of the past few days has made the slope a disagreeable place to stay upon. There are fewer seals on it than usual.

#### ARDIGUEN.

About the head of the slide are 100 or more yearlings and 2-year-old bachelors, playing and chewing one another as at the other end of the Reef. The stream of bachelors extends down into the runway off Reef Point. There are cows and pups among them farther down.

The big brown bull that has been in A's place is on hand to-day, with the bachelors about him. Two young bulls are fighting near him. One of them seems very much excited and keeps up a steady roar. He remains while the other one withdraws. He sees me, and then watching me, keeps on roaring. He goes down into his old place, then goes out to meet the big brown fellow, and after a show of fight the big fellow moves away. The smaller bull is just in and dripping. As he dries he begins to look familiar, and, catching sight of his left fore flipper with its great scar, I recognize him at once as the original A of the slide back in his old place. His every action seems to proclaim that he is at home. A wet cow comes up with her pup and he rounds her up and talks to her. He moves about just as in the breeding season. This bull has not been about for at least three weeks, and he comes back looking as if he had been away feeding.

The big brown bull has gone over to B's original place, just as if he recognized A's right to the shelf under the rock and went home. He looks as though he might actually be B.

A wet cow is coming up the "slide," calling loudly. A little gray pup, very thin and with a starved look, wakes up from under the big rock on the south side of the slide. He is at the top of the cliff and she is at the bottom, and it looks like a case of recognition. The little fellow sets out to climb down and slips, sliding head over heels to the bottom. The cow recognizes him and starts up the incline at a place beyond, the poor little pup after her. He has to make many trials. He looks just like many of the pups we have been pronouncing doomed. The cow's ears are white. She wanders about and settles down on the flat stone that formed part of the

boundary of B's harem. Her pup begins nursing eagerly. You can almost imagine you can see his sides inflate.

The brown bull B starts for the rock, drives off the cow, and settles down on it. She wanders off and the pup after her. Presently the bull starts after another cow. At once the cow returns with her pup. The bull comes back and gets on the rock. When last seen he was lying on the rock and the cow sitting on an edge beside him, while the little pup stands in the mud.

There are at least 3 freshly dead pups in the slide. In one place there are 4 close together, all of which have died within a week. Two hopelessly starving little fellows are seen moving about.

Returning by Zoltoi sands, I find that the half albino which was so conspicuous in the earlier part of the season is out again, wet. It looks as though these were home-coming days.

#### SEPTEMBER 19.

I went this morning to Lukanin to see the branded pups. Search was made for the castrated pup, but it could not be found.

It is evident that when you pick up a pup on a rookery you can't be certain that he belongs where you find him. He may belong to another rookery. At the very upper extremity of Lukanin are 2 of the little single-brand pups from Kitovi, and one of the triple-brand pups taken at the upper extremity of Lukanin certainly belongs in Kitovi.

A number of branded pups are in sight. The backs of some are beginning to heal, the scars growing narrower. Most of them still look uncomfortable, but none seem in danger of dying. Colonel Murray found one of the branded pups dead early this morning, but I have been unable to find it. He said the pup must have been dead ten days or two weeks, and probably died soon after the branding.

I see one of the little fellows with a sore back nursing. His mother notices his back and puts her nose to it. He stops nursing with a snap as though to prevent her touching it. The little branded fellows have usually one or two admiring or criticising or perhaps sympathizing neighbor pups looking at them and investigating. They snap and growl resentfully.

It is impossible in going to the Reef to go round and over the ridge. The whole space is full of bulls with bachelors mixed in. In order to pass by way of the angle you must drive into the water 200 or 300 bulls.

#### KILLERS.

Going out over the killing ground with a view to coming in along the beach on the east side under the cliffs, I find a school of killers in the water, perhaps a third of a mile out. They are moving up toward Kitovi Point. It takes twenty minutes for them to get out of sight. They are moving along slowly, rising at regular intervals in a curve, which brings the head, then the fin and part of the back, and last the tail out of the water. They have a motion very similar to that of the seal, except that they do not rise entirely out of the water. There are 7 of them. One is a large fellow, bearing somewhat the same relation to the others that a bull seal might to his harem of cows. There is a small one, a young one probably; it is following and evidently playing with the big fellow. Three of the others are together and the remaining two

are behind them. The whole lot act as if playing, and move along very leisurely. Occasionally a little cloud of spray is blown up. I should say that the fin of the big killer was over 2 feet long. The others are smaller, and the little fellow has a stubby fin.

There is a band of a dozen seals moving along in dolphin leaps in the same direction and about midway distant between the killers and the shore. There are seals beyond the killers, before and behind them at considerable distance. There is no excitement among the seals, and the killers do not appear to notice them.

The bulls and bachelors in the little cove go into the sea. There is a starved pup among them, which will probably be dead to-morrow. I find another starved pup at the same place dead among the rocks. These are half a mile from the Reef and farther from Kitovi rookery. Under a little ledge is a strong, healthy pup sleeping. He is evidently resting from a swim. I rap on the stone above him and he bounds like a rubber ball down over the rocks and out into the heavy surf.

As I go down along the brow of the cliff there are many bulls playing in the water, rolling over and over and going through all the motions that the cows and pups show. There is a cluster of these old fellows having a good time between two lines of breakers, associating in perfect harmony one with another. I have noticed within the last few days many bulls off Gorbateh and the Reef swimming among the pups, holostiaki, and cows. They are fat and satisfied.

#### REEF.

In the little angle just before reaching the northern termination of the Reef there is an isolated harem. The bull sits among his cows and pups roaring at me just as he did in July, the day we finished counting this rookery. One could imagine that he has not left his post yet, but he is fat and sleek and it is probable that he has been away and has returned. He occupies an isolated position and has had no interference, an angle of the cliff cutting this harem off from the others. He could easily have been gone for two weeks and found his place vacant on his return, or he could have thrown out any intruder. He is a vigorous fellow.

#### ARDIGUEN.

Occasionally in different parts of the rookeries you find a bull in some particular place who seems not to have left it. They are generally in isolated positions. The black fellow that has been for the past two or three weeks at the head of the "slide" is an example.

There are more and more seals on the flat height of the parade ground. Cows and pups have moved back into the green flat at the eastern side on account of the rain.

At the mouth of the "slide" the bachelors are as yesterday. They have spread out over a good part of the little grassy hollow back of the mouth of the gully. There is a wet bull in C's place. He acts as though he owned the place, working industriously but ineffectually to keep out the young bachelors who are playing sikatehi. He drives them all far out, then comes back and lies down; but they are back about him in a few minutes. The wet fellow goes over to make a lunge at the

big black fellow and then does the same thing to A—just the performance of the breeding season, but in a milder way.

The bull at A is the original A without a particle of doubt. He is dry now and is recognizable by general appearance without his scar, but this removes any possibility of doubt. One would think that these old fellows knew us; they have seen us so often. They look up and roar. A is rounding up his cows and parading himself over his shelf just as in former days.

A little gray pup, just able to move about yesterday, is now dead on A's shelf. The little half-starved gray pup noticed trying to find his mother yesterday is nursing to day, and has filled out considerably, though he still shows the effects of his fast.

The old black bull is lying on the rock from which he put the mother off yesterday. She is on another rock.

There is a big wet bull coming up the "slide" fresh from the water. He is in fine condition, and he toils up slowly. When he gets to E's place he goes over there roaring, routs up and smells of the sleeping cows. He then moves to the foot of the cliff near the big rock, roaring all the time. The black bull above gets off his stone and comes to the edge. They lunge at one another. The black bull goes back and the wet bull sits down in D's place. It seems likely that this is D himself, and that here are four of these original bulls back (A, B, C, D).

A youngish bull with a group of small cows is a short distance back of the slide. One cow occupies his attention. She acts as though she were coming in heat. She hangs to the bull's throat. He cuffs her about. She moves off, but always comes back and takes him by the throat. She is evidently staying of her own accord, and neither of them go, though I pass near them in plain sight. The bull roars defiance at me.

Going back, I find along the edges and by the sand dunes the same line of bulls that we used to run upon in coming and going in the early part of the season, and which have been absent a month or more. One could almost think that they were the same lot.

In talking with Mr. Barrett-Hamilton after returning, I find that he has noticed a rejuvenation in the old bulls on Zoltoi. They lunge at one another and show a good deal of fight. They do not run as they used to, and some of them even strongly resent intrusion. The bulls at the angle of the sands do not even deign to go into the water as I pass, while those on the landward side only stare, moving a little way to leave a passageway. There is evidently no thought of stampeding.

#### SEPTEMBER 20.

I went this morning, in company with Mr. Barrett-Hamilton, to visit the Reef.

The bulls have thinned out considerably on Zoltoi, perhaps on account of the strong wind blowing in here and causing the sand to drift and sift everywhere.

Two bulls near the water's edge are in a crippled state. One carries his left fore flipper in a sling, figuratively speaking, while the other does not seem to have good control of either fore flipper, and pushes himself along on his chest.

#### ARDIGUEN.

At the slide we find still more bulls than were present last night. The one which came in yesterday has taken his place beside B on the flat. These two seem to



have an understanding with each other and are combining forces to drive off two young bulls that persist in coming in from behind. They are unusually fat, and the exertion is hard on them. The bachelors are thick, and in some cases the old bulls try to run them out when they get among the few cows and pups that lie about them; but as a rule they pay no attention.

Between A and B is a youngish bull that looks very much like the young water bull that first took up his place on the slide. He is very active. A is as lively as ever.

Back of A's place are three black bulls who seem to correspond to the idle bulls of the breeding season. The four bulls in position keep them back.

One old bull is out in the surf with the pups, acting as though he would land. He did land in a few minutes, but went away again.

A heavy surf is coming in here. The pups are evidently afraid of it. When they want to land they dive under a breaker and then come in in the spent water. When the returning water begins to let them down on the rocks and another breaker is coming behind them they turn about and dive out under it, coming up in the spent water and swimming in as before. Sometimes they have to go through the process several times. The old cows take a longer time than the pups, and are decidedly cautious. The surf this morning is higher than I have seen it here.

The bulls are lunging at one another and herding up the cows, just as in the earlier days; but all their motions are mild and lacking in the old fire. They evidently realize that there is nothing to fight for.

A cow is swimming about in the surf, with a pup following her. It is evidently her pup. When they get separated she calls and the little fellow answers.

#### GORBATCH.

On going over to the other side on the cinder slope I find that the edge of the hill is thickly covered with cows and pups. There is a vacant space down to the rocks where the hair seals lie, and beyond there is a strip of seals in an irregular belt running from the beach to the top, terminating in a flock of bachelors which extends out on the flat above.

There are about 20 hair seals on the rocks. They take to the water as soon as they see us at the top. Their sense of sight must be acute. No fur seal would see us at this distance. Contrary to their usual custom of disappearing immediately, they come up, and their round heads bob up and down as they come back in a group toward their rocks. They do not land, however, while we stay. The place where they have been lying is white with excrement like that of the sea lion.

The bar forming Zoltoi sands has evidently increased since we came in July. It extends far out beyond the angle at the cliffs, and toward the village a considerable extent of the boulder beach has been covered. Three pups which, when Mr. Lucas and I counted them, were at a distance from the sand are now, together with the rocks about, partially covered. Mr. Redpath says that the ice will pack in and currents will be formed, carrying the sand away, to be piled up by the surf next summer.

## KITOVI AND LUKANIN.

In the afternoon I go to Kitovi and Lukanin. The usual pups are on the flat rocks under the point of Black Bluff. Many fine gray ones are among them. Six of the single-branded pups are here. One has a raw wound, but seems not to be troubled by it. The others are dry. One has a dry scab which is somewhat turned up at the edges. If he went in the water it would probably peel off and leave a raw place like his neighbor's. It is probably the action of the salt water that keeps these wounds looking raw and inflamed.

From the rocky photographic station back of Kitovi Point I can count 26 of the single branded pups. It was from under here that one of the pods was driven. They all look well.

In the Amphitheater of Kitovi, which is fully an eighth of a mile from where the branding was done, and is cut off from it by a projecting cliff, is one of the single-branded pups. He lies beside the rock on which is the triple branded pup. The latter pup looks in bad shape, but it is plump and probably in no danger. He has evidently decided to remain at home after this, as he has been in or near this position for ten days.

There are 2 old bulls swimming about in the water in front of the Amphitheater among the cows and pups. The pups and bachelors show no fear of the bulls in the water.

From the brow of Lukanin Hill I can see the 8 pups which were scored so deeply in the branding of the first day. There is a decided improvement in their condition. Their wounds are all clean and much narrowed, showing progress in healing. They are dry and have lost the raw appearance. No pus is visible. The pups have evidently not been to the water for a few days. One of the worst looking pups is nursing its mother. She is looking inquiringly at his back. There is no thought of abandonment by the mother of the pup because of the brand. Every day one or more of the branded pups are seen nursing.

The dryness of the day has probably something to do with the appearance of the pups. All pups look uncomfortable in the wet, the branded ones more so than the others.

From the cliff lower down I can see about a dozen of the branded pups near the water's edge. They are all looking better, though many have sore backs.

I notice a large number of old bulls lying on the rocks just back from the water's edge on the beach at the foot of the cliff. There are 23 in sight where there could not have been more than 3 or 4 yesterday morning, for the entire water front was then examined with a glass for branded pups.

Some of the pups are already very handsome in their gray coats. Occasionally you see a little silvery yearling which is scarcely distinguishable from one of these pups.

If the time of turning gray is uniform as to age of the pup, there must be a wide variation in the birth of pups. About one-third of the pups are fully gray; roughly speaking, another third are turning, showing the gray on the belly and about the nose; while another third are perfectly black. It is to be noted, however, that some of the black pups are really the largest.

Jacob Kochuten, who has been watching the past week at S. W. Bay, brings in two spearheads attached to long lines which he found on the rookery there. One of

these with two lines attached shows well the way in which the hunters handle the spear. The spear shank comes loose when the spear strikes into the animal, but being attached at both ends to the spearhead it is dragged as a sort of a bridle in the water. The lines from each end of the shank unite in one line, which is fastened to the head. This union of the two lines is shown in the case of one of the heads. The dragging of the shank impedes the progress of the seal and prevents it from sinking. The lines have been torn from the shank. The heads were brought ashore by the seals, and were torn out by the catching of the lines in the rocks.

#### SEPTEMBER 21.

I walked out this morning across Zoltoi and found it practically deserted. A few bulls are up among the rocks, but most of them are gone. The sand is sifting and whirling under a stiff gale, and probably annoys the bull.

In the afternoon I walked with Mr. Barrett-Hamilton to Tolstoi. Found a freshly dead starved pup washed up at the extreme upper end of the Lagoon. It must have been carried over from the Lagoon rookery.

The usual line of sleeping bulls is to be seen on the sands of English Bay. The sandy tract of Tolstoi is wholly deserted, except for one harem-like group containing a bull, 3 or 4 cows, and about 25 pups.

Along the water front are cows and pups sitting on the rocks. Among them are stationed at intervals a number of old bulls. A few of them are wet. In the water are others. Those on land are loath to leave, and will even make a show of charging at you.

The cows and pups have, for the most part, moved far up the bluff. Among them also are old bulls. One fellow dripping wet is perched on a stone far up the slope. I count a number of old bulls and find 65 on the shore and in that part of the slope that can be seen from below. As the cows are alarmed at our presence, the old bulls wake up and bustle about among them trying to quiet them. The great pod of seals on the hillside, with 25 or 30 bulls in it, has all the appearance of a rookery in the height of the season. The bulls are bawling, roaring, and rushing hither and thither among the bleating cows.

The number of weak and starving pups seems small. Mr. Barrett-Hamilton and I can not find more than 5 on the extent of the sandy tract, the shore front, and the edge of the rocky slope. The pups, to be seen everywhere, are fat, strong, and vigorous. It is certain that the starving pups do not congregate at the water's edge, and must be looked for wherever pups have been.

#### SEPTEMBER 22.

I went this morning to Lukanin to look at the branded pups.

Most of the pups seen are in good shape, except in the case of those that have just been in the water. The salt water has the effect of opening up the wound and removing the scab, leaving it raw. Those pups that have not been in the water lately show their wounds dry and in process of healing, while those recently in from the water look fresh almost as if bleeding. Three of these wet pups are seen.

From the brow of Lukanin Hill only 1 of the branded pups watched there for a number of days back is visible. He is almost well; at least his back is dry and healing. Probably if he were to go into the water he would come back with his

wounds freshened up. There is, however, a manifest narrowing of the size of the wound.

There are 27 old bulls along the water front sleeping.

No trace can be found of the castrated pup. A close search has not been attempted, but one will be made before long. Very few starving pups are seen on Kitovi and Lukanin.

In the afternoon I went to the Reef to search for starving pups. The great majority must be dead. Zoltoi sands are almost bare of bulls. There are more bachelors, many yearlings. More seals are in the water than usual.

The hauling ground of the Reef is full of bachelors so that one can not get down to rocky observation point. The rookery still maintains its appearance of the first week of September.

#### ARDIGUEN.

Bull A is not on his shelf and is not anywhere to be seen. The other bulls are in position and 6 fresh arrivals are seen lying on the rocks at the foot of the slide. There is one gray pup plainly starving near the water's edge. He is trying in vain to nurse sleeping cows.

#### REEF.

I go down to the tip of Reef Point and pass along the shore as far down as the southeast point, about three-quarters the extent of the rookery. Looked carefully for starving pups. Found only eighteen that could be certainly said to be starving to death. Four of these, large gray fellows, are knocked in the head and brought up for specimens. Two of them were unable to walk; none of them would have lasted over till to-morrow.

Many very small pups were seen along the water front, certainly born to late-arriving cows. They can not be more than a month old. These pups must undoubtedly have been born late in August. I counted over 20 of them. Similar pups are plentiful on the Amphitheater of Kitovi.

Numerous old bulls are to be seen lying on the rocks just up from the water's edge, and many are spread all over that portion of the Reef originally occupied by harems. They are even back among the cows in their present position. These bulls were not in the position they occupied a week ago. Some of them will stand their ground. I had to back out and go round one or two. Those nearest the water's edge go off, but those back from it simply look and roar.

#### KILLERS.

As I approached the extremity of the Reef to the east my attention was attracted to two killers which were emerging from the mass of seals between the shore and Sea Lion Rock. The seals had parted, leaving the neighborhood of the killers, and were either making toward the shore or standing up in their customary stupid manner looking in their direction. The killers moved up in a leisurely fashion, following the coast toward East Landing. As they passed along the seals could be seen standing up and watching them. There was no evidence of stampeding among them. The killers were evidently feeding, as a long train of gulls were following in their wake and lighting at intervals. I did not see them catch any seals.



One little pup, the only one I have seen that shows crippled condition, is lying on a rock; his fore flippers are badly out of order, one is stiff and the others swollen. He can not use them, but pushes himself about on his stomach. I saw him two weeks ago in a worse condition. He is evidently nourished. He has just as bad a temper as any of his well brethren.

#### INVESTIGATIONS REGARDING FEEDING OF PUPS.

In the afternoon we killed 2 pups on the rocks at Point Warehouse for the examination of their stomachs. These pups had come over from the Lagoon, and after their swim were sleeping on the rocks. If the hundreds of pups swimming in the cove are feeding, it would be natural to suppose that those coming out on the rocks to sleep are those that have satisfied themselves. Mr. Macoun and Judge Crowley were present.

The stomach of one pup contained a small quantity of thick, creamy milk. The milk was dotted with reddish specks, which Mr. Macoun thought might be bits of the little red seaweed, but contained nothing else.

The second stomach contained more than a pint of rich, creamy milk, with no trace of any foreign substance in it. These pups were very large and of the oldest. Fortunately, they were both males. The skins will be made into specimens.

Attached to the end of the wharf was a piece of rope about 10 feet long. Five pups within a few yards of us were pulling away at the loose end of this rope. They would swim in toward the dock and then swim out as far as the rope would go, almost turning somersaults when it became taut. Pups will play with anything within their reach. If they eat anything it is by accident. A fish head thrown to one was immediately seized and used as a plaything.

#### SEPTEMBER 23.

I went over this morning with Judge Crowley in the whaleboat to Zapadni. Pups are visible in the water all the way along from Lagoon to Tolstoi. About midway there is a pod of upward of a hundred, with some yearlings (they might be cows) and one old bull among them.

The circuit of pups is doubtless complete from Kitovi and Lukanin down to East landing, the Reef, Gorbach, Zoltoi Bay, Village Cove, Lagoon, Tolstoi, English Bay, and up away beyond the point above Zapadni where the watchhouse is. The water throughout this entire coast line is full of pups.

#### ZAPADNI.

Landing at Southwest Bay, Judge Crowley and I walked along the shore front throughout the length of Zapadni. We counted the starving pups and found only 20 in the whole distance. There were a good many of the late small pups which I noted on the Reef and at Kitovi. The Judge thought they might have been born as late as the 15th of August.

On Zapadni, as on the Reef, everything has drawn back high up from the original rookery ground. All the flats are bare. We will be able to get the greater part of the dead pups in our count here, but the number of recently dead ones will be small. Found one freshly dead pup and took him for a specimen. There seem to be fewer gray pups and more small pups here than anywhere else.

The same proportion of old bulls is to be seen here, and bulls, cows, and yearlings are lying on the rocks at the foot of the cliff all around the point beyond the rookery.

I talked with Judge Crowley about the possibility of fixing the sand flats on Zapadni. He suggested the arranging some sort of a block and tackle to pull the rocks from the beach up on the flat. From what he said there will probably be something done toward fixing these places, and also the sandy tract on Tolstoi.

It is interesting to note that the killing ground near the watchhouse bears exactly the same relation as regards distance and wind to the hauling ground of Zapadni that the village killing ground does to Zoltoi, and in the latter case the number of seals killed is several times as great. It was to the beginning of killing on the shores of Lake Anton that Nickoli Krnkof ascribed the scarcity of seals at Southwest Bay.

A large gray pup was found imprisoned in a crevice in the rocks. He had dropped down in a crack and could not possibly have escaped himself. Evidently this is the source of a small loss of pups.

#### SEPTEMBER 24.

A heavy gale is blowing from the north. One can hardly make headway against it.

Walked to Kitovi and Lukanin. The pups are under the cliff at the head of Black Bluff in about the usual numbers. The spray is driving thick over them. A few are in the water. Here and there one can be seen swimming along in the hollow between the breakers, turning and diving head first under the approaching wave, coming up behind it.

It is with difficulty that one can stand on the edge of the cliff over Kitovi Amphitheater. The spray from the heavy surf falls over the whole slope in rain. The little triple-branded pup is still on a rock near his old position. He is evidently having a hard time with his back, but he is far from a dead pup yet.

I see 2 of the 8 pups under the brow of Lukanin Hill. They are getting better. I can see a number farther down. Their wounds are dry and healing.

#### SEPTEMBER 25.

The gale continues. The air is thick with flying sand, which cuts and smarts one's face. The force is sufficient to burrow holes in the hard street about the company house. The sand to the depth of a foot or more has been carried away from Zoltoi. There are not over a dozen seals on the Bluffs. Occasionally a sleeping bull, half buried in the sand, will rouse up, shaking the sand off in a cloud.

The wind has force enough to burrow a hole right into a sand dune, and it is easy now to understand, after experiencing this wind, how the hollows and passageways among the dunes are cut out.

This north gale is probably washing clear over Sea Lion Neck, and will wash away many pups on Northeast Point. It will probably be best for us to begin the count of pups on Monday. Nothing will be gained by waiting till the 1st, as there are very few dying pups, and this kind of weather reminds one forcibly of how much he is at the mercy of the sea on St. Paul Island. There has scarcely been a day since the *Rush* left, on September 7, when a landing would have been possible. It is needless to say we have seen no vessel since.

## SEPTEMBER 26.

The wind has somewhat abated, but the surf is still very high.

I walked to Polovina this afternoon to see this rookery, and determine, if possible, whether it will be advisable to begin counting on Monday morning, the 28th. The result of observations on Reef, Zapadni, Tolstoi, and Kitovi and Lukanin seems to be that there are few pups to die within the next week.

On the way to Polovina I counted 14 dead pups, most of them about the shore of Lukanin Bay, beginning at the angle of the hauling ground to the west. These have been washed up in the gale of the past few days.

## BRANDED PUPS.

Among those at Lukanin Bay were two of the triple-branded pups. One of them seems to have been dead for some time, perhaps a week. The other was very fresh. Beside the second one is a very large, fat pup. They are all washed up above high-water mark, showing that they were brought in by the high surf of the past few days.

I cut open the 2 fresh pups. Their lungs are deeply congested, but no other injury is visible. They were probably drowned. Both pups were unusually fat. The branded pup had nothing whatever in his stomach. The other had his stomach full of milk. The second branded pup was too far gone to permit of examination. It may have starved.

The branded pup examined gave an opportunity to study the effect of branding at close range. Every particle of the surface touched by the brand was of the color of cured ham. There is no trace of break in the skin. I cut into the marks and found the wound affecting only the outer skin. Not a trace of pus was in the wound. The inflamed backs noticed on the branded pups are evidently not so serious as they seem at long range. The salt water keeps the wound free from pus and probably in the end helps its healing. It is now seventeen days since the branding was done and it would seem that the wound should be healed by this time.

## POLOVINA.

In the heavy surf from Stony Point, at intervals, lone pups were to be seen swimming. At Polovina the seals are found drawn far back from the original rookery ground, fully 200 feet from shore. There are about 25 or 30 pups under the ragged rocks at the angle of the hauling ground. The whole sloping basin above is empty. There are 5 large gray pups which will be dead in a day or two. I also see 4 black pups in the same condition. They are late pups. One of the gray starving pups is blind and lies perched on a stone. When touched it rolls off the stone with a piteous wail, doubly helpless in its hunger and blindness. The pups back in the main body of the seals are large, healthy, and an unusually large number are gray; or it may be that the pups are turning gray faster now than before.

There are still here, as elsewhere, many large black pups apparently as old as any. A very heavy surf is breaking over the low reef off Polovina.

The tide is low and the rocks should naturally be bare, but a swift current of water about a foot deep is flowing over. The pups, cut off by the cliff, try to pass around along the beach above. They persistently strike out into the heavy surf off

the reef only to be landed back into the shallow water. It is only necessary to see the pups handle themselves in this surf to appreciate the nonsense of the "deadly surf nip."

The seals and pups on this rookery, in their present position, remind one of the appearance of the rookery in the breeding season. The old bulls are numerous, and as soon as the cows are disturbed they begin rounding them up and roaring. Along the shore there are others which dispute your passage with a little show of old-time vigor, but soon take to the water.

Judging from this rookery and others visited there will be no loss in beginning the count Monday morning. The few pups that will die within the course of next week can be counted or estimated. I should not put the number on Polovina at more than 50 and this estimate would be about right for the other rookeries of the same size.<sup>1</sup>

#### SEPTEMBER 27.

#### BRANDED PUPS.

I went this morning with Colonel Murray to look up branded pups more closely. We drove off the seals from the part of Lukanin on which the branding was done, watching the pups as they went down over the rocks to the sea in order to note the branded ones and particularly to see if any trace of the castrated pup could be found. Nothing was seen of the latter. A number of branded pups were seen, and all were in good condition, most of their backs being well healed, some completely so. One of the single-branded pups from Kitovi was among the Lukanin pups, and his brand showed no soreness.

A branded pup was found just on the verge of starvation. He was killed for closer examination. The scars on his back were in a bad condition, the skin turned up at the edges, and the wound being full of pus. The skin was shriveled and shrunken, but its bad condition was due to the fact of starvation. There was no vitality to carry on the work of repair. This pup is doubtless one of those suspected of starving at the time of the branding.

After the seals had left the ground it was carefully searched for starved pups and branded ones. The castrated pup was not found among the dead, nor were other branded pups found dead. There is left but one pup whose death is unaccounted for. This one may have died as a result of branding, but not necessarily. Of the two pups found dead, one looked as if it had been drowned; the other was emaciated and seemed to have died of starvation.

Going along under the cliffs and up to the face of Lukanin Hill, we found many other branded pups, all nearly or quite recovered from their brands. There is no doubt as to the spoiling of the skin by branding, and there is no doubt of the success of branding.

One large gray pup, greatly bloated and unable to make any use of his front flippers, was found. He was full of fight, but helpless to raise his head. He will probably be here when we come to count the dead pups in a day or two, and we will then have him killed.

<sup>1</sup>On close inspection a very different result was obtained. A very inadequate count of the starving pups gave 1,500 for the rookeries of St. Paul, and it was doubtless far below the facts.



## KITOVI.

The little branded pup belonging to Kitovi Amphitheater is not there this morning. One of the triple-brand pups is playing among the single-brand pups farther down on Kitovi. Many of the single brand pups are about, none of them showing inconvenience on account of their burns. For purpose of identification the single brand is quite effective.

There are a very large number of bachelors just below the rocks at Kitovi Point, which serves as a photographic station. These must be bachelors from Lukanin. None were here during the season and none have been on Lukanin hauling ground since the first branding was done there on the 2d of September.

One of the triple-brand pups is on the reef jutting out into Kitovi Bay, where they have been seen several times before. The usual number of pups are under the cliff at the head of Black Bluff.

Going over to Lukanin this morning two killers were seen in the bay off Point Warehouse. They were probably feeding on the pups swimming in the water. The intense stupidity of the seal is never better illustrated than in connection with the killer. They apparently show no alarm: or when they show evidence of seeing their enemies, they simply stand up in the water and look.

The high wind and surf of the past few days have quieted down. There seems no good reason why we should not see a cutter if it is the bad weather that has kept them away. No vessel of any kind has touched here since the departure of the *Rush* on September 8. We will be ready to leave here by the 1st or 2d; but who knows that we can do so?

## SEPTEMBER 28.

The count of dead pups was begun this morning on Zapadni, completing Inner Zapadni, Zapadni Reef, and Tolstoi during the day. We went over in the morning by boats and had the boats pick us up on our return at Tolstoi head.

## COUNT OF STARVED PUPS.

Colonel Murray and Mr. Barrett-Hamilton with two natives went in advance and turned all the seals into the water, making as complete a count as possible of pups evidently starving and sure to die. It soon became evident that this count could not be made accurate or in any sense complete. But there are a number of pups which are very thin and which will probably be dead within a week. The count will catch most of these and will therefore strengthen the count of dead ones. There are no intermediate pups now or pups beginning to starve. There has been practically no sealing weather since September 8. The pups, therefore, show only two classes—those in good condition, well fed, and those so thin and weak that they can scarcely walk.

## ZAPADNI.

In order to make the count of dead as nearly absolutely correct as possible a force of natives was taken along. Four men in two pairs, each with a long fish line, laid the rookery off in narrow spaces. The pups within one space of 20 feet were counted, and while the advance line remained stationary the other was carried forward to

include another strip, which was counted in the same manner. The lines were about 200 feet long and Outer Zapadni was split in two. Several natives were employed to pass along the bowlders of the water front to search out and indicate hidden pups. Another force under the direction of Judge Crowley marked the terminations of the sections and cleared out a line of pups to avoid duplication on the return count.

The counting was done entirely by myself and Mr. Macoun, each one seeing personally practically all the pups counted. The total number of dead pups counted on Zapadni was 4,395. The total of dead pups previously counted on this rookery was 3,095. This leaves a margin of 1,300 pups chargeable to starvation. To this should be added 154 doomed pups counted by Colonel Murray and Mr. Barrett-Hamilton, making 4,549 in all. Undoubtedly some pups have disappeared since the first count, but the number seemed not as great as was expected.

It is not possible to separate the death trap areas in this count. The increase on them has not been great, as for the most part these spaces have been abandoned by the seals, which have hauled far back beyond them, preferring the rocks to the sand in wet weather. It was in these sandy areas that the chief loss of pups formerly counted will be felt. The gale of wind has covered a few of them with sand, and the passing back and forth of the seals has worn others to pieces.

Mr. Barrett-Hamilton kindly gives me the following notes regarding pups:

"One pup with a peculiarly deformed nose was found. The nose, which had a number of warty growths upon it, was preserved.

"One pup was found blind in the left eye; one with a cut on his left flipper; one had the left hind flipper gone; one had a fore flipper broken. Two blind, gray pups were found; they were fat and in good condition; their mothers evidently find and nurse them. One pup apparently had no eyes at all; the openings were very small and closed up tightly. Another blind pup was seen on Zapadni Reef."

I afterwards saw 3 of these blind pups. The eyes of 2 were white—of the "moon-eye" type. The eyes of 1 were green, like the eyes of an angry cat.

By Judge Crowley's direction a number of starving gray pups were killed, it being evident that they were doomed to die within a day or two. The skins were taken for museum purposes.

Sixteen pups were found on the sands of Southwest Bay. This is considerably less than the number counted August 14, and some of the present ones are freshly washed up.

#### LITTLE ZAPADNI.

On Little Zapadni rookery the lines were dispensed with, as the rookery is small and the dead pups are chiefly near the beach. Judge Crowley and I passed along the beach portion of the rookery, Mr. Macoun along the upper part. Natives were lined up at short spaces between. This placed a man at every interval of 10 feet throughout the width of the rookery. The dead pups were pointed out and recorded by Mr. Macoun and myself. Mr. Barrett-Hamilton and Colonel Murray, as before, went in advance and drove off the seals, counting the starving pups.

The count of dead pups for this rookery gave a total of 677. It had on the previous count 134 dead pups. Sixty-four starving pups were counted.

## THE EFFECT OF DISTURBANCE.

We had an excellent opportunity on Zapadni to see the effect of a clean sweep of the rookeries. Colonel Murray and Mr. Hamilton went along in advance and drove everything off for 200 feet or more into the water. Many of the animals were back out of the water and hustling across the upper and undisturbed heights before those making the count came along. In returning for the second swath all the seals were driven off in advance, and before we got to them the wet seals were back and had again to be driven off. Looking back along the rookery we could see pups and cows and bulls hastening back to their places, and it is safe to say they are all back within an hour's time. The unusually rough sea of the past few days has probably given the seals out at sea but little chance to rest, and they want to sleep on land.

An interesting feature of the present state of the rookeries is the attitude of the bulls. Very many, one could almost say as many as originally had harems, are back in or near their old places. Some of them are still thin, but many of them are full and plump; some very fat, scarcely able to walk. They have evidently been feeding. They have recovered their tempers and are to-day quite as difficult to manage as were the bulls at the time of the first count. While all of them will not fight, many will, and these you can not budge. Colonel Murray and Mr. Barrett-Hamilton found it impossible to move many of them, and they were left for us, and we had to get around them as best we could. Many of them were quite as bold and dangerous as in the height of the season. It is probable that none of them would give ground any more readily to-day than in the breeding season if the cows and pups did not move away so readily. The bulls go with them because the crowd goes.

## ZAPADNI REEF.

On Zapadni Reef there were found a large number of pups on that portion of the reef which was not occupied by harems. They seem to have been washed up by the surf and may have come over from the big rookery. They were in some cases embedded in the seaweed and an overhauling of the seaweed would probably have disclosed more of them. A number of these pups were only skeletons washed up after the amphipods had cleaned them off. These have undoubtedly been floated in from elsewhere.

The number of dead pups counted here was 327. Eighteen starving pups were found. The number of dead is small in comparison with Little Zapadni, but this rookery has undoubtedly lost more than any other rookery by the washing of the surf. It is narrow, and the high surf breaks almost to the top of the space occupied by the seals. One hundred and four dead pups were counted here at the time of the previous count.

There was an unusual number of bachelors out on Middle Hill and the sands of English Bay. The usual number of old bulls were along the water front the entire distance across the foot of English Bay.

An unusually large number of seals seemed to be on land to-day, and as they were all turned into the water they literally made the waters of English Bay black. In coming down with the boats along the shore it was a most interesting sight to see the scampering of the seals in getting out of the way. They seemed not to be frightened over it, but they would leap out of the water in every direction, only to close in

behind the boat almost immediately. They followed the boat, coming up close to it, sometimes striking the oars. Their every action shows that they feel entirely at home in the water.

The sands of English Bay, where 232 pups were counted as washed up by the surf, gives to-day only 172.

#### TOLSTOI.

The sandy tract of Tolstoi was first counted, the lines being used as on Outer Zapadni, dividing the rookery into two sections. The sandy tract and the beach above gave 1,717 pups. About 1,400 were counted here originally. The bowlder bluffs above, where the seals are at present located, gave 463 pups. There were 269 on the beach under the cliffs. This part yielded 116 on the former count. The percentage of dead pups on narrow beach lines like this exposed to the action of the surf is smaller. Doubtless they are washed away from such places in greater numbers. One hundred and ninety one starving pups were counted for Zapadni.

Though every cow, bull, and pup on the rocky slope of Tolstoi had been driven into the water when making the count of dead pups, before we had reached the green cliffs the sands were covered, the wet animals distributing themselves over their grounds again. It is nonsense to suppose that if the seal is driven off the rookery he will not come back.

#### ACCIDENTS TO PUPS.

While the seals were being driven from the rocks above the sand flat a large stone was rolled down upon 2 large, fine-looking pups, killing them. These pups, of course, were not counted as starved. The stomachs of both were full of milk.

Just at the upper edge of the sand tract, where the rocks begin, a gray pup was found imprisoned in a crevice under two overarching rocks. There was a small hole, through which his nose protruded, but it was entirely too small for his body. He was dug out and released. It was found that he had crawled in at the bottom, and the hard wind of the past few days had drifted and packed in the sand in such a way that he could not get out. It took the men five minutes to dig the way, as that was the only way of getting him out. He fought, bit, and chased his benefactors in true seal fashion when he got out and scolded constantly during the process of digging.

Under the cliffs a little pup was found wedged in between two rocks. The surf had evidently moved a heavy stone up on him while asleep. The stone jammed out one of his eyes and held him a prisoner. The eye and socket was rotting, as was also his side, which was pinched. Life still lingered in the animal. It was killed. It is evident that being crushed between the rocks is the cause of a certain percentage of the deaths of pups.

Had an opportunity to-day to observe the testes in a number of bulls, among others those which showed strong inclination to fight. In some they were visible; in others they were not. This has been the result of all observations so far. As a rule, when lying down the 4-year-olds and half bulls show the testes more uniformly than the other bulls.



My opinion now is that the testes are under the control of the animal to a certain extent and can be drawn up into the body. Though one can not be sure of it, it is probable that they are drawn up when the animal walks about. They show most plainly when he is lying down. On one occasion a bull was seen which showed no trace of testes in one position, while upon rolling over they were plainly visible.

#### SEPTEMBER 29.

The wind began to freshen a little, and it was thought best to get Sivutch Rock out of the way while the landing was good. Arrangements were therefore made for a boat from East Landing to meet us on the Reef at 10 o'clock and take us over.

#### GORBATCH.

Immediately after breakfast counting was begun on Zoltoi sands. On the sands we found 27 of the 33 pups counted there previously. Some of these were freshly washed up, but it shows that the percentage of loss even on these places is not large. Not more than a dozen of these pups would have been found, however, if it had not been for the high wind of the past few days, which drove off the sand that had for a week covered them.

No attempt was made to separate the pups as to parts of the rookery. There were found to be on Gorbatch, exclusive of the sand beach at Zoltoi, 1,851 pups; including the 27 on Zoltoi, 1,878 in all. The previous count was 712. One hundred and thirty-four starving pups were counted on Gorbatch. A few additional pups belong to this rookery on account of removals for dissection, but it was decided to simply add to the total of dead pups the number of dissected pups. One hundred and fifty will cover pups removed for all purposes from the rookeries after the first count and before the second. All pups opened for dissection on the rookeries have disappeared. These pups have been reduced to skeletons by the gulls or carried off by the foxes.

Two blind pups were noticed in the progress of the count; one thin and starving, the other fat and healthy; the eyes of both white—"moon eyes." One pup was killed by jumping off a cliff while the starving pups were being counted. A living pup and afterwards a cow were found imprisoned in crevices in the rocks. They were both released by noosing them and drawing them to the surface. The cow seemed very stiff; the pup showed no injury, and was, as usual, ready and willing to bite every one.

It is evident that in this imprisonment of animals there is a considerable percentage of loss. These two instances show another way in which the rookeries can be improved. A force of men should be taken over them and cracks and seams of this sort should be filled with rocks. A heavy sledge to break in the edge would be the thing. The ledges of rocks at the Sea Lion Point of Gorbatch contain many crevices, which would be death traps should seals or pups fall into them, as they are deep and narrow and the animals could not extricate themselves.

#### ARDIGUEN, SIVUTCH, AND REEF.

The slide was counted next and found to contain 78 dead pups. There was one cow which was not noted in the previous count. Eight starving pups were counted here.

Before beginning the count of Reef rookery we went over to Sivutch Rock and counted the dead pups there. A total of 284 was found, and 31 starving pups. Mr. Lucas's area on the slide, which he marked by outlying stones, and which contained 33 cows and 4 pups, was measured roughly and found to contain 256 square feet.

A beginning was made on the Reef and it was completed in the afternoon. A total of 2,786 dead pups was found on this rookery and 300 starving ones.

The old bulls were again conspicuous. Many of these animals proved very difficult to move, and some of them could not be moved, discretion on our part being the substitute for valor.

#### EFFECT OF DISTURBANCE.

The return of the seals to the rookery was well illustrated by their action on Reef rookery. Mr. Barrett-Hamilton and Colonel Murray had driven about half the seals off the Reef before we got through counting Gorbateh. Instead of beginning at once to count the Reef we went over to Sivutch Rock. When we got back all the seals and pups were in their places. They were again driven off. We left the rookery for dinner, and on returning an hour afterwards the seals were everywhere in their old positions. They were driven again into the sea as our count progressed, and when we reached the northern end of the rookery, completing the count, the seals for more than two-thirds of the rookery space were settled back on the ground as if nothing had happened.

In the afternoon the seals were back on Gorbateh in as great numbers as ever and in their old positions. Even the two long, tongue like masses which run up the cinder slope were reproduced and one could not tell that the seals had been disturbed. For some reason the seals want to be on land just now and are very reluctant to be driven away.

#### LAGOON.

After finishing the Reef we went over in a boat and counted the Lagoon rookery. Here a total of 316 dead pups were found; 78 were counted here in August. The count of starving pups was 51.

The shank of a pelagic sealing spear was found in three pieces on the Lagoon and brought in. It is probably the handle of one of the spear heads recently found at Zapadni. The seal probably broke loose from the towing shaft in the bay, making her way to Zapadni, the shaft floating in to be thrown up by the surf on Lagoon rookery.

To-day the watchmen of Southwest Bay brought in the skin of a cow which had been struck with a spear in the left shoulder. The head pierced the shoulder, but pulled out. The cow was alive on the rookery, but helpless. She was killed. The wounded seal probably tries at any cost to get home.

During the afternoon there were a number of snow squalls, one of considerable violence, lasting for half an hour, which would have put an end to the counting of the day had not the sky cleared and the sun quickly melted the snow. It has resumed snowing again since dark and it may not be possible for us to continue the count on Northeast Point to-morrow morning, as intended.

In our count to-day we used the lines and searched the outskirts of the rookeries for stragglers. The count is almost absolutely correct for carcasses identifiable. All

carcasses, with few exceptions, were seen by either Mr. Macoun or myself, and in most cases by both.

Mr. Macoun suggests that in his judgment not more than 20 per cent of the former count of pups have disappeared. We will leave the matter open until the count is complete, but so far as I can judge 20 per cent would be ample to cover the loss.

#### SEPTEMBER 30.

A start was made this morning at 6 o'clock for Northeast Point in two buekboards to make the count of dead pups there. Although the ground in the village was pretty well covered with snow, the day looked favorable, and fortunately the snow did not extend above Polovina. If any snow fell at Northeast Point, it was very light.

#### NORTHEAST POINT.

We arrived at Northeast Point at 9 o'clock, and began counting on the east side off Webster House. One hundred and forty dead pups were found on the first point and the little beach beyond. Only 32 pups were found on Sea Lion Neck. There were 10 on the sands off Walrus bight. Five hundred and forty-three were found in the patch about the rock pile just past the bight. On the point where the sea-lion rookery is located there were 225. From here to a line with the eastern angle of Hutchinson Hill there were 1,441. On Hutchinson Hill, the beach below it, and to the end at the sands west of Cross Hill were 1,872, the total for Northeast Point being 4,263. Four hundred and thirty starving pups were counted. There were 2,293 in August.

Doubtless Sea Lion Neck has lost more pups in proportion between the two counts than any other rookery ground through the tremendous surf of the last few days, which evidently washed across the Neck.

Three pups were found imprisoned in a narrow fissure in the rocks. They were noosed and drawn out with difficulty. One or two pups were injured, and possibly others killed, by jumping from steep cliffs. The work of the present count is being done with the utmost thoroughness, in the hope that it may never have to be done again. It does the seals no good to be thus driven off, no matter how carefully the work is done.

#### PARALYZED ANIMALS.

Several cows have been found during the work of counting which seem to be paralyzed with fright. They lie on the rocks as if in a fit, their bodies twitching, their eyes rolling, their necks stiff, and heads thrown far back. They are perfectly helpless, and can not be induced to move. We have not been able to find them in their places an hour or so afterwards, and it is probable that they recover. Two of these cows were to-day seen on Northeast Point and others were seen on other rookeries.

A heavy surf was breaking on Northeast Point and the seals were very much averse to going into it. They got out immediately and resumed their places.

Everything was driven off the slope of Hutchinson Hill and the count finished at noon. Lunch was eaten on the top of the hill, and by the time it was over, about fifteen minutes, hundreds of seals were back and the vanguard were at the highest point on the hill.

Only one or two sea lions were seen about the rookeries of these animals.

Colonel Murray and Mr. Hamilton report the number of bulls on the sand beach below Cross Hill to be about 1,800. Only 50 of the 430 starving pups were counted for Hutchinson Hill. This is far too low, but it is impossible on wide spaces of rookery ground to make the seals go slowly enough to make a full count of the starving. The chief value of this count will lie in the fact that it is under, not over, the facts and can not be disputed.

#### LITTLE POLOVINA.

The work at Northeast Point was finished at 2.30, and we immediately started for Polovina. Little Polovina was counted first, and 119 pups found. Twenty-two starving pups were noticed by Colonel Murray and Mr. Hamilton.

Another of the paralyzed cows was found on this rookery. She lay quivering, rolling her eyes and frothing at the mouth. Poked and rolled over, she made no effort at resistance or escape. In half an hour she was gone. The pups and cows were lying far back from the rookery proper on the flat. The number of cows out on the rookeries at this particular time is very great. All the rookeries are alike in this respect and the cows on all show a uniform disposition to stay on land at any hazard.

Under the cliffs of Polovina 180 dead pups and 12 starving ones were counted.

#### POLOVINA.

On the main rookery 1,375 dead pups were counted and 43 starving ones. A number of pups dropped over a steep cliff and 4 were stunned and apparently killed on the rocks below. All but one, however, recovered in five minutes sufficiently to make their way slowly into the water. One was so badly injured that he was killed. His stomach was found to contain milk only.

The natives show an exasperating stupidity in their actions when dealing with the seals. They will follow them right out to the edge of the cliff, with a view to turning them back, and make them all go over. They do not seem to have any horse sense. You can't make them understand by calling unless you talk through the chief. They stand and stare or else keep right on till the mischief is done.

#### THE ARRIVAL OF THE BEAR.

On returning from Northeast Point the *Bear* was discovered steaming over from St. George. This is the first vessel we have seen since the *Rush* left on September 8. On going aboard in the evening it was found that for some reason the *Grant* and all the rest of the fleet had pulled out of the sea on September 20. Captain Tuttle had instructions simply to take us off when ready and land us at Unalaska. But there is no vessel leaving Unalaska, and our only chance to get away will be to wait till the *Bear* goes down on the 25th of October. We may as well remain on the islands, where we can continue to make observations.

Captain Tuttle landed a boat's crew under charge of a lieutenant and is to leave another on St. George. He wished to sail for St. George at midnight, but kindly consented to wait until to-morrow noon for us to finish the count on Lukanin and Kítovi, taking us with him to make the count on St. George.



On returning from the *Bear* at 10 o'clock the wake of the boat and the water raised by dipping oars was luminous with phosphorescence. Several seals were seen to rise in the water of the cove to look at the boat, and to dash away, leaving a luminous streak. One came up so close to the boat as to be struck by an oar.

OCTOBER 1.

The weather turned stormy in the night, and no communication with the *Bear* could be had.

The rookeries of Kitovi and Lukanin were counted immediately after breakfast. Kitovi furnished a total of 609 dead pups and 42 starving ones. Lukanin gave a total of 579 dead and 27 starving pups.

This closes the count of dead pups for St. Paul, and from the appearance of the weather it is in good time.

A gray pup and one cow were killed to day; the pup to throw light on the question of feeding, the cow to get the uterus for examination.

Coming home from Ice House Lake this morning, I found a starving pup which had probably swam up the lagoon from the rookery on the Reef. It crawled out of the water and lay down exhausted on the beach. It had not strength enough to take to the water on seeing me. Killed it to end its misery.

The cow and pup killed for examination were found lying together, and it is thought that they were mother and pup.

Made the following measurements of the cow, following Dr. Stejneger's methods:

	Ft.	in.		Ft.	in.
Total length (to root of tail).....	4	1½	Distance between tips of outstretched fore limbs .....	3	11
Nose to outstretched hind feet.....	5	4½	Girth of neck behind ears .....	1	5½
Nose to armpit .....	2	3½	Girth over the shoulders .....	2	8½
Nose to eye .....		3½	Girth behind fore limbs .....	2	5
Nose to ear .....		7¾	Girth in front of hind limbs .....	1	8
Distance between eyes .....		3½	Weight, 73 pounds 10 ounces.		
Length of ear .....		1½	MEASUREMENT OF LARGE GRAY PUP.		
Distance between ears .....		8	Tip of nose to end of tail (root of tail) ....	2	10½
Length of longest mustache bristle .....		4	Tip of nose to fore flippers .....	1	7
Length of fore limb (to angle of body)....	1	3¾	Length of fore flipper .....		7½
Width of fore foot.....		5	Hind legs .....		9
Length of hind limb.....	1	4	Tip of nose to front angle of eye.....		42
Width of hind foot at tarsus (extended) ..		46¾	Tail .....		1½
Width of hind foot at end of toes (extended) .....		27¼	Girth behind fore flipper .....	1	10½
Average length of toe flap .....		10	Ear.....		1½
Length of tail.....		2½	Weight, 33 pounds 10 ounces.		

The skins of cow and pup were saved for museum specimens.

The stomach of the cow was opened, and contained nothing save a few of the common worms. The uterus and ovaries were saved in formalin for Mr. Lucas.

The uterus of the pup, which was also a female, was saved. The stomach of the pup was full of milk. It contained also a small piece of seaweed and two small crustacea. These were put in formalin for further study. This is the first trace of marine life found in the stomach of a pup. It is to be remembered that they occur in a stomach otherwise full of milk.

<sup>1</sup> Not extended, 4 inches.    <sup>2</sup> Not extended, 4½ inches.    <sup>3</sup> To fur, 11 inches.    <sup>4</sup> Eye, 1 inch.

Three "killers" are seen passing along the side of the reef in the direction of Otter Island. There is no special commotion among seals. They are evidently feeding, judging from the gulls alighting in their wake.

It is plainly not true that all the pups turn gray. Many are now in color exactly like the yearlings—the brown ones. These pups are just as large and sometimes larger than the gray ones. There is just the same distinction in the pups as in the yearlings, and, for that matter, the cows themselves—individuality of color.

The count for St. Paul Island being completed, after discussing the situation it was agreed between Mr. Macoun and myself that 20 per cent would cover the loss of pups included in the count of August and not recognizable in the count just concluded.

The count of starving pups includes only those weak, emaciated, and plainly about to die, and was made by Colonel Murray and Mr. Barrett-Hamilton, assisted by Jacob Kochuten, a native. The count is necessarily only approximate and is an underestimate rather than an overestimate.

#### OCTOBER 2 AND 3.

It has been impossible to get on board the *Bear*. The weather continued rough and stormy with no landing through Friday and Saturday. The *Bear* still keeps her anchorage off the village cove. It is impossible to get out to the rookeries on account of the weather and also because of the necessity for getting off the moment the sea goes down enough to permit sending out a boat.

#### OCTOBER 4.

There being a landing this morning, Colonel Murray, Mr. Barrett-Hamilton, Mr. Macoun, and myself went aboard the *Bear* with our baggage. The ship steamed immediately for St. George Island, and landed us at 4.30.

A boat's crew in charge of Lieutenant Hooker of the *Grant* was also put ashore. These boat's crews are landed for the defense of the rookeries in the absence of the cutters from the sea.

#### OCTOBER 5.

##### ST. GEORGE ISLAND.

As the weather was very uncertain and the captain very anxious to get back to Dutch Harbor, it was thought best to send Treasury Agent Judge and Mr. Barrett-Hamilton to count East and Little East rookeries. Colonel Murray was left to obtain the statistics of the killings on St. George. Mr. Macoun and myself set out for Zapadni rookery at 6 o'clock, counting that rookery, Staraya Artel, and North on our way home, arriving at 1 o'clock. East and Little East having been counted and the other work done, we went at once on board the ship, leaving Mr. Barrett-Hamilton on the island to be picked up later with the lieutenant and boat's crew.

The count of dead pups on St. George was a surprise and extremely unsatisfactory. But one whole pup carcass was seen by me. This was on Zapadni. Mr. Barrett-Hamilton afterwards reported one from East rookery. The skeletons, skins, or skulls were all that could be recognized. The foxes, which were numerous, furnish the explanation. They have long since eaten up the earlier dead pups and are apparently disposing of the starving pups as soon as they die. In one case appearances seem to indicate that a pup had been eaten into while still alive but too weak to escape. The carcass was warm and the blood fresh.

The foxes on all the rookeries were right in among the seals eating carcasses there or preparing to haul them out. The greater part of the carcasses found were off the present location of the rookeries, at places to which they had been dragged and eaten.

On Zapadni 4 foxes were seen. There were 7 on Staraya Artel and 9 on North. They were not counted on East and Little East, but reported as "very numerous and bold." Three of the foxes seen were white. The foxes of St. George are much larger and finer looking than those on St. Paul. They evidently feed better.

#### THE COUNT OF STARVED PUPS.<sup>1</sup>

On Zapadni the remains of 527 pups were counted. The former count for this rookery numbered 199. Three natives assisted in the count, pointing out scattered pups. As close watch as possible was kept for starving pups, but only 4 were seen. The difference in time is probably sufficient to account for the small percentage of starving pups. The rookeries of St. Paul would to-day show as dead nearly, if not quite, all those counted as starving.

Zapadni rookery has a fine lot of pups. The number of gray pups is, however, very small. Most of the pups seem to have turned the color of the little brown yearlings without passing through the gray state. In fact, the gray pups are beginning to look so much like the little silvery yearlings that it seems probable the gray pups are the silvery yearlings and the others are the brown yearlings.

The rookery, as a result of the rain, is as filthy as a hogpen. The seals are drawn back on the clayey hillside away from the rocks. They seemed loath to go into the water, though a bath would have been good for them. A few went in and the water became colored like the hillside. But it took so long to put them in, that we went about them and drove them back up the hill. They immediately resumed their places in the dirt of the hillside. It would have been impossible to stampede them. For some reason the seals at this time are adverse to going into the water.

The seals now spread over the entire hill slope. They extend back in a long, narrow strip, following the ridge of rocks in the hollow at the foot of the hill. None are now to be found on the shingle of the beach. A tongue-like mass of breeding seals runs out along the ridge in a depression at the foot of the hill and is joined by a crowd of bachelors which extend out into the high grass. At two other points in the rear of the rookery the bachelors are hauled far out. In some cases they are out to the limit of the seal grass supposed to mark the original extent of the rookeries. Their track is narrow, but well defined by the beating down of the grass. A larger number of seals would soon denude the whole space.

From a consideration of the conditions here and at Staraya Artel, and the similar conditions on St. Paul, I am inclined to believe the grass area can be trusted only to show the former extent of the ground traveled over by the seals. This area bears no direct ratio to the size of the herd. Doubling the present size of the bachelor herd would cause greater proportionate diminution of the grass-grown area. Where bachelors are now to be found they are at the extreme limit, in the edge of the grass. As the grass becomes beaten down they move on. Each move extends the area occupied this year, while the ground behind is unoccupied.

<sup>1</sup> For a summary of the counts of starved and starving pups on both islands see Volume I, pp. 213 and 214.

## STARAYA ARTEL.

On Staraya Artel 10 bachelors were lying far out and up the hill, at the outer limit of the area, which we remarked as being ten times the present area of the rookery. These bachelors had cut a narrow band or way through the grass-grown area to the outer limit. The space behind the rookery in the earlier part of the season occupied by idle bulls is now covered with the cows and pups of the rookery.

That certain areas on the breeding grounds are bare in the breeding season does not mean that this unoccupied territory is all recently abandoned rookery ground. As a matter of fact the backward movement of the seals at this time of the year covers all this ground. On the Reel rookery of St. Paul fully an acre of grassy plain of the parade ground has been occupied by the cows and pups to such an extent as to beat down and kill the grass.

The grass-grown areas of the hauling ground merely represent the area once trampled over by the seals, the roaming bands of bachelors, and the grass-grown extension of the rookeries represents ground once occupied, when the herd was larger, by the backward movement of the animals late in the season, as the bare areas now represent the ground at present occupied by this movement.

The bachelors are extremely few on St. George just now, and the same is true of St. Paul.

On Staraya Artel rookery 194 dead pups were counted in a similar condition to those on Zapadni. Only 3 starving pups were seen. The same disinclination to go into the sea was noticeable here. After driving the seals off the upper half of the hill and counting it, we simply went below and turned the greater part of them back up the hill to their former location.

## NORTH ROOKERY.

On North rookery 145 carcasses only could be found. Here the loss between the two counts becomes striking. Two hundred and fifty pups were originally counted here. Seven starving pups were noticed on this rookery.

The pups on the rookeries of St. George were a fine lot, the majority of them as large as the yearlings seen about the rookeries of St. Paul.

It was on North rookery that Colonel Murray did the branding. Mr. Macoun and I watched closely for the result. Eighteen of the 62 branded pups were counted, one with one brand, one with two bars, and one with three bars.

We saw 2 of the 9 branded cows—1 full grown cow, evidently with a pup, and 1 small cow—probably a virgin 2 year-old. Each cow had 5 distinct brands on her back, and there could be no mistake as to the spoiling of the skin. The wounds on cows and pups alike were perfectly healed and the animals showed no bad effects.

## EAST ROOKERY.

Only 15 dead pups were found on East rookery where 112 were counted by Mr. Lucas in August. On Little East 16 were found out of 31 in August. Four starving pups were seen on East and 1 on Little East rookeries. Treasury Agent Judge and Mr. Barrett-Hamilton made the count. The foxes were very numerous in the neighborhood of these rookeries. Only 1 whole pup carcass was found, and the pups were busily eating that. The count had to be based upon skulls and fragments.

It is likely that the foxes on the east side are more numerous, at least more so in proportion to the supply of pups. It may also be that there are fewer starved pups



on these rookeries. This condition might also apply to North rookery. If the cows on these rookeries feed to the eastward, they may not have been so heavily drawn up by the sealers as the cows on the western rookeries, which would undoubtedly go west and mingle with the large herds of St. Paul.

The bulls are present in numbers on the rookeries of St. George, as if freshly returned from feeding. Much excrement of a brownish color and also of the color of putty is present in the rookery grounds.

A good deal of chalk-like excrement is to be seen, as if seals had been feeding on the same things the sea lions are wont to eat. On Zapadni, of St. George, very near together were seen a number of great splashes of yellow excrement such as cows and bulls frequently void when excited, and especially when stampeded into the water. It was noticeable simply by reason of the nearness together of a number of instances. Probably a number of seals had been feeding on the same material.

On Zapadni three patches of spewings were seen near together which contained numerous squid beaks and eyes. Mixed with the stuff was some dark reddish substance like the supposed red seaweed found in the pup stomachs. Perhaps the squid were caught in the seaweed and portions were swallowed with the food. Near by was another spewing containing fish bones and undigested flesh, probably of pollock.

Noticeable about the pups of Zapadni of St. George is the small number of gray ones, or rather the small number of pups which have not turned gray, or else have so modified their coats as to have much the same appearance as the brown yearlings.

The *Bear* held its anchorage through the gale of the night, having to let out 80 fathoms of anchor chain to do so. The wind was down in the morning a little, and a boat was sent ashore with some baggage, and for the mail.

At 6 o'clock we started for St. Paul, Captain Tuttle having kindly consented to run over to that island. There being no prospect of getting home by any other vessel than the *Bear*, I thought best to spend the intervening time on St. Paul. Mr. Macoun decided to do the same thing. Colonel Murray remained on the *Bear* to go to Unalaska.

The *Bear* arrived at St. Paul at 12.30, and without coming to anchor put us off at Gorbatch, no one in the village having noticed the ship, and consequently no signal being set to show that the village landing was good.

The *Bear* will return for Lieutenant Hall and his boat's crew about October 20. He will then take us down to Seattle.

#### OCTOBER 8.

It rained all day yesterday and has rained so far to-day. A very heavy surf is running in at East Landing.

Went out in the afternoon to Kifovi to see the pups. None were about the point of Black Bluff, and no wonder, for the surf is breaking over the shelf on which they sleep.

One of the single brand pups was visible on the rocks in the bay. Two of the double-brand pups were there. They are in good condition. The heavy surf has driven everything on shore at Kitovi and Lukaini.

## OCTOBER 9.

Went this afternoon to visit the Reef. While watching the bulls and bachelors in the little cove across from Zoltoi, I saw the whole lot start up in great fright for no other reason than that an extra heavy wave made a noise which awakened two or three. They jumped up and the whole flock nearly stampeded. In a few minutes they were again sleeping or engaged in playing with one another.

The testes of the bulls show in exactly the same manner as in September. In some they show distinctly, in others not at all, depending upon position. In nearly all they show somewhat if the animal is lying in a position of relaxation. When the animals first lie down they do not show. In 4-year-olds the testes show more uniformly than in the older bulls.

From the top of the cliffs I watched the seals swimming back and forth in the water. There seems to be a constant interchange between Kitovi and the Reef past East Landing.

One big bull was seen passing slowly along at the foot of the cliff. In the clear water he was diving to the bottom and plainly searching along, just as pups do. As a rule the bulls in the water seem only to be playing, or just taking a bath. This fellow seemed to have a purpose.

From the rock pile above the Reef it is interesting to see that notwithstanding all the disturbance and confusion created by the count on this rookery a week ago it has resumed the exact shape it had before the count was made. The seals must have a very definite sense of locality.

Three killers, apparently the same crowd, are passing along the Reef in the direction of Otter Island. This seems to be their regular beat. There is no special commotion among the seals. The killers are evidently feeding, as the usual flock of gulls are hovering and lighting in their wake.

## ARDIGUEN.

The slide is about as usual. Only 3 cows and no pups are on the flat above the mouth. One starving pup is visible. The pups here are very large, many almost seem larger than the yearlings. It is evident that many of these pups are not to turn gray at all. In all likelihood certain black pups develop directly into the brown yearlings and that the gray pups become the silvery yearlings.

## OCTOBER 10.

This morning at breakfast the new chief, Nickoli Grumof, reported that a killer had come in almost to the wharf at the Point Warehouse after pups. He came in on a great roller, and came very near getting stranded. At one time he was more than half out of water.

In about an hour the chief brought up the half-eaten carcass of a pup which had been attacked by the killer. The hinder part of the pup was entirely gone. The head was severed, except for the wind pipe, which united it to the body. The skin was stripped off from the body, but remained attached to the head. The vital organs were gone.

Judge Crowley and I, accompanied by Apollon Bordukofsky and Karp Buterin, went this morning to Lukanin to try to get some pups for the examination of their

stomachs. We could not find any that gave evidence of being recently in the water, and came back to try at the Point Warehouse, but the pups have ceased to land there.

Though we did not get pups, our trip had an important result. While watching the pups off Lukanin cliff a number of the branded pups were pointed out to Apollon and Karp. Apollon said, "I thought all them pups die, boss, that's sure; but they just as lively as ever." He went on to say that all the natives believed that the branded pups had died. Both men seemed pleased to find the pups all right. As many as 20 of the pups were pointed out. Judge Crowley is going to have some of the older men among the natives brought over to see the pups. The purpose of the branding was explained to them. This feeling on the part of the natives explains their sullenness and indifference at the last branding.

#### OCTOBER 11.

##### THE TESTES OF THE BULLS.

Went down under the cliff on the east side of Reef neck and crept up on a sleeping bull, getting within 6 feet of him. His testes were plainly visible. Aroused by a pebble, he raised his head and the testes partially disappeared. Roused again, he showed considerable alarm. In a few minutes he quieted down, though still standing up. He began scratching his neck with a hind flipper. The testes had entirely disappeared and the scrotum was nothing but a fold of wrinkled skin. The animal was now in the position he would occupy when standing. The bull lay down again presently, and in the course of twenty minutes the testes were visible as at first, the animal having become perfectly composed.

It is evident that when the animal was thoroughly aroused and preparing to move away, if necessary, he drew the testes up in the body, and this is probably the regular thing when the animal is in motion.

A big bull in fine condition landed while I was watching the above bull. He came in very slowly, rubbing his neck and nose on the stones as he went along; acted as if tired; looked like an animal that had been feeding and had come in to rest. As soon as the sleeping bull saw him he began to growl; the incoming bull returned his growl, but as he approached, the dry bull got out of his way. The newcomer took the vacant place with a satisfied air as if he owned it. This bull showed no trace of testes.

I passed down along the beach and watched 6 other bulls, 2 of which afforded an opportunity for observation, with practically the same results.

##### ZOLTOI.

There were only a few seals on Zoltoi this morning. Within the past few days Judge Crowley has had one of the sailors patrol the east side of the Reef looking for killers and he has taken a short cut across the hauling ground on his way home.

However, among the few seals out is the albino bull which has been noted here so often. He has evidently been away for the past week or two.

A school of killers were seen passing up along the east side from the direction of Sivutch Rock, their usual course. The customary flock of gulls followed them, fighting and feeding at intervals in the water.

Opposite East Landing the killers stopped and began swimming about in various directions. Then they rounded up and began playing or something that seemed like it. They went about in a small compass of water making it boil and foam. Occasionally one of the small ones would jump entirely out of the water, much as a seal might. They kept up this performance for half an hour and then moved back toward the south. They were just out of range and could not be touched with the rifle.

Nickoli Krakof said that the killers had rounded up a flock of seals and were eating them. Seals were all the time passing unconcernedly to and fro along the shore.

#### REEF.

Went out on the Reef again in the afternoon with Karp and Apollon. The killers were to be seen passing the western side of the Reef from the direction of Zoltoi Bay. One of the sailors shot several times at them, though out of range, and it apparently frightened the animals, for they swam quickly away. They appeared again off Sivutch Rock to the east later on and had another tournament or round-up in the water.

#### KILLERS.

The killers are evidently about the islands every day, and the number of pups and cows they eat must be large. Two instances are said to be on record where the animals were taken. One had 18 and the other 21 pup carcasses in their stomachs.<sup>1</sup> Of course it is not known how often they feed, but they seem to be at it all the time, judging from the frequency of their appearance within the past few days.

If a boat's crew is to be continued on the islands, they should be armed with guns that can reach these animals and equipped with a boat that will enable them to be hunted with safety in fair weather.

I walked most of the length of the Reef with Karp and Apollon. Saw no starving pups among the thousands of pups along the water's edge. There were 300 of these pups when the count was made on September 29 and they have evidently all died since. There is apparently no new crop of starved pups coming in to take their places. But remembering how different were appearances and fact in the inspection prior to the count, no great reliance can be placed upon this.

The pups are very strong and active. They seem in every way quite as capable of taking care of themselves in the water as the yearlings are. They certainly have more blubber to work on. It would seem as if the pups were storing up a supply of this article with which to stand out any period of fasting which may result in the transition from milk to fish diet.

A cow was started up on the Reef which acted as if blind, though her eyes seemed all right. She plainly did not see. When touched she ran stumbling and falling over rocks until she was well up into the parade ground. Then she lay down and would not move. She went into much the same state as did the cows seen on Northeast Point and Little Polovina—a sort of cataleptic fit. In the course of fifteen minutes she got up and slowly stumbled back to the rookery. Karp said that the bright sun blinded her. Both Karp and Apollon said that she would be all right.

<sup>1</sup>On tracing these stories they seem to have no basis in fact so far as the islands are concerned, having apparently been transferred as sailors' yarns from events among the hair seals on the Labrador coast.



Karp told me to-day that last week when he was watching at Northeast Point he found a cow whose sides were sticking full of "those worms that bore into the dock at Dutch Harbor" (teredos). The heads were embedded in the skin, the bodies hanging out like strings. He caught the cow and pulled out the worms, letting her go free. Of course he did not save any of the "worms" and it is doubtful whether they could now be found. This must have been the "barnacle covered" cow which Mr. Hamilton and Colonel Murray saw at Northeast Point and which caused so much discussion.

## ARDIGUEN.

Two young bulls were on A's shelf at the slide to-day. The other bulls, including A, have been gone since the day of the count.

I had Karp and Apollon kill 2 large gray pups on Gorbateh for examination of stomachs. These pups were large, well fed, in good condition, and in a position near the water.

The pups were brought home and the stomachs opened in the presence of Mr. Maconn and Judge Crowley. They contained no milk whatever, only some pebbles and some mucus similar to that found in the stomachs of seals on the killing grounds. Some blood was in one stomach, but probably due to the fact that the animal had been stuck with a knife instead of clubbed, to save the skull.

## OCTOBER 13.

Yesterday it was too stormy to go out to a rookery. I went this morning with Apollon and Karp to Lukanin. The surf running in at Lukanin was still very high, but the pups did not seem to mind it. They were out in the usual numbers.

There was a cow with an imperfect patch of fur on her rump. Judge Crowley says that the natives and Mr. Redpath have seen an increasing number of such defective animals this summer. I therefore had the cow killed to secure the skin for examination. Another cow was wanted for examination of the uterms, anyhow.

The cow seemed to be over 4 years old. She was thin. She had been in milk, though apparently nearly dry. Her stomach was devoid of any trace of food, containing only some pebbles and worms.

One of the branded pups was killed. The brand had not entirely healed, though nearly so. A better specimen could have been secured, but the pup seemed dwarfish and we thought it starving. The skin shows the brand clearly.

The pup proved not to be starving. The stomach contained a small quantity of milk. The milk showed traces of the reddish coloring matter so often noted. Whatever the substance producing this color is, it is always in such a state of decomposition as not to be recognizable. I took a quantity in a bottle hermetically sealed for chemical examination, but doubt whether it can be preserved.

Another pup near the water, which looked thin, was also killed. It proved to be blind, with eyes slightly of the "moon-eye" type. The second stomach was empty except for the usual pebbles and a very small quantity of reddish mucus, as in the other.

In the afternoon, in company with Mr. Maconn, I went to Kitovi to get more pups. Killed 2 pups—large gray ones—1 full and plump and 1 slightly thin. The pups were taken from the side of the bay. They are constantly in the water. The pups killed

in this, as in other cases, except that of the branded pup, were males. The stomach of the plump pup contained a quart or more of milk, perfectly white, without coloring matter of any kind. Three little scale-like objects—Mr. Macoun says they are from the inside of a little seashell—and a small shred of green seaweed were found in the milk. The usual pebbles were present.

The second stomach was devoid of milk. The usual pebbles were there and one small tunicate. The tunicate, scales, and seaweed were taken on formalin for reference.

#### OCTOBER 14.

I went over to the Reef this morning with a tape-line to remeasure the area on the slide designated by Mr. Lucas. On the closer measurement the space proved not essentially different from the former result, 256 feet—about 8 feet to each animal.

On the way over I found that the bluffs of Zoltoi, which had been vacant for a few days, and on which few bachelors have been for three or four weeks, were filling up. About 50 bachelors were in a pod at the angle. They were playing. Some were going up the sand; others landing were pretending to be scared and dashing back into the water, only to return with greater assurance and finally to go up the hill.

This seems to mark the return of these bachelors from feeding. It was said they had abandoned the place because of our frequent traffic across the sands. On my return in the evening a large number of new arrivals had hauled out in addition.

Yesterday, when we were trying to catch the plump pup, he voided a small piece of hard cylindrical excrement. This seemed noteworthy, because all pup excrement heretofore seen had been soft. As I crossed Zoltoi sand beach this morning a lot of pups and bachelors were sleeping and playing out in the bay offshore. The tide was receding, and at the line of its fall were hundreds of pieces of this same kind of excrement, some of it plainly from its size voided by older seals, but most by pups. Does this mark a change in the diet of the pups?

#### ARDIGUEN.

There are no bulls on the upper part of Ardignen, and only 1 or 2 cows on the flat. There are 8 bulls lying at the water's edge, or rather teasing cows there, for they chase every moving cow that comes near and try to hold her. As a rule she hovers about a minute, biting gently at the bull's neck, and then edges off; the bull does not follow. The bulls have evidently just come back from feeding. They are in good condition. It is evident from their actions that if necessary they would be able and willing to serve cows.

One of the bulls on turning about proves to be our old friend A, having his scar and general appearance. He has not been on his shelf since before the count.

On account of the rain this morning the bulk of the seals are in the water. Those on land are perched on stones and holding their heads in the air.

#### KITOVU.

In the afternoon I took Jacob and Apollon to Kitovi for more pups. Brought home a large gray pup for measurement. The result of the measurement will be found on another sheet.

I had killed also a very small pup: it can not be over 6 weeks old. It will by contrast with the largest pup killed—33 pounds, 10 ounces—or with one killed to-day—29 pounds—show the limits of birth. The little pup was not a dwarf, or underfed, or sickly, but as lively and bright as a pup could be.

Killed also a pup on the point of starvation, though he might have lasted two or three days. Wanted this pup for measurement by contrast with a well-fed pup. It was gray and seemed about the same age of the other gray pup killed to-day.

The stomachs of the 3 pups were opened in the presence of Mr. Macconn and Judge Crowley. In none was any trace of milk. The large pup had absolutely nothing in his stomach save a few pebbles. The stomach of the little fellow had some of the red coloring matter and it was wrapped up and placed in formalin for examination.

The stomach of the starving pup contained a soft red crab. The crab seemed about disappearing in the intestinal tract. It was in the lowest part of the stomach. The crab was preserved. It seemed not to be affected by digestion.

*Two pups killed October 14.*

Measure.	Normal sized pup.	Young pup.
Tip of nose to root of tail..... inches..	33½	28
Tip of nose to fore flipper.....do....	17½	12
Tip of nose to front angle of eye.....do....	2½	2
Length from fore flipper to body angle.....do....	9½	8
Length from fore flipper to fur line.....do....	7½	6½
Length from hind flipper.....do....	10	8½
Length from eye.....do....	7½	.....
Length from ear.....do....	1½	1½
Length from tail.....do....	1½	1½
Girth behind fore flipper.....do....	22½	16
Weight.....pounds..	29	14½

Of these small pups there are many on the rookeries. They have probably been born late.

OCTOBER 15.

THE FOOD KILLING.

Judge Crowley had a drive made this morning from Zoltoi to determine whether the stagy season had passed. About 500 or 600 seals were driven up at 5 o'clock. After breakfast the killing commenced. Fifty-nine were killed, enough to give each family a carcass.

Of the first 3 pods driven up 20 were killed, and 71 rejected, being too small or too large, principally the latter.

I took measurements in accordance with Stejneger's methods of what were said to be a 2-year-old and a 3-year-old bachelor. The measurements seem to indicate rather short and long of the same age, the difference being slight in the figures, though I thought it sufficient in the appearance of the animals stretched out.

*Bachelor measurements.*

[Taken in accordance with Dr. Stejneger's methods.]

Measure	3-year-old.	2-year-old.
	<i>Inches.</i>	<i>Inches.</i>
Total length to root of tail .....	54 $\frac{1}{2}$	48
Tip of nose to end of hind flippers .....	72	71
Tip of nose to armpit .....	29 $\frac{1}{2}$	28
Tip of nose to eye .....	3 $\frac{1}{2}$	3
Tip of nose to ear .....	7 $\frac{1}{2}$	6 $\frac{1}{2}$
Distance between eyes .....	4	3 $\frac{1}{4}$
Distance between ears .....	8 $\frac{1}{2}$	8 $\frac{1}{2}$
Distance between tips of fore limbs .....	49	48 $\frac{1}{2}$
Length of ear .....	2	2 $\frac{1}{2}$
Length fore limb (to angle) .....	17	17
Length hind limb .....	17	16 $\frac{1}{2}$
Length tail .....	2	2
Average toe flap .....	10	10
Length longest bristle .....	6	4
Width hind limb .....	4	4
Width hind foot .....	5	4 $\frac{1}{2}$
Width fore foot .....	6	5 $\frac{1}{2}$
Girth behind ears .....	20	20 $\frac{1}{2}$
Girth over shoulders .....	36 $\frac{1}{2}$	35
Girth behind fore limbs .....	31 $\frac{1}{2}$	31
Girth before hind limbs .....	18	18

The stomachs of all the bachelors were opened and were found to be wholly devoid of recognizable food substance. In fact, beyond the pebbles and a few shells, etc., there was nothing but worms and mucus. In a number of cases the same coloration noted in the milk found in the stomachs of pups was present. A miscellaneous collection of shells and other things were taken and preserved in formalin. In one stomach was a small tunicate like the one found in the pup's stomach. A small piece of red crab was also found just like the one in the starving pup's stomach. These bachelors are in good condition and have plainly been feeding recently.

In all the seals killed the testes were found well embedded in the body. The scrotum did not show trace of their having been down, not being wrinkled as in the case of the old bulls.

In half an hour after the killing the seals were again drawing out on Zoltoi. The rejected seals had been turned into the village cove.

Jacob Kochuten found the fresh carcass of a seal cow on Gorbateh to-day which had floated ashore in a mangled condition, probably killed by the Orea.

## LUKANIN.

I walked out to Lukanin in the afternoon. Saw many of the branded pups; all in good condition. I counted 25 bulls out on the water front of the rookery. They were not out at the time of my last visit and their simultaneous appearance is exactly like that noted some time ago. More than half the bulls are rounding up and talking to the cows about them. The scene has very much the same appearance as the rookery had just after the harem system gave way in August.

One cow, from the way in which she clung to the young bull, seemed as if in heat. She would go about him biting his neck; he nuzzled her, snuffing and smelling over her for ten or fifteen minutes. At times he would crush her down under his breast and hold her. She finally went away and lay down at some distance. The bull remonstrated, but did not follow.

Three of the branded pups were seen nursing. One little pup was wet, just in from a swim; his mother was wet also.



## OCTOBER 16.

In the afternoon I walked out to Tolstoi. The sand flat is deserted. The usual number of seals are in the water and passing back and forth.

A large number of bulls are out and active in rounding up cows. The same condition is shown here as at Lukanin.

Saw a small pup, black, if anything smaller and younger than the one killed the other day.

Saw a cow and pup recognize one another in the water. The cow called and the pup came swimming and answering for a considerable distance. The cow showed no inclination to land but swam about. The pup followed her, swimming with his nose touching her side. Once he lost her and came swimming to her calling. Every time the cow's head came above the water the pup came up in front calling and shaking his head.

## TOLSTOI SAND FLAT.

The heavy blow of the last few weeks has produced marked changes in the sand dunes back of English Bay. All the loose sand has been blown away from the sand flat and it stands out the graveyard it really is. It is literally white with pup bones. Most conspicuous are the scapula and the curved top of the skull. The latter bone was so conspicuous that I measured off a space 13 by 14 yards and counted them. The space contained 336, each representing a pup. These are, of course, pups of other seasons than the present. The bones show the pups to have been small—young ones. The same condition, or if anything worse, appears in the extension of the sandy area beyond the present terminus of the rookery, and the bones of pups are strewn a considerable distance up the slope toward the Lagoon. This furnishes another evidence of rookery shrinkage, as this must at one time have been covered with breeding cows.

The cows and pups are now farther back than ever up the hill, or it may be that they are backed by a lot of bachelors. The usual array of bulls is on the sands of English Bay. There has been no change since September 8.

## LUKANIN.

Walked across the country to Lukanin Bay. An old bull which evidently had tramped very thoroughly over the space about him was found lying on the sand. Beside him was a great splatter of excrement of a light yellowish color. Mixed with the excrement was a multitude of very fine white short worms—like pieces of white thread.

The bull when aroused seemed very unwilling to move, but finally shuffled off dragging his hind flippers. He was not an old bull, but was very thin, probably sick.

Along the sand of Lukanin beach at the mark of each subsidence of the surf were hundreds and hundreds of little cylindrical pieces of excrement, evidently voided by the pups which are swimming, sleeping, and diving in the water just offshore. This is exactly similar to the condition noticed already on Zoltoi.

One of the branded pups is seen swimming in the water. He keeps his back bowed up, showing the 3 brands distinctly. Is he showing off? Watched for ten minutes, he maintains the same position and keeps swimming about. A stone thrown

near him causes him to dive under with the others like a flash. In a few minutes he is again visible and in his wonted position, which he maintains as long as I stay.

#### OCTOBER 17.

I accompanied Judge Crowley this morning to Zapadni rookery. He took over a force of natives to make a beginning in fixing the death traps on this rookery. About one-half of the first gully was covered at intervals with small bowlders from the beach which the men carried up on their shoulders. Larger angular bowlders were rolled down from the surrounding banks and scattered among the smaller stones. A part also of the second gully was covered. The bowlders are probably too small to be of the best service.

As it rained incessantly all morning and was very disagreeable, the work was discontinued at noon pending better weather. The main point was in getting it started and in showing the natives what was wanted. They can go ahead and finish the work when the weather permits. They took great interest in it and worked willingly.

Had a thin pup killed for examination of stomach. The pup was on the way to starvation. Stomach devoid of milk or any foreign substance except the usual pebbles. In the intestines was found a quantity of the blackish secretion which is associated with starvation.

#### STARVING PUPS.

We were evidently mistaken about the subsidence of starvation soon after the count of starved pups. The number to starve after that time did not seem great at any inspection, but they have been constantly visible to the present time and are not all dead yet. The pups now dying could not have been recognized as starving October 1. Our count of starved pups therefore must fall far short of the facts. The figures obtained, however, are on this account not open to dispute. The error from this source is not so important as the greater error in the loss of early dead pups which would have resulted had the count been longer postponed.

Had a large bull, in fine condition and who had evidently been feeding, killed for examination of stomach, also testes, and for measurement. The measurements are recorded elsewhere.

The bull was very fat—containing an immense coating of blubber. Jacob Kochuten, who skinned him, said the bull had been feeding for two months—ever since he left the rookery in August.

His stomach, however, was devoid of food. A quantity of shells, a very few stones, and, strange to say, a number of pup bones—two or three ribs and a section of vertebra. Does this mean that he had eaten a pup? More likely it means that instead of loading with pebbles for ballast he had stored in some bones picked up on the rookery ground.

The animal's intestines contained nothing but worms and a thin yellowish watery fluid, of which he voided a quantity on the short drive to the place of killing.

An examination of the testes of the bull was made. The organs themselves were dissected out and preserved. The dead animal showed externally no traces of testes. The scrotum was simply a wrinkled fold of skin. By pressure on the abdomen the

testes could be forced down into the scrotum. They could then be pressed back into the body cavity. The organs were then carefully cut out and preserved.

It seems clear, therefore, that the testes are under the control of the animal, and can be withdrawn out of the way when the animal moves about. Thus it happens that the only logical groundwork for the absurd theory of sexual injury from driving falls through. In the early years, when the animals are driven most, the testes are naturally out of danger. In the adult animals there is special provision made for protection against the apparently exposed position of the organs.

#### OCTOBER 20.

The past two days have been so stormy that it has been impossible to visit a rookery.

#### A SICK COW.

Some of the natives reported a sick cow among the sand dunes of Lukanin beach. I went out with Neon Mandrigau and Peter Rustikof to see her. She was still alive, but helpless. As she had been lying there a day and a half, I ordered her killed, with a view to ascertaining the trouble and to obtain the uterus, thus avoiding the necessity of killing a healthy cow.

No bones were found broken. The lungs seemed to be slightly congested; other organs apparently in good condition. The stomach was wholly empty. She must belong to that class of cows of which 3 or 4 have been seen overcome with fright. It is possible that she might have recovered. She was lying in a little hollow where a temporary lagoon had been formed by the high surf washing over Lukanin beach. She was probably washed in and left when the water subsided.

Her skin had a spot bare of fur in it, and in her back was a recently healed wound, evidently caused by a bite.

A bull with a broken back was seen on the sand at Lukanin. Redpath says the bull will get along all right. Says he has seen seals turn up in the drive with both hind flippers taken clear off, with one front flipper taken off close up to the shoulder. The seals were in good condition and got around all right.

#### NOTES.

Made the following notes from the Judge's report, which he kindly let me read this morning:

- “This year the first bulls arrived April 13.
- “The first killable seals arrived May 11.
- “The first cow seen on North rookery June 8.
- “Five cows were seen on Reef rookery June 12.
- “The first pup was seen on Reef rookery June 14.”

#### ZOLTOI.

I had Karp Buterin shoot with a rifle one of the many pups playing and sleeping just off Zoltoi sands. The pup was in the act of playing with a piece of seaweed. Its stomach was found to be full of milk, without trace of other substance. It is difficult to shoot these pups, and it was only after repeated trials that we got this one.

The intestines of this pup were full of fecal matter of the color of that seen thrown on the beach. The rectum contained cylindrical feces hard like that on the sands. This one specimen is probably too slight a basis on which to establish the matter, but it seems that these pups, which spend so much time in the water, are the well-fed pups. Those killed on the rocks at the Point Warehouse just after coming ashore, the one killed by Mr. Macoun and Judge Crowley while coming out of the water, and several others were all full of milk. For the most part, on the other hand, the pups killed on shore have been empty—waiting for their mothers.

The presence of these well-fed pups in the water in contrast to the empty ones on shore, considered in the light of the fact that the stomachs of the bachelors taken from Zoltoi the other day immediately after coming in from the sea, seems to suggest that the fur seal naturally digests its food in the water. The adult waits offshore to finish digestion if it arrives before it is completed, and the pup, when he has a stomach full of milk, takes to the water and sleeps and plays there while it is being digested.

There are a score of bachelors off Zoltoi sleeping and playing with the pups. There has been a band of seals all summer off the rookery fronts. There is mingled with the pup excrement on the sands of Zoltoi the feces of adult seals. In this digestion of the food before coming on shore we have the explanation of the fact that seals are not seen during the summer to land directly from the sea, but always from the band of swimming seals.

In further investigation of the question of the feeding of pups, Judge Crowley will kill pups at intervals as late as they remain on the rookeries. Up to this time there is absolutely no evidence whatever to favor the idea of the pup's ability or inclination to obtain other food than mother's milk.

#### OCTOBER 21.

Spent the forenoon in packing preparatory to leaving the island. The *Bear* came in from the direction of St. George and anchored off Lukanin Bay, the only landing place, and we got away early in the afternoon. The ship had picked up Mr. Barrett-Hamilton and Lieutenant Hoover and his boat's crew from St. George. An unsuccessful attempt was made to land mail on St. George in the night, and the *Bear* sailed for Unalaska. Mr. Barrett-Hamilton reports that killers were seen almost daily about St. George during his stay there. A food killing of 59 seals was made from North rookery on October 20, and another of 18 on the 21st at Zapadni. He reports counting 70 bulls on Zapadni.

The *Bear* arrived in Unalaska on the morning of the 21th of October and sailed for Seattle at noon on the 25th, arriving in Port Townsend at midnight of November 2.



## NOTES BY TREASURY AGENT CROWLEY.

The following notes were made by Mr. J. B. Crowley, special agent, after the departure of the commissioners in the fall of 1896 and before their return in the summer of 1897:

November 3, 1896. Two large gray pups were killed this afternoon on Lukanin rookery and their stomachs examined. One stomach contained over a quart of milk and the usual stones, the other about half a pint of milk of a pinkish color. No traces of other food than milk was present.

November 5. Reef rookery was visited this morning. No evidence was found of the departure of pups. Many of them were in the water along shore, and many cows were with their pups on land. Many pups were observed nursing. No holostiaki were hauled out on the Reef.

November 6. A visit to Lukanin rookery showed no bachelors hauled out. There were a good many cows and some bulls on the rookery. There was no evidence seen of the departure of pups. They seem fewer in number on land, but more plentiful in the water. Many of the branded pups in good condition (one of them nursing its mother) were seen.

November 11. A few bachelors are hauled out on the Reef mixed with the cows, of which there are many still on the rookery with their pups. Many pups were seen nursing. The usual number of old bulls are about the rookery among the cows. They are in excellent condition. The warm weather of the past week has evidently brought out many seals and the bellowing of the bulls and cows reminds one of the days earlier in the season when the harems were being formed.

November 19. The seals have been gradually leaving Lagoon rookery for the past ten days. Not more than one-third of them remain. Cows are present on the rookery about in proportion to the remaining pups. A noticeable decrease is observed in the seals on Reef, Kitovi, and Lukanin rookeries. The presence of cows and pups at this date is undoubtedly due to the unusually mild weather.

November 26. The seals are gradually leaving and those still remaining are restless. The older pups are disappearing. Those remaining seem to be in proportion to the cows. Eight branded pups, in good condition, were counted on Lukanin and three on Kitovi.

December 1. A few pups are present, but they are rapidly leaving the rookeries.

December 4. No pups were to be found on Lukanin and Kitovi rookeries this morning. A few yearlings, bachelors, and some young bulls were hauled out on the rocks.

December 6. A food drive was made to-day from Reef and Tolstoi; 354 seals were killed. One cow was killed on the Reef, in accordance with instructions from Dr. Jordan, for purposes of scientific investigation. One male gray pup was killed in accordance with similar instruction. The stomach showed no trace of food of any kind. The pup was very fat, the blubber along the back and sides being an inch and a half thick. Among those killed this morning was a seal with a fresh gunshot wound, from which the blood was flowing. Two buckshot were found in the fleshy part of the fore flipper.

December 14. A seal drive for food was made from the Reef and 126 killed.

December 15. Sivutch Rock is covered with seals to-day.

December 30. It is reported that about 100 bachelors are hauled out at Northeast Point under Hutchison Hill. Sivutch Rock is covered with seals and many are in the water between there and the Reef.

January 3, 1897. About 40 seals are reported on Tolstoi rookery, and Sivutch Rock is still covered.

January 7. The high wind of the past few days has driven the seals off Sivutch Rock.

January 29. A number of seals are hanging about Sivutch Rock, in and out of the water according to the wind and weather.

February 16. About 30 seals are reported on Sivutch Rock.

March 2. The natives succeeded in landing on Sivutch Rock and killing 19 seals for food.

March 17. Natives killed 29 seals on Sivutch Rock for food.

April 19. A young bull is reported swimming in the open water between Reef shore and the ice.

May 1. Five seals are hauled up on Sivutch Rock. None are reported elsewhere.

May 5. Two bull seals are reported hauled out on Gorbateh and one at Polovina.

May 6. Eight bulls and about 20 bachelors are out on Sivutch Rock.

May 7. Two bull seals are hauled out at Tolstoi and some bachelors are swimming in the water. The pool in the runway to the hauling ground of Reef rookery was drained to-day. It was intended to cover the surface with bowlders, but this had to be abandoned on account of the arrival of the bulls.

May 10. Seals are reported to-day on the various rookeries as follows: Northeast Point, 20 bulls; Polovina, 4; Lukaniu, 2; Kitovi, 2; Reef, 1; Gorbateh, 1; 40 bachelors on Sivutch Rock.

May 11. Fifteen bulls are reported ashore at Zapadni and 5 in the water. Ninety seals were killed on Sivutch Rock.

May 12. Sixteen bulls are reported on Tolstoi, and 8 bachelors.

May 14. Twenty bull seals are reported on Gorbateh and Reef, 8 on Lukaniu, 7 on Kitovi. The first bull hauled out to-day on Lagoon.

May 15. Thirty bulls and 12 bachelors are hauled out on Tolstoi.

May 17. Seventeen bulls on Little Zapadni and many on the main rookery. Four new bulls haul out on Lagoon. Bulls are hauling fast at Tolstoi.

May 19. There are 200 bulls at Northeast Point and about 100 bachelors.

May 24. A perpendicular wall of ice from 8 to 10 feet high extends along the water's edge of Reef rookery for a considerable distance, forming an impassable barrier. The bulls, however, haul out to the south of it and travel over the rocks to their desired places.

May 22. A small food drive of 36 seals was made from Tolstoi.

June 2. The old bulls are occupying their places on the rookeries, but the young bulls have not yet arrived. Bachelors are reported scarce on all the hauling grounds.

June 10. The first cow seen on St. Paul hauled out on Tolstoi rookery to-day.

## DAILY JOURNAL OF OBSERVATIONS.

1897.

MAY 22-JUNE 7.

I sailed from San Francisco on the North American Company's steamer *Del Norte*, Capt. Charles E. Allen. Col. Joseph Murray, chief agent, and Mr. John M. Morton, assistant agent, in charge of the seal islands, and Mr. James M. Macoun, Canadian commissioner, were also passengers on the steamer. Mr. Bristow Adams accompanied me as artist assistant to the commission.

The trip was an exceedingly favorable one, no bad weather being encountered. It was unexpectedly long, owing to the fact that the *Del Norte* had to touch at Wood Island to land supplies there, the company's schooner, *Gen. Siglin*, sent to Wood Island earlier in the season, having been wrecked.

While passing out of the Golden Gate a hair seal was seen in the water near the vessel. During the entire trip not a single fur seal was seen either in the North Pacific or in Bering Sea. A large number of "killers" were seen in the passages among the Aleutian Islands.

At Dutch Harbor Captain Tuttle of the *Bear* told me of the skin of a branded pup seal which Mr. A. Gray, of the Alaska Commercial Company, had in his possession. It had not been unpacked yet, and Mr. Gray promised to send it up on the first cutter coming to the islands. I learned from Mr. Gray that the pup was taken in the bay at Akun, where it was swimming with others. The date was late in November. The animal was reported as "lean" and the brand as "unhealed." From the description given of it I should judge that the "rawness" noted was the corn-beef-like appearance under the action of the salt water which was conspicuous in the pups on the islands last fall before the wounds had fully healed, and somewhat hidden by the new water hair.

Captain Tuttle also told me that as he left the Sound on May 10 a sealing schooner belonging to the Neah Bay Indians came into port with a catch of 10 skins as the result of a sixty-five days' cruise.

In conversation with Mr. James M. Macoun, Canadian commissioner, I learned that Mr. Halkett's investigations of last summer on board the sealing schooners placed the percentage of females in the pelagic catch at 84.

In the early morning of June 7 the *Del Norte* came to anchor off St. George with a good landing. It was decided that so long as it was possible to discharge cargo at St. George the vessel would remain. Otherwise it would go at once to St. Paul.

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<sup>1</sup>Prior to July 1st these notes are the work of George A. Clark; after this date notes by Dr. Jordan, Mr. Lucas, and Messrs. Adams, Farmer, Warren, Greeley, Snodgrass, and Edwards are added as indicated.

## JUNE 7.

Soon after landing I visited North rookery and counted the bulls in place on the rookery ground, finding 180. Twenty others, apparently young fellows, were swimming in the water in front. No cows were present.

The bulls do not stand their ground well. Among the regular bulls are evidently many young fellows which will undoubtedly be driven out when the cows come. These wander about, shifting their places, without apparent notice to the older bulls. There is an utter absence of fighting and very little of the usual bluffing. Some of the bulls show scars of more or less recent wounds, probably the result of contests on first landing.

A dozen bachelors—the only ones on North rookery—are hauled out on a point of rock near the middle of the rookery among the old bulls. They play undisturbed. There are no bachelors on the regular hauling grounds. Mr. Judge reports that a small food drive was made from North rookery on the 22d of May.

In the afternoon I visited Little East and East rookeries in company with Mr. Morton. About 50 bulls were in position on the former. No bachelors were visible.

The appearance of East rookery as outlined by the bulls was very similar to that of last year on the main part of the rookery. No bulls could be seen along the beach toward the Sea Lion Point, where were a few scattered harems in 1896. With this exception on East rookery as well as on Little East and North, bulls seem to be occupying places wherever harems were last year.

At a point thickly covered with harems last year is a pod of about 100 bachelors. Among them are many young bulls. The old bulls about do not pay any attention to them, except to protest mildly when the young fellows come too closely in their play. It is worthy of note that in every instance where bachelors are seen they are within the rookery confines and not in the hauling grounds. Two sea lions are lying on the beach just below the bachelors.

On this rookery is a harem containing a single cow and her pup, reported as being present on June 3. They were not present on June 1. This seems to be the earliest recorded birth of a pup.

A food drive was made from East rookery on June 2. The bachelors so far have been scarce on all the rookeries.

At the Government House Peter Rezanzoff, a native returning from watch on Zapadni, reported about 180 bachelors at that place and many bulls.

## JUNE 8.

North rookery was again visited this morning. The bulls are more numerous through additions of young fellows, probably those yesterday seen in the water. Some of these are wandering about in the rear. Following along the shore toward Staraya Artel I found that the bulls were hauled out on the beach to a considerable distance beyond the rookery limits. These fellows will probably move to the rookery ground when the cows come.

Staraya Artel was visited in the afternoon. There are 67 harem bulls in place on the slope. There are no bulls now occupying the ground held by the idle bulls of last year here or on any of the other rookeries. These bulls if present are on the outlying beaches or crowded in among the regular bulls to be driven out when the cows come.



The bulls on Staraya Artel are as savage and courageous as of old. Two of them charged at me for a considerable distance, and none of them would give ground. In this respect they contrast sharply with the bulls on North and East rookeries. They stopped and drove back a small pod of bachelors which attempted to get through to the sea. There were 64 bachelors in all on the rookery, here as elsewhere among the bulls and not in the regular hauling grounds.

#### JUNE 9.

I walked this morning with Mr. Adams to Garden Cove, and followed down the beach in search of the sea-lion rookery. Under a cliff at some distance to the east of the cove was a group of about 40 sea lions. They were not all bulls; some looked like cows or bachelors, but there was no evidence of a harem; no pups were present. The distance from the top of the cliff was too great for close observation. Two or three sea lions were swimming about under the kelp at some distance out from the shore. They were prowling about on the bottom as if feeding. A bachelor seal has been doing the same thing in the kelp off the village landing since the arrival of the vessel.

At East rookery the number of bulls seems this morning to be increased. They are located farther up the rocky slope, and with a glass they can be seen to extend through to the sea lion point. Ten large sea lions are lying at the foot of the slope among the bulls. There are 103 bachelors present in the same position as before.

A second cow is out in charge of the nearest bull to the one having the cow and pup. She is a large cow. By contrast and with the aid of the glass it is easy to see that the first cow is a young one, doubtless a 3-year-old with her first pup. She is very light in color. Her early appearance is probably due to the fact that she arrived before the usual time last season. That an occasional 2-year-old cow may wander in thus early is supported by the fact that among the bachelors are evidently many 2-year-olds and some few must be yearlings.

In the evening five killers were seen in the bight between the vessel and North rookery. They were fired at several times with a rifle, but the range was too great. They moved off along the shore in the direction of Staraya Artel. These animals are evidently on hand for the arriving seals.

#### JUNE 10.

The *Del Norte* steamed round to Zapadni in the early morning to land salt. The landing was doubtful and the time too short to permit of a visit to the rookery, but the opportunity for inspecting it with a glass was good. The bulls were all roused up by the noise of the vessel. They seemed very numerous on the beach and up to the first bench on the slope of the hill. There were none up where the idle bulls were last season. A killer was seen swimming about in the bay.

On returning to the village the landing was deemed so uncertain that no attempt was made to visit the rookeries, arrangements having been made to start for St. Paul the instant the landing gave out.

#### JUNE 11.

I landed this morning and again visited North rookery. The young bulls in the rear of the rookery are steadily growing more numerous. They are constantly

shitting and wandering about. In all likelihood they come and go from the water. The old brown bulls stick to their places closely. One bull has located himself in a little breastwork of rocks built up by the natives to shoot ducks from in the winter time. It is inclosed on three sides. The bull sits facing the opening as if proud of his "castle" and ready for all comers.

When roused up, one bull shows some bad cuts and many show slight ones partially healed. No fighting has been seen among them; only occasional instances of "bluffing." There must, however, have been some fighting. The regular harem bulls have now reached an understanding.

The only cows seen on the rookeries of St. George have been the 2 on East rookery. The watch on North rookery at least has been constant enough to have found any that might have appeared.

The vessel will get off to-night for St. Paul. Fortunately there has been little to see on the rookeries, else this week has been practically wasted so far as observations go.

#### JUNE 12.

We landed at St. Paul Island at 8 o'clock. After greeting the people, I walked out to Gorbatch. The bulls were present wherever harems were last year. A few young bulls are in the domain of the idle bulls, but this class has not yet begun to occupy the cinder slope of Gorbatch. At the west end bulls are located all along under the cliff to Ardiguén. No harems were here last year.

#### ARDIGUEN.

There are three bulls on the flat at the mouth of the slide of Ardiguén. One is our scarred friend of last year. The others look familiar, but have no distinguishing marks. There are 20 bulls altogether on the little rookery. Surely the distinctness of this scar a year after disproves Mr. Elliott's contention that the brand will heal without a scar.

Reef rookery is well stocked with bulls, but they do not extend back beyond the line of harems; in other words, there is no fringe of idle bulls. About 500 bachelors are grouped in the largest of the runways of the rookery. Mingled with them are many bulls. The ponds have been drained and the bachelors are lying in them. There are none back in the regular hauling ground, and no others on the Reef.

Bulls lie under the cliff on the east side of the peninsula and in the little cove. There are no bachelors on Zoltoi sands or bluffs. A half dozen young gray bulls lie at the angle of the sands. The sand beach has built away out since last season. It certainly extends as much as 50 feet farther out than at the close of last season, and it was then much farther out than at the beginning. The sand has drifted over the ice, which is melting and letting the sand bank down in places.

Since we arrived at St. George it has been dry and clear, two of the days giving continuous bright sunshine. To-day is as fine a day as could be found anywhere. It is said there has been neither rain nor fog on the islands so far.

#### THE SURVEY.

The surveyors are hard at work on the rookeries. One foree is just completing Gorbatch. They have gone over all the rookeries and marked conspicuous stones at

intervals of a few hundred feet. From 20 to 40 of these stones are marked with figures on two faces. An attempt (not always successful) has been made to locate them in the median line of the harems. They might have been made twice as numerous to advantage. It is the intention to locate these stones on the maps, so that with their aid the observer can trace in the rookery boundaries.

I saw the first genuine fighting of the season to-day on Gorbateh. A wet bull had landed and was working his way up to the rear, when a bull attacked him. He fought well for a time, but was finally forced back into the territory of another bull. The fresh bull got him by one fore flipper and turned him over, throwing him on his back. A third bull came in and seized him by a hind flipper, raising him from the ground and turning him over on his head. The beaten bull limped off slowly and dropped into the water, where he remained motionless. He was very seriously injured.

#### KITTOVI AND LUKANIN.

In the afternoon I went to Kitovi and Lukanin with Mr. Adams. There were 156 bulls in all on the former rookery. The bulls here are quite fierce and ready to charge. There were a few young bulls in the rear and more in the water, which were not counted.

Under the cliff's at Lukanin is a single cow, now first seen at 4 o'clock. Judge Crowley says she was not there yesterday afternoon. This is the first cow seen by me on St. Paul. The surveyors working at Tolstoi report 2 there, which arrived on the 10th.

On Kitovi and Lukanin the surveyors have not been so successful in locating their stones. Instead of being marked as separate rookeries, the numbers run consecutively from the beginning of Kitovi to the end of Lukanin. Kitovi really begins between stones 3 and 4. At the end of Lukanin the numbering is continued through the hauling ground and around to the little reef on the other side of the bight. It will be necessary later to put in separate terminal marks and some special marks to distinguish the hauling grounds, which are here, as on the Reef, numbered in with the breeding grounds.

#### JUNE 13.

The weather has changed to real Bering Sea weather—thick fog, alternating at intervals to rain and snow. At noon it was clearer, then thickened up again. I visited Lukanin in the afternoon. The bull and cow noted yesterday are now in the wash of the surf.

The surveyors were asked to discontinue work on the rookeries, to avoid criticism on the score of disturbance. They will transfer their work to the interior of the island for the present.

#### JUNE 14.

The weather continues foggy, with occasional showers of rain.

I visited Lukanin in the afternoon. The cow under the cliff has moved back from the water's edge to the foot of the cliff and is in charge of a different bull. A second cow is present at some distance away; time, 4 o'clock.

A small animal which looks like a 2-year-old bachelor lay for some time on the rocks and then started up through the rookery. It had almost reached the outermost

bulls when one saw it and gave chase. The bachelor turned for the water, and, running into another bull, was promptly caught. The bull was attacked by another at that moment, and the young bachelor, for such it must have been, escaped into the sea.

Two cows are present to-day for the first time on Kitovi; time, 1.15 o'clock. They have no pups, nor has the one first seen on the 12th at Lukanin.

The *Del Norte* steamed for Dutch Harbor and San Francisco at 4 o'clock, taking Mr. and Mrs. Crowley as passengers from the islands. Colonel Murray becomes chief agent, Mr. Morton second agent.

#### JUNE 15.

A drive was made this morning from the Reef. There were no seals on Zoltoi. The herd arrived at the village killing ground about 7 o'clock. After breakfast the killing began. A record was kept of the rejected seals—119 were too small; 144 too large. The total killed was 492, or 65 per cent of the animals driven. The skins seemed to run about the same grade as those taken last year. No accidents occurred.

The stomachs of 20 bachelors were opened and found to be empty except for mucus. There were but few worms and only two contained stones.

Among the small rejected seals were perhaps 10 yearlings. The others were small 2-year-olds. The large seals contained some young bulls, but were chiefly large 4-year-olds and 5-year-olds.

With a view to keeping close watch of the cows on Lukanin and Kitovi, I sent Mr. Adams there this morning. He reports an additional cow, but no pups. I visited Gorbateh in company with Mr. Morton. Under the cliffs at the beginning of the rookery is a cow with a pup. She was not present on the 12th. The pup seems to be at least a day old, as it is lively and moving about.

One very light cow is out on Ardignen. Her bull is showing her a great deal of attention, the only instance of such attention so far seen. For the most part the cows lie sleeping unnoticed by the bulls, who also spend their time chiefly in sleeping.

Mr. Macoun reports that a pup was born at 3.30 this afternoon to one of the cows on the amphitheater of Kitovi. She was first seen at 1 o'clock, June 14, and was not there on the afternoon of the 13th.

After supper I walked out to Lukanin. Many bachelors are swimming along on the water front. At intervals they attempt to land, but are driven off by the bulls. The same thing is seen on Kitovi.

On Kitovi just beyond the amphitheater is a cow with her pup, which was not present at 4 o'clock on the 14th. There is a new cow on the amphitheater, a third one, at the foot of the cliff. From the summit of Lukanin Hill a new harem of 2 cows can be seen. This was not present at 4 yesterday afternoon. It is now 9 o'clock.

From the positions of these cows I should say that they steal past the sleeping bulls and take up their places where they wish. I have watched closely, but have not yet seen a cow land. Those which have landed on these two rookeries have apparently come in in the night.

#### JUNE 16.

The weather is clear but cloudy, with light fog at intervals. Mr. Adams went to Gorbateh to watch the cow and pup there. I walked to Kitovi and Lukanin with Mr. Morton.



In the little gully east of the Amphitheater of Kitovi is a new cow with the pup. It is 9 o'clock. Half an hour later another new cow is seen at the foot of Lukanin Hill. She is light colored, small, and restless. The bull treats her roughly. These must be 3-year-old cows. The old ones lie quietly and make no trouble.

I walked over to Tolstoi. There are about 75 to 100 bachelors on the slope of Middle Hill and on the sand beach at the foot. There is a bunch of 265 at the angle of Tolstoi with the sand beach. There are many young bulls among them. One has a cow and pup right in the midst of the bachelors. Two others apparently have cows, but as there are no pups one can not be sure. The bulls watch over them carefully and fight off the bachelors, which are trying to tease the cows.

I can count 9 other cows along the beach below the sand flat. The flat is covered at regular intervals with bulls. There are 3 pups in all on Tolstoi. One harem has 3 cows, another 2. The harem of 3 is the largest yet seen.

The slope on Tolstoi above the sand flat is covered with bulls. There are no bachelors in the usual place at the top of the slope. No bachelors were noticed by us last year on the sands where they are hauled to-day. They probably do not haul so far backward at this season.

Returning by way of Lukanin I found a new cow out at the foot of the hill: time, 11.15. Passing on to the Amphitheater I found that the cow at the foot of the cliff had disappeared. There was a great commotion, and a bull at a distance was trying to hold an animal which might be a cow, but looked like a bachelor. It was not the cow which had left the foot of the cliff.

Mr. Adams reports the landing of a third cow under the cliffs at Gorbach. He witnessed the landing of the cow and thus described it: "She swam along the shore back and forth several times, apparently examining it. She started to land and then went out again. When she landed a second time a big bull which had stepped into the water for the purpose caught her in his mouth and threw her up the beach. He then drove her up to a place which seemed to be his and held her there."

A half dozen bachelors have hauled out at Zoltoi; the first of the season. Complaint has been made about Mr. Adams passing Zoltoi and Gorbach, but until to-day there have been no animals to disturb, and he will make a circuit to avoid disturbing those now out.

#### JUNE 17.

I went to Kitovi this morning. No new cows were present. On Lukanin I found 5, making 11 in all. Directly under the cliff on this latter rookery is a cow with her pup, evidently but a few hours old. She was not there at 5 o'clock last evening. None of the 5 new cows were there then. Two of them form one harem. Another is in a harem with a cow first seen on the afternoon of June 14. Both these cows have pups this morning, first seen at 8 o'clock. They are close together and one cow bites and shakes the other's pup. The mother resents it and the bull attempts to stop their quarreling.

Another pup is seen in the harem of 2 under Lukanin Hill. These 2 cows were first seen at 9 o'clock on the evening of June 15. The pup was not there at 5 o'clock last night.

During four day watches of four hours each no cows have been seen by me to land. Such new arrivals as have appeared on Kitovi and Lukanin came at night.

Three killers passed by Kitovi Point close to shore and then veered off to sea.

The water front of the rookeries is full of young bulls swimming back and forth and landing at intervals, only to be driven off by the beach masters.

In the afternoon I again went to Kitovi and Lukanin. One of the cows in the Amphitheater has just had her pup. It goes about dragging the fresh placenta.

I made another count of the bulls on Kitovi. There were 180 to-day exclusive of the young fellows swimming offshore or roaming about in the rear.

In all there are 9 cows on Kitovi to-day, but there are only 3 pups as yet. The harem at the extreme end of Kitovi has received a new cow since 9 o'clock this morning. A supposed cow held by a bull in the Amphitheater turns out to be a bachelor.

On Lukanin there are 2 new cows out since 10 this morning. It is now 3:30. There are 13 cows in all on this rookery; 6 have pups.

Mr. Adams reports from Gorbatch that in the space where there were but 5 cows yesterday there are 13 this morning. There are only 3 pups. One of the new cows not present at 5 o'clock last night has her pup with her at 1.45 to day.

He witnessed the landing of a second cow at 1:30. She was seized on landing by the nearest bull.

I visited Kitovi and Lukanin after supper, but found no change beyond the accession of one new cow.

#### JUNE 18.

I attended the killing at Zapadni this morning, going over in the bidara. Bulls lie at intervals along the foot of the cliffs leading round from Lagoon rookery to Tolstoi Head, a number being at the latter place. They dropped into the water for the most part as the boat passed close to shore.

After watching the killing for a few minutes I left the recording of rejected seals to Mr. Morton and went to make observations on the rookeries. On Zapadni I found the bulls naturally distributed over the gully on which the stones were put last fall. In the long gully beyond I counted 66 bulls. They were having an unusual amount of trouble with one another. One young fellow was seen to be forced down into the gully from the bank. He was immediately set upon by the bulls, which passed him along toward the sea with little ceremony. At one time four of them had him pinned down to the earth. On the flat above the gully lay a dead bull, from which the skin was torn in great patches. I could not get close enough for an examination, but at a distance under the glass the wounds seemed fresh. He was probably killed in a fight.

#### COUNT OF BULLS AND COWS.

I made a count of the bulls in the rear portion of Little Zapadni and then taking the whaleboat skirted the water front of the three Zapadni rookeries counting the bulls there. This gave a complete count of the bulls on the two smaller portions. Little Zapadni had 231 bulls. These bulls are all in positions where harems were last year. They may include idle bulls, but not territory occupied last year by them.

Zapadni Reef had 128 bulls. They are scattered along the reef without breaks, though the patches of last year are more or less clearly marked by the grouping of the bulls.

On the sloping boulder beach of the main rookery there were 281 bulls. There were 46 bulls on a long flat slope which seemed inaccessible from the rear. The bulls

counted are those which could not be seen from land. An effort will be made in a day or two to complete this count by enumerating the bulls on the higher ground from behind. I believe that this count will be more accurate than any that can be made in the height of the season, and at any rate it will serve as a check. From the total now attained can be deducted the idle adult bulls to be found later in the season.

A record was made of the cows, there being 50 in all. One harem contained 11 cows (the largest thus far seen); another 4; three had 3 each; a number had 2 each, and the rest 1 each. If the cows do not have much to say in choosing their location, it is hard to understand how these two largest harems could be formed. The bull with 11 cows in his charge was surrounded by bulls without cows. Two were close in the rear, 1 on either side, and 1 lay between him and the water. The cows were very much excited by the presence of the boat, as were also the bulls in the vicinity. But no bulls attacked him or tried to steal his cows. The same conditions may be noted in regard to the harem of 6.

On Little Zapadni 15 cows were counted. No harem was found larger than 2 cows. On Zapadni Reef only 2 cows were seen. Three pups were counted on the main rookery, 4 were seen on Little Zapadni, and none on the Reef.

At the killing this morning a total of 316 skins were taken. Of the rejected seals 130 were too large; 26 too small. Mr. Morton, whose presence is required on the killing field, has kindly consented to make the record of registered seals, thus leaving me free to watch the killings or to make other observations. Of the total drive 67 per cent were killed. The skins were brought over to the village in the bidara.

In the salt house 3 lots of 10 skins each were weighed—73, 102, and 96 pounds, respectively, or an average of 9 pounds each for the 30 skins.

#### LUKANIN AND KITOVI.

Mr. Adams watched on Lukanin and Kitovi. He reports 4 new cows: 1 on Kitovi in the gully at the south of the Amphitheater; 3 under the cliff at Lukanin. All were first seen between 9 and 10 o'clock.

I visited the observation points on these rookeries in the afternoon. A new cow had arrived since morning and was still wet; time 3.20. Two other cows already dry had also arrived. They were located near the cow under the cliff, which has been out since the 12th, but has no pup yet. There are 19 cows on Lukanin. A count of bulls shows 131 in all.

There are a great many bachelors swimming about in front of the rookery, landing at various points only to be driven off. One of these bachelors, which has been herded up by a bull on the Amphitheater of Kitovi for the past two days, escaped this afternoon, greatly agitating the bull and creating quite an uproar.

While watching on the Amphitheater, a cow was seen to land and deliberately enter the extreme harem, already containing 2 cows. She smelled over the 2 cows. The bull aroused himself long enough to greet her and went to sleep again. She seemed perfectly at home. In getting to this harem she passed close to 2 sleeping bulls which had no cows. A harem on Lukanin has in like manner grown from a single cow to 3, and it is several tiers of bulls back from the water.

## JUNE 19.

Mr. Adams reports that the cow seen for the first time at 9.45 yesterday morning on the Amphitheater had a pup at 9 o'clock this morning. He noted no further change. I visited the observation points and saw a cow land on Lukanin at 11.30. When first noticed she was preening herself on a rock in the little bight. Almost at the same instant there was a splash and a bull seized her and forced her on shore. She tried to escape, but was unable to do so.

In the afternoon Mr. Macoun reported a similar capture, where the bull deliberately left his single cow and swam out for the incoming cow, securing her and adding her to his harem. A singular thing about all this is the utter absence of trickery on the part of the neighboring bulls. They do not seem to be jealous of the success of those which obtain cows and do not take any unfair advantage of them.

In the evening 1 new cow was seen in the Amphitheater, but otherwise no change. An increased number of bachelors are on the hauling ground of Lukanin. They extend to the top of the hill.

## JUNE 20.

I went to Kitovi this morning and found 1 new cow. The Amphitheater has 46 bulls, 8 cows, and 3 pups.

Under the cliff at Lukanin a harem which had but 1 cow last night at 9 o'clock has now 3 cows. A cow which had no pup last night at 9 o'clock now has one; time, 10.30. This cow was first seen at 9 o'clock on the morning of the 18th.

While watching on the cliff I saw a cow land. She swam along the shore back and forth for some time. She snapped viciously at the bachelors which attempted to play with her. Finally she landed and climbed up the rocks toward a sleeping bull with a single cow. The bull saw her and started after her. She escaped into the water and swam about for five minutes until the bull went to sleep again. Then she landed on the rocks at the same spot and cautiously made her way to a position beside the cow. In a few minutes the bull awoke and greeted the newcomer, going to sleep again.

## GORBATCH.

A cow was seen to land on Gorbatch at 1.45 on June 17 by Mr. Adams. He visited the rookery this morning at 11 o'clock and she had no pup. At 3 o'clock I found her with a pup, evidently just born. The time between the arrival and delivery of this cow is therefore very definitely known and is practically 72 hours.

I made a count of the bulls on Gorbatch rookery and found 335. These are all such bulls as would be classed as harem masters or idle bulls, not young bulls. It will be possible to note how many of these bulls are idle in the height of the season and so obtain a check on the count that is to be made then. The count of the bulls can now be made with much less disturbance than would result later in the season and can therefore be made more thorough.

No count of cows was made. One harem was seen which contained 6 cows, the largest seen since the visit to Zapadni. A cow was seen with her breast streaming with blood. Another was seen with a hole bitten in her back from which the blood was oozing. Her bull was watching her closely and treating her roughly.

A pup was seen to wake up and cry. It was lying beside a bull which has no cow, nor was any cow nearer than the wounded one noted above. Very soon this



cow answered the pup, which continued to call. The distance between the two was at least 100 feet. The pup, which was not very old, struggled hard to make its way in her direction. The natural stupidity of the fur-seal pup was well exemplified by the number of attempts it made to climb impossible rocks instead of going around them. The pup was following the sound of its mother's voice, which it received in a straight line. But at last it reached the cow, was recognized by her, and allowed to nurse. It is not likely that this pup wandered away. The bull probably stole the cow and in doing so bit her in the back. The sleeping pup was left behind.

A rather remarkable capture of a cow was witnessed at the western end of Gorbatch. A bull was watching a cow swimming in the water. She was several yards out from the edge of the cliff. The bull plunged off the cliff and swam toward the cow, which turned to escape. He soon caught her and holding her above the water in his mouth, swam in and slammed her on the rocks. It is probable that many of these pregnant cows are injured in this way.

#### ARDIGNEN.

On Ardignen there are 30 bulls, all told. Three bulls are on the flat above the slide. Bull A, with the scar on the left flipper, is on his shelf under the bank. The other two are in the positions occupied by B and C last year, though they do not seem to be the same bulls.

The bachelors on the Reef are working back to their usual hauling ground. They are all about the pile of stones which was used as an observation point on the 12th. At that time they were lying in the dry bed of the pond. There are a few bachelors out on Zoltoi sands.

I walked to Lukanin after supper and found that a harem which had 2 cows and a pup at 3 o'clock in the afternoon had now 4 cows and 2 pups. The 2 cows having the pups arrived on the 18th and 19th, respectively. Probably the pup born between 11 this morning and 3 in the afternoon was from the first cow. The cow arriving on the 18th was seen to land at 3 o'clock; the one on the 19th at 2 o'clock. We have, therefore, an interval of about 48 hours for one and 30 for the other.

The earliest born of the 2 pups above noted is dead, apparently crashed in a crevice in the rocks. It was doubtless killed by the bull in his efforts to secure the 2 cows which he has added to his harem during the afternoon. This is the bull which swam out and captured his second cow in the water. It is the first dead pup so far seen.

#### JUNE 21.

I went to Kitovi rookery this morning and counted the population of the Amphitheater—46 bulls, 9 cows, 3 pups. A count of the bulls on Lukanin rookery was made—136 in all. There were 52 cows on this rookery.

I witnessed the landing of 4 cows and saw a fifth as she was entering a harem of 3 cows. In no case did the bull know of the presence of the cow until she was settled in the harem. Each bull, when aware of the addition to his family, bustled about and welcomed her. She made no attempt to escape.

Mr. Adams watched Lukanin in the afternoon. He reports that a bull left 3 cows to capture a fourth, which was landing near his harem. She tried to escape, and

it was necessary to follow her in the water. He got her and brought her ashore, treating her very roughly and cutting two long gashes in her side. While his attention was given to the new cow, one of his neighbors stepped in and took the 3 cows. The rightful owner of the harem did not dare to attack the intruder, and had to be content with his single cow, which he held in place near the water."

This is the first instance where a bull has been seen to take the advantage of another while attempting to secure additions to his harem. This gashed cow landed at 3.30 in the afternoon. She will be a cow easy of identification. So long as single harems exist it is possible to keep the history of their occupants, but as additions are made to them, this can not be done with certainty.

It is probable that there is no hard and fast rule regarding the matter of the landing of cows. On Zapadni and at Gorbateh it seemed as if the cows came in and sought out their places. On Lukanin, however, while they seem to reconnoiter the shore and choose a location, the extent of the choice seems to be that the landing cow joins another where possible. No landing cow has been seen to go to a lone bull. Where single harems are established, they are doubtless in every instance the result of capture. The cow while trying to make up her mind where she is to go is surprised by a bull and held by him.

#### LUKANIN.

I visited Lukanin after supper and found a third pup in the harem with the dead one. This cow landed between 3 and 9 p. m. yesterday. Her pup was born between 5 and 8.30 this afternoon.

Colonel Murray walked out with me. I suggested to him that the loose rocks behind the cliff portion of Lukanin might be thrown into the form of a rough double wall between which observers could approach the seals without disturbing them. This place and the Amphitheater at Kitovi could in this way be made excellent observation points. With a similar passage constructed at Kitovi Point, these two rookeries could always be accurately counted without disturbing the seals.

There are also several pools of filthy water in the depressions in the basaltic columns which form the upper part of the Amphitheater. A cow lies on a narrow space between two of them. Shortly after her pup was born some days ago it slipped into the water. The mother fished it out. It has now apparently disappeared again and may have been drowned. It would be an easy matter to open a drain into one of the numerous cracks in the rock, or if this could not be done, the holes could be filled with small stones, of which there are many within easy reach. These holes exist in numbers on Reef rookery and on Vostochni.

An unusually large number of bachelors are out on Lukanin hauling ground. In the early days after our arrival the bachelors did not occupy their usual hauling grounds, but the little reefs and bays near the rookeries. They are now back where they were to be found last season. Numbers of them still hang about the front of the rookeries, swimming back and forth in small groups. It is possible that these are newly arrived bachelors which have accompanied the cows to the vicinity of the rookeries and hang about for a time. The hauling grounds are evidently receiving large accessions each day.

It has been noted that bulls have hauled out on the eastern side of the neck of Reef Peninsula, where no harems ever occur. In this connection it is interesting to

note that there are about a dozen bulls lying out on Lukanin sand beach in the same position where they were noted last summer soon after our landing. They were then popularly referred to as worn-out bulls, or those which had been driven off the rookeries. They will doubtless come back to try again later on, and are at present like the young bulls and the idle bulls as a class, shifting about. They can be seen wandering about behind the harem bulls or swimming about in the water.

On Lagoon rookery for some time there have been bulls on the side of the reef toward the lagoon. These have now disappeared, probably attracted to the other side by the landing cows. It will be some time before the cows will be numerous enough to work their way over. The lagoon channel is fast filling up.

#### JUNE 22.

A count of bulls on the Amphitheater of Kitovi showed 46 bulls still present, though 3 new ones, or rather hidden ones, were found under the cliff at the lower edge. Some of the bulls in the rear have probably moved on. There are 23 cows and 6 pups. In the matter of pups, however, it is impossible to be certain about them, as they lie sleeping in crevices in the rocks.

The largest harem on the rookery has 7 cows. Its size is evidently the result of its advantageous location at the angle of the cliff, where access is easy.

From the way in which the harems are formed under the cliffs on Lukanin, it would seem that the line of bulls nearest the water gets all the cows. These bulls have become alert now, and a cow rarely gets past them. The cows themselves show a disposition to enter harems where other cows are.

The cow which has been out so long (since the 12th) has a companion to-day, and our last observation harem has been lost. One by one the harems whose occupants we have had under observation have become confused through the accession of new cows.

The gashed cow seen to arrive at 3.30 yesterday afternoon has just given birth to a pup at 11 to-day. On the point of rocks in the Amphitheater a cow which arrived on the 19th at 9.30 gave birth to her pup to-day at 4.15. A pup was born to the fourth cow on the rocks where the dead one is between 11 and 1.30 this afternoon. The mother of the dead pup has not been seen to indicate her loss in any way, either by calling to her pup or by showing any attention to its dead body, on which she lies. The same thing is true of the cow on the Amphitheater, whose pup has apparently disappeared.

There is certainly little maternal solicitude and affection wasted on the pup fur seal. For a few minutes after birth the mother calls over the pup and acts as if she would shield it from the trampling of her sisters or of the bull. A gull alighted persistently for half an hour on the rocks to peck at the placenta near a newly born pup. The mother, as often as the gull alighted, lifted the pup away by the skin of the neck and then drove off the bird. But this is the limit of care on the part of the mother, and this even is not shown apparently after the first day.

#### TOLSTOI.

I went to Tolstoi this afternoon. The large pod of bachelors still hold their position at the angle of the sands. The little harems are still among them. There are

also a hundred or more bachelors in the regular hauling ground back of the slope. None have been seen here before this year. The ground occupied by idle bulls here is now more fully occupied than it was at any time last season. It was with great difficulty that I got to the observation point to-day which I reached without trouble on the 16th.

There are 395 bulls idle and in places where harems were last season on Tolstoi. This count will doubtless be of little value, as it is difficult to get at any distinction between the idle bulls and those likely to have harems. The bulls on the sand flat about the point where the excessive mortality occurred last year are inordinately thick. They seem literally to cover the ground. This will probably result in the usual excessive fighting and consequent trampling of pups. At one or two points on the sand flat single cows are located even to the edge of the cliff. The majority of the cows on Tolstoi, however, are located on the bowlder beach, which is rapidly filling up.

When we consider that through these harems must pass the great mass of cows that are to fill the sand flat, it is easy to see why this rocky beach is almost if not quite as much of a "death trap" as the flat itself. It was evidently from here that the windrow of dead pups washed up on the beach came last fall.

One instance of copulation, the first of the season, was witnessed at the farther end of the sand flat. The cow was a single one, and her pup seemed, by comparison with other pups whose age we know, to be about 3 days old. It might be a week. I do not know anything about the arrival of the cow or the birth of her pup. She was not present, however, at the time of my visit on the 16th.

The salt lagoon is rapidly filling up or else the tides are unusually low just now.

#### JUNE 23.

The schooner *Louise J. Kenney*, of Seattle, bound for the Arctic on a trading voyage, sailed in close to the east side of Reef peninsula at 4 o'clock this morning and drifted south before the wind past Sivuteh Rock, coming in to the village landing. Mr. Miner Bruce and his wife came ashore for a few minutes.

Drives were made this morning from Zoltoi, Reef, and Lukanin. A total of 708 were killed; 184 were rejected as too small; 556 as too large. No accidents occurred.

It is to be regretted that so many young bulls escape killing under the *modus vivendi*. There are already more adult bulls than are needed, and these young fellows will simply add to the confusion and destruction of cows and pups.

I had a young bull with defective fur knocked down and skinned. This is a blemish in the skin similar to that in the cow skin taken last year. There are certainly many of these animals, and whatever may be the cause they should be weeded out.

In the salt house 60 skins in two lots of 30 each were weighed. One lot averaged 7.7 pounds per skin.

In regard to the turning back of large seals, it must be remembered that last year, on the 25th of July, from a combined drive of these same rookeries, 1,008 large and 1,177 small seals were turned back. The small seals are not present yet in large numbers, while it is safe to say that all of the large ones turned back to-day were among the number rejected in July of last year.

I visited Lukanin and Kitovi rookeries in the afternoon. The Amphitheater has still its 46 bulls. There are 37 cows. It is not possible to get a correct count of the pups.



There are 103 cows on Lukanin rookery to-day. There were 74 yesterday and 52 the preceding day. This increase of cows is so slight as not to be recognizable except by actual count. There is no bustle or confusion. The cows land singly, quietly, and are distributed over the entire length of the rookery.

Under the cliffs at Lukanin there was yesterday a harem with a single cow in it, to which a second cow was added. To-day one of these cows is held by a bull in the rear. She has a long gash in her hip, showing that she has probably been taken by force. Her pup is with her.

Yesterday a neighboring harem, in which was a single cow, the earliest to arrive on the rookery, received a second cow at 11.45. She has just had her pup. At 2 o'clock it seems not over 2 hours old. The cow which landed first is distinguished by a scar behind her left front flipper. She does not look gravid. She may be a 2-year-old, or she may have failed of impregnation last year for some cause. Unless other accessions are made to the harem it will be possible to trace her further. She has been out since the 12th of June.

An instance of copulation was witnessed on Lukanin at 3.30 to-day. The harem contained 5 cows. It was formed during the night of the 19th, 3 cows being present in it at 8.30 o'clock on the morning of the 20th. It was not possible to distinguish either the exact time of the arrival of the cow or the hour of the birth of her pup, but it is reasonable to suppose that she was one of the original 3, and an approximate estimate of the time between delivery and service can be reached.

#### JUNE 24.

I visited Kitovi and Lukanin rookeries in the morning. The Amphitheater has its 46 bulls and now has 45 cows. One cow is in charge of a bull far in the rear of the rookery. It is not likely that she was stolen, as bulls intervene between her position and any harem. She must have wandered through thus far before any bull noticed her.

Lukanin rookery had this morning 131 cows, all told. There may be a few more cows lying among the rocks, but this enumeration as well as those preceding with which it is compared are relatively correct.

Directly under the cliffs are a number of harems which have grown to a considerable size. One has 12, another 10, another 8, and still another 6 cows. With the exception of one formed on the 12th instant these harems date no further back than the 17th. They have grown by additions of 1, 2, and 3 cows a day since. At the same time bulls with no cows alternate with these and there are single harems that have received no accessions. The cows in landing seem to be attracted to the crowded harems. Doubtless when the bulls in charge of them get all they can manage the other harems will fill up.

#### STEALING OF COWS.

A young bull which ventured down one of the slides in Lukanin cliffs was attacked, and endeavoring to make his way to the sea, all the bulls in the vicinity were set in an uproar. He passed close to a harem of 6 cows. The bull in charge was unusually valiant and followed him into the water. Perceiving this, one of the bulls in the rear rushed into his harem and seized a cow, carrying her back about 20 feet. The bull set out in a rage to rescue her, but thought better of it and turned back to make sure of his remaining cows. For an hour afterwards, however, he kept

charging at the thieving bull, who had great difficulty in retaining the unwilling cow. This is the third case of such stealing witnessed from this point. It would seem as if this was the way in which the rear line of harems was built up. All the harems so far on Lakanin are in charge of bulls in the first line from the water. This does not seem to be true in as general a way on other rookeries.

When the cow was stolen her pup, which was sleeping, was left behind. It was only about a day old and not able to climb the stones very well. When awakened in a short time by the commotion in the harem it cried lustily. The mother answered it. The pup recognized her voice and immediately started in her direction, but a line of rocks over which it could not climb intervened. The mother continued to call at intervals and the pup to answer. After tiring itself out in attempts to get over the rocks it gave up and started around them. Twice it was on the point of rounding the rocks when it heard its mother's voice and instantly returned to the original attempt to climb the rocks in a direct line to the mother. During all this time the pup could not see its mother. After twenty minutes of severe labor it finally got around the rocks and into comparatively smooth going. In ten minutes more it was welcomed by its mother and lay down upon her back, evidently tired out. The great difficulty with the seal pup is that it wants to climb over every rock that appears in its way, no matter how inaccessible it may be. It is only after a number of repeated failures that the idea occurs to go around.

It is evident from this instance and from that noted on Gorbateh a day or two ago that the fur-seal pup even at the age of one day knows the sound of its mother's voice and can follow it. He is not confused and misled by the voices of other cows, because in the above instance at the time the pup was awakened, and for most of the time during which it was endeavoring to get to its mother, 4 other cows and their pups were calling about it as they were roused up and scolded by the excited bull.

A day or two ago a bull was seen to lose his harem of 3 cows while trying to capture a landing cow. He started a new harem with a single cow, which he cut severely in getting her. This morning the cow is in charge of another bull some distance in the rear. Her pup lies beside the original bull. This is evidently another case of stealing. This over-ambitious bull is now without cows and his rival, holding the original harem, has this morning 12 cows.

Mr. Adams, who visited Lakanin cliffs during the afternoon, reported that the pup had succeeded in covering half the distance to its mother, thus furnishing additional evidence of the ability of the pup to recognize its mother's voice. This pup was born at 4.15 on the afternoon of the 22d, and is consequently less than 2 days old.

#### THE DEAD PUP.

In a harem of 6 cows under the cliff the birth of a stillborn pup was witnessed this morning. This is the harem in which the first dead pup was noted. The mother stripped off the placenta and lifted the pup to the nipple. She was lying on a slanting rock and the pup rolled back. She dragged it up again only to have it slide down. She moved her position and placed the pup on a little shelf. She continued to lift it about and fondle over it for nearly an hour, acting in a very worried and excited manner. She bit the other cows and stirred the whole harem up. There was no evidence in her actions that she realized her pup was dead. Her efforts were directed to getting the pup to nurse, the first thing the mother always does. At last the cow

gave up the effort and lay down to sleep. She did not call out to the pup at any time, as the mother usually does. When visited again in the afternoon, she seemed to have lost all interest in the pup.

The average living pup would not have received one-hundredth part of the attention which was bestowed on this limp dead pup. The fur-seal mother seems to go on the principle that the pup must learn to do for itself, and as soon as she finds it able to move about and nurse she pays no more attention to it.

The suggestion arises whether the other dead pup in this harem was not also stillborn. It may be so, though the position in which it was first seen seemed to point to its being trampled. The bull in charge of this harem has been a very aggressive one. He it was that swam out and surprised the cow in the water, treating her very roughly in his efforts to secure and bring her in. It is probable that the death of the pup was the result of injury at this time.

#### POLOVINA.

I walked to Polovina this afternoon. A great pod of bachelors were lying along the end of the rookery adjoining the sand beach. They extended also along the back of the rookery for some distance. It was impossible, therefore, to approach closely enough to inspect the beach line. In the rear the idle bulls occupy all the territory held by them last year, and it is possible only to get a general view of the flat slope. It was very thickly set with bulls. Unless the number of active bulls is small compared with the idle ones, this rookery must be larger than we estimated last season.

The idle bulls are, however, out in full force now, and on such rookeries as Reef, Gorbatch, Tolstoi, and Polovina, where there is abundant territory in the rear, they are very numerous. By the middle of July, when we saw the rookeries first last year, many of them will undoubtedly have hauled off to the sand beaches.

Above the cliff portions of Polovina lies a fringe of bulls, in some places three lines deep. The line on the immediate front is composed of full-grown harem bulls; the others are young fellows. It is not possible to approach to examine the conditions below the cliff.

There are only about 25 bachelors and young bulls on the upper hauling ground of Polovina. The number at the southern end must be between 600 and 800.

Little Polovina has the same characteristics as the main rookery. The bulls are numerous. One harem of ten or a dozen cows was seen on the slope which forms the principal landing place to the rookery.

#### JUNE 25.

Mr. Adams visited the observation points at Lukanin and reports the capture of another cow. Her pup was left behind. There are 7 pups and 6 cows in the harem from which she was stolen, so that it is not possible to distinguish hers. Six of the pups are podding by themselves under the lee of a rock. The stolen cow is badly cut.

The pup belonging to the gashed cow, noted as stolen yesterday, has now made its way to its mother.

I visited Lukanin and Kitovi in the afternoon. There are 56 cows on the Amphitheater and the usual number of bulls. One cow noted as having apparently lost her pup can not be seen. Three cows were present in the harem just before noon, but there are only 2 now.

There are 176 cows, all told, on Lukanin to day. Mr. Adams saw 8 new cows arrive in the course of an hour. The largest harem in sight under the cliffs has 13 cows. A cow arrived at 4 o'clock this afternoon and was captured by a bull without other cows. It will be possible to keep her under watch. All the other harems with single cows are mixed up by the accession of new cows.

#### JUNE 26.

A killing was made this morning from Tolstoi, Middle Hill, and English Bay. The day was extremely unfavorable, bright sunshine prevailing all the time. This is the fourth day of such weather. By turning the seals frequently into the little pond at Ice-House Lake the killing was carried on without serious accident.

Mr. Morton and Colonel Murray made the count of rejected seals. The total killing amounted to 1,098, and 214 small and 402 large seals were turned away. In the salt house 100 skins were weighed and the average weight found to be 7.4 pounds.

The rejected seals were turned into the salt lagoon, and went directly out over the reef at the angle of the cliff. The larger seals doubtless made the trip last year and remember the way.

I went to Lukanin when the killing was well under way. A cow was stolen from a large harem by a bull in the rear. This is the second cow which he has been seen to steal from the same harem. He has a third cow, which was also doubtless stolen. A pup newly born in the harem is in great danger from his efforts to control the new cow. Its mother picks it up, holding it in her mouth for some seconds, and putting it down in front so that she can stand guard over it. The pup of the recently stolen cow is calling and the mother answering. In the course of ten minutes the little fellow has reached his new home.

A badly torn cow which was found carried off into another harem has not yet succeeded in getting her pup. She calls it at intervals and it answers, but can not get over the intervening rocks and has not sense enough to go around. The cow was first seen in her new position yesterday morning.

There are 207 cows this morning on Lukanin. A number of the harems range from 12 to 19 cows each. The large harems are constantly growing larger. Many bulls, even at the water's edge, have no cows, and a good many have only 1 as yet. Where a harem is formed with a single cow it is either by theft or by the capture of a landing cow. Where the cows have any choice in the matter they tend to get into the harems which are already occupied. The Amphitheater has 76 cows.

A test of 100 skins from the killing this morning in ten lots were weighed, the weights being as follows: 65½, 74½, 73½, 74, 70, 76, 79, 75½, 76, 78½. This gives an average weight per skin of 7⅝ pounds.

#### REEF.

In the afternoon I visited the Reef. All along Gorbatch we have the same phenomenon of big harems with small ones mixed in and bulls without any cows. In the rear are the scattering small harems, evidently formed by capture. The same is true of Ardiguen, and, so far as can be seen from a distance, of Reef rookery also. The harems in the latter place are under the bowlder beach and are not visible from the rear except in one or two places. Everything tends to show that the cows in



landing, if they have any rule or preference, seek the biggest crowd. It is, however, true that a cow in landing has a very definite idea of the place at which she is to come out of the water. She may land on the rocks and escape to sea because of the awakening of a bull, but when she returns she will land in the same identical cove, in the end, perhaps, to be captured by the very bull from whom she has fled.

There are 56 cows on Ardignen, where were only 3 cows on the 20th. The number of bulls is the same, 30: but there are 4 young bulls hanging around the rear of the 3 bulls above the mouth of the slide.

Five killers were swimming about between Reef Point and Sivntch Rock, making the water boil. They are probably feeding on seals.

Sivntch Rock, viewed with a glass, has on it a large number of bachelors. There is one very large harem and many small ones in the little bight where the landing is usually made.

A great pod of bachelors, chiefly the large ones, are lying in the bed of the pond on the Reef, which has evidently now been accepted as a hauling ground. There are a few, however, up in the regular place. A large number of overgrown bachelors are out on Zoltoi. When another drive is made from the Reef these fellows will all come up again.

## LUKANIN.

I went to Lukanin in the evening with Mr. Adams. A cow alone with a bull is terribly torn. The wounds are gaping and bloody. Her bull is covered with blood. On her side is a piece of skin 6 inches square torn at three sides and trailing on the ground. It is difficult to see how this cow can live. She was evidently stolen from a large harem in front of her present position. There are very few cows in these small harems that do not show wounds of some kind, many quite serious. A cow roughly handled by her bull this morning limps on the front flipper by which she was caught. Another cow has a bad cut on the hip and drags her hind flipper. It is likely that many of these cows will bring forth stillborn pups.

The cow already noted as stolen on the morning of the 24th has not yet got her pup. It calls to her and she answers, but it can not extricate itself from the rocks. A sleeping pup awakens at the call of a cow in a harem at a distance of about 50 feet. This is a harem of 3 cows, 2 of which are known to have been stolen. The pup makes a straight line for the mother's voice, and there is a happy reunion. This pup has been absent from its mother for the better part of two days.

The question naturally arises, What if this mother had been stolen immediately after the birth of her pup, or even while it was being born? The pup would simply never reach her, and would die of starvation. Beside the cow stolen yesterday was a cow in the act of delivery. She might have been the victim of theft, and the result would have been fatal to the pup, as it could not have walked to her, and it would have been absolutely impossible for her to return. This must be recognized as one of the sources of early starvation among pups.

An instance of copulation was witnessed in a harem immediately under the cliff. The harem has now 19 cows, so that it is not possible to be definite as to the exact history of the cow in question. The harem, however, was formed on the 18th with 1 cow. She was first seen at 9 a. m. Two other cows were added to the harem at 10.30 of the 20th, and a fourth at about the same hour of the following day. Beyond

this no record of arrivals could be kept. Two pups were born to the harem at 3 p. m. of the 21st. The first pup in the harem was born on the 19th at between 8 and 9 o'clock a. m. Beyond this the record of pups is not known.

Close watch has been kept of this harem, among others, and it is probable that this is the first case of copulation, and that the cow is the earliest arrival, making the time about eight days. Even if it were the second or third case it would doubtless be one of the two landing on the 20th. While this data is only approximate, it is fairly definite.

The first cow seen to have arrived on Lukanin is still present without a pup, and she has given no evidence of coming in heat.

#### JUNE 27.

I visited Lukanin and Kitovi this morning. It is still clear and bright, unprecedented weather for St. Paul.

I counted the cows on Lukanin and found 257; there are 105 cows on the Amphitheater, with the usual number of bulls.

At 9 o'clock in the evening another visit was made to these rookeries. The torn cow under the cliff is much more badly injured than she was at noon to-day. She seems in no condition to make any attempt to escape, and it is hard to see any reason for the renewed attacks upon her. Perhaps the taste of blood has rendered the bull unusually savage.

It seems likely that the bulls and cows drink whenever the water is conveniently within reach. At high tide a number of the bulls are reached by the water. Several of the harems are flooded when there is the least surf, pups and cows getting up on the rocks. At these times the bulls are seen to put their heads down into the water and hold them up as if drinking. At least a dozen instances of this have been seen.

A case of copulation was witnessed in the harem containing the cow which has been out since the 12th. She has not yet had a pup. A second cow was added to this harem on the 21st at 10 o'clock a. m. and gave birth to her pup at about noon of the 22d. The copulation must have been with this second cow. There are at present 5 cows in the harem, but the remaining 3 are recent arrivals and have not had pups. This copulation occurring at 9.30 of the 27th must be about 129 hours after delivery of the pup.

A pup in this same harem was born under the nose of a cow, which was greatly annoyed, and picked up the pup at least a dozen times in a quarter of an hour, shaking it like a wet rat. The newly made mother protested mildly, but both cows were too lazy to change their positions, and so the poor pup had to take it.

Two harems are located in a place which at high tide is partially covered with water, and if there is any surf it washes over the rocks. The pups are perched up on the projecting rocks and are shoved off into the water when any commotion occurs in the harem. None have been seen so far to be washed away, but if a heavy surf were running these pups must move back or be washed away.

The mother and pup which have been noted as separated on account of the stealing of the cow have not yet got together. The cow is calling at infrequent intervals and the pup answers, but it is so hemmed in by the rocks that it invariably loses its way. To-morrow it will have been 72 hours away from its mother. The two are separated by about 15 feet of space containing, however, a large stone.

The corn cow looks in such a bad condition that it seems best to kill her and end the misery. I will bring a native over in the morning to shoot her and try to get her out.

Mr. Adams reports that while he was watching on Lukanin this morning the mules crossed the foot of the hauling ground, frightening the bachelors through the end of the rookery into the water. After this the mules will be herded. They have a tendency to approach the edge of the rookery to crop the grass which is springing up in the recently abandoned grounds. This grass is much greener and fresher than that found elsewhere.

#### JUNE 28.

I went with Jacob Kochuten to Lukanin to try to get the lacerated cow. Colonel Murray and Mr. Adams accompanied us. She was found dead and in charge of a different bull at some distance back from her position of last night. She had literally been torn to shreds in the night. She was secured without much difficulty and skinned. The skin of the right side was torn completely off, and over the back where the skin was not broken it was still loosened from the blubber. There were three great gashes in the left side and the rump was badly torn. She was bitten in the throat, doubtless the immediate cause of death.

She contained a full-time fetus. This weighed  $11\frac{1}{2}$  pounds. The skin of the cow was taken for purposes of illustration. A photograph of it was also made. A more striking example of unfeeling brutality could hardly be imagined than this case shows. This is the worse case yet seen, but the harems are full of cows badly torn and cut from the rough seizure of the bulls. The condition of this cow recalls that of the bull found dead at Zapadni. He had evidently been torn to pieces by his companions.

#### NORTHEAST POINT.

In the afternoon I went in company with Mr. Morton and Mr. Redpath to Northeast Point. The first drive of the season will be made here to-morrow if the weather is favorable. The bright sunshine of the past week still continues.

The seals were found not to be very numerous on the rookeries, and from the weather indications it is decided not to drive to-morrow. In the evening I visited the sea lion rookery on Sea Lion Neck. It is not possible to approach it closely. The roar which its inhabitants keep up is something wonderful. It is greater than that of a whole rookery of fur seals, though there can not be over 300 or 400 animals, all told.

#### JUNE 29.

#### SEA LIONS.

I went again in the forenoon to visit the sea lion rookery, crawling up close to it. With a glass it was possible to get a good view.

The animals were mostly sleeping and the roar of the previous evening had subsided. The bachelors are evidently mixed up with cows and pups, or at least lie in close proximity to them. There does not seem the same distinct division into harems, though the bulls are so distributed as to indicate that each one controls a certain number of cows. In the largest pod of cows are 5 bulls. Three cows are

seen to land within a few minutes and take their places in the midst of the sleeping cows. They call lustily as they come from the water and pups respond, though no effort is made to find them. The wet cows sit around drying themselves. As one comes in she flounders over the sleeping cows and pups, waking them up in the same aimless way that the female fur seal has. As each cow appears the bull arouses himself up and inspects her. One cow belongs to one bull and two to a second. The actions of cows and bulls are identical with those of the fur seal except that the bull in his calling nods his head in a peculiar fashion while the bull fur seal shakes his head.

The sea-lion cows are not unlike the fur seals except in size. When they crane out their long necks they look like great lizards. The nose of the sea lion is broader, shorter, and has a decided upward tendency, especially in the younger animals. In the pup and young bachelor it is not unlike that of a pug dog. All the movements of the animals are less easy and graceful. The swaying motion of the head and shoulders when walking and the constant bobbing of the head when discussing family affairs are the most characteristic movements of the bulls.

The little brownish-black pups, which are now about the size of the fur-seal pups at the age of 3 months, play about with one another just like the fur-seal pups. One is lying asleep on its mother's back. Another is climbing up and tumbling down. Several are nursing and others are podded by themselves, sleeping or playing in twos and threes.

Among the sea lions, as with the fur seals, the young or half-grown bull seems ruled out. The bachelors are more privileged characters. The half bulls lie at some distance from the cows. Some are at a distance, at the other side of the neck. One lies across the little bight in the midst of a fur-seal rookery. Two came up in the water before the rookery and began roaring. The old bulls started for the water. One young bull immediately fled. The other stood his ground and did not retreat even when an old bull went into the water after him. They bluffed at one another and the old fellow returned to the shore; both continued roaring and nodding their heads at one another.

Two bachelors play with each other in the water in front of the rookery just as fur-seal bachelors might. They attempt to stop the landing cows.

The old bulls occasionally indulge in the same kind of bluffing which characterizes the bull seals. The quick snap at the angle of the fore flipper, and the equally quick withdrawal of this limb, shows that with the sea lion, as with the fur seal, it is a coveted and vulnerable point of attack. No serious fighting was seen and no ents could be distinguished. The bulls, when not sleeping, were alternately bluffing at one another and rounding up and talking to the cows.

A female sea lion was seen to drive away a strange pup which attempted to nurse.

In every respect, so far as noted, the habits and actions of the sea lions were exactly identical with those of the fur seals, except in that the bachelors were not so much an object of jealousy as with the latter. Even in their case the difference may not exist in the regular breeding season. The pups are apparently all born, and doubtless most of the cows, if not all, are served.

The other sea lion rookery, at the tip of the point seen from the top of Hutchinson Hill, shows practically the same features, but it is evidently much smaller.



A fur-seal harem of 4 cows was located right in the midst of the sea-lion cows. The sea-lion pups were playing about among the seals and were driven off by them. Other smaller harems of 1 and 2 were lower down on the beach. The animals appear simply to ignore one another.

#### NORTHEAST POINT ROOKERIES.

Northeast rookeries do not afford good opportunity for observation, except from the top of Hutchinson Hill, and there the distance is too great. The bulls occupy the entire space at the foot of the hill, and are scattered over its slope to the very summit.

Along the bowlder beach below the hill are 5 groups of seals, evidently single harems which have expanded beyond the control of a single bull, though one or two of them seem to be still dominated by a single bull. On the outskirts lie other bulls, however, which can not be displaced, and which will eventually have part of the lot. Two of the bunches of seals number nearly 200 cows each, and the others number over 100. There are doubtless small scattering harems between them, but they are not visible, and probably have but 1 or 2 cows each. In these bunches we have a segregation of the cows similar to that shown in the larger harems of from 15 to 45 on Lukanin. About the large bunches are small harems of 1 and 2 cows each which have plainly been stolen and carried back. It may be that some of them have wandered away and thus been captured. One cow with her pup is in charge of a bull near the foot of the hill, far back from the shore and with a score of bulls intervening. It is a mystery how she could reach her location. She could not have been stolen and carried there.

At intervals along the beach cows are similarly congregated in large harems. It is plain that the tendency is for the landing cows to seek the crowded harems until the mass becomes too large for the control of a single bull, when the outlying bulls first occupy positions on the outskirts, and finally divide the bunch with the original possessor. Cows also undoubtedly wander away while the bull is occupied, and are taken up by bulls in the rear. It is certain that many of the cows are stolen from these large harems and carried off bodily.

A dead bull was seen just back of the beach at the foot of the hill. His side showed numerous cuts and scars as if he had been killed by his companions while fighting.

A large pod of bachelors are hauled out on the sand beach just opposite Cross Hill and at some distance from the beginning of the rookery. I did not see anything but old bulls there last year, but this is, doubtless, a regular hauling ground early in the season.

Mr. Morton accompanied me to Hutchinson Hill. Returning, we found a little blue fox pup lying outside a den. He looked sick—at least, was not afraid of us—and allowed himself to be handled and photographed. A second one, more timid but full of curiosity, came out of the hole and in a few minutes was ready to play. Mr. Morton offered it a piece of tobacco which it bit and tried to pull away. Almost instantly the little fellow fell down in convulsions, becoming finally unconscious. It revived in a few minutes, but declined to play further. The incident was a rather unexpected argument against the use of tobacco.

JUNE 30.

A drive was made this morning from the western side of the peninsula, Vostochni rookery. The killing was made on the flat by the side of Webster Lake. A total of 790 was killed; 214 small and 376 large seals were rejected.

Of the large seals many were young bulls, but there were others which were killable seals in 1894-95. Bearing in mind the *modus vivendi* of 1892-93, every possible killable seal should have been killed in the years immediately following. When these seals are grown up and enter the lists for places on the breeding grounds there will be exciting times. It would be well for the Government to have all the old and in any sense disabled bulls shot each fall when they haul out on the sand beaches so that the rookeries can be restocked by young blood. It would be better to kill off the older rather than the younger bulls. One or the other class should be diminished. There are double the number of bulls about these rookeries that will get cows.

At the killing this morning I weighed with a hand scale 52 individual skins. Twenty-two small skins picked out on the field weighed less than 6 pounds each. The individual weights are as follows:  $5\frac{1}{2}$ ,  $5\frac{1}{2}$ , 5,  $5\frac{1}{2}$ , 5, 5,  $5\frac{1}{2}$ ,  $5\frac{1}{2}$ , 5,  $5\frac{1}{2}$ ,  $5\frac{3}{4}$ ,  $5\frac{1}{4}$ ,  $5\frac{1}{2}$ ,  $5\frac{1}{2}$ ,  $5\frac{1}{2}$ ,  $5\frac{1}{2}$ ,  $5\frac{3}{4}$ ,  $5\frac{3}{4}$ ,  $5\frac{3}{4}$ ,  $5\frac{1}{2}$ ,  $5\frac{1}{4}$ ,  $5\frac{1}{4}$ . Of the remaining 30 skins 16 were less than 7 pounds, as follows: 6, 6,  $6\frac{1}{4}$ ,  $6\frac{1}{2}$ ,  $6\frac{1}{2}$ ,  $6\frac{1}{4}$ , 6, 6, 6, 6, 6,  $6\frac{1}{2}$ ,  $6\frac{1}{4}$ ,  $6\frac{1}{4}$ . The remaining skins weighed as follows:  $7\frac{1}{2}$ , 9, 11, 8, 7, 8, 8,  $7\frac{1}{2}$ , 7,  $9\frac{1}{4}$ , 7,  $8\frac{3}{4}$ , 9.

In walking down to the village I found a dead bull on the sands midway between Northeast Point and Polovina. It had evidently died this spring, but was too far decomposed to permit of close examination.

## LUKANIN AND KITOVI.

In the evening I visited Lukanin and Kitovi. I counted 210 cows in the Amphitheater in 10 harems. Mr. Adams reports that there were 137 cows on the 28th and 168 on the 29th.

One of the harems here numbers 42 cows and is located on the flat above the little gully at the southern end. At the foot of this gully is a harem of about 15 cows which fills the passageway. The harem at the top must have received its cows through this passageway, and the only explanation is that the bull below could not possibly hold all the cows and they passed through to the flat above. There are only 3 easy landing places on the Amphitheater (its shore being for the most part abrupt), and at each of these are grouped several large harems, the rear ones having evidently been formed by cows passing through. They are larger than the original harems. In one case the original harem has 20, the harem behind it has 33. In the harem with 33 cows there are 15 pups.

One case of copulation is in progress on the Amphitheater. Nothing can now be known of the history of the cow, as the harem is a large one. It was founded with a single cow on the 14th and she was alone until the 17th, when her pup was born. The harem then increased rapidly.

## COPULATION.

Mr. Adams reports 6 cases of copulation observed by him on the 27th, 28th, and 29th in the harems under watch. Three of these were in a harem whose history is pretty well known. It was founded with a single cow on the 18th at 9 a. m., received

2 new cows on the 20th at 10.30 a. m. and 3 additional cows on the 21st, 22d, and 26th, respectively. The pup of the first one was born at 9 o'clock on the 19th. The record of the other pups is not known. The cases of copulation were at 5 p. m. on the 28th, at 4.30 and 9.30 on the 29th. No other cases of copulation have been noted in this harem. It is probable, though not certain, that the 3 cows concerned were those arriving on the 18th and 20th, respectively. Two of the 3 remaining cases occurred in a single harem, one at 10.15 a. m. on the 27th, the other at 5.30 of the 30th. This harem was founded with a single cow on the 21st. She remained alone until the 23d and by the 25th there were 4 cows. No record of birth of pups is available.

The last case occurred in a harem formed on the 21st with 1 cow. The harem was not closely observed. It grew rapidly, and by the 25th had 13 cows. There is no record of the birth of pups. The case of copulation noted occurred at 3.05 p. m. of the 29th. Eight other cases were noted, but no data is available regarding the harems.

While these last two harems do not furnish exact data, an approximation of the time can be reached.

Mr. Adams also reports the apparent departure of two cows. In the first case the cow was dry and of the reddish-brown color which goes with presence for some time on the rookery. She left deliberately. The second cow escaped during a fight over an intruding bull. She was intercepted in the water by two bachelors, but swam off directly to sea. Of these cows no definite data as to time of arrival, etc., is known.

I counted the cows on Lukanin rookery and found 636. There were 257 on the 27th, thus showing a large increase within three days. The cows are evidently coming in fast now, while few if any have taken to the water as yet.

The lost pup and its mother are still separated. It is now about six days. The pup is plainly starving. It is thin and calling piteously, wandering about the cows in the harem, by whom it is persistently repulsed. It is growing gray and pinched about the mouth. The mother has ceased to call. She is still alone.

The first suggestion of podding is visible about some of the older harems. The pups by twos and threes are sleeping at some distance from the cows.

#### JULY 1.

The Amphitheater at Kitovi counted this morning shows 246 cows and the usual number of bulls. One harem, which contained 42 cows last night, has now only 35, but this does not necessarily indicate the departure of cows, as a small harem in the rear has grown considerably. If any departure of cows has taken place it can not be general and must be confined to the very earliest arrivals.

The *Rush* came in this evening, bringing Mr. Lucas. A letter from Mr. Judge at St. George indicates that seals are very scarce there. Two drives have been made to date as follows: June 16, East rookery, 150 killed, 93 large and 159 small rejected; June 25, from Zapadni rookery, 140 killed, 74 large and 192 small rejected. This proportion of small to large among the rejected is directly opposite to that found on St. Paul.

Mr. Morton reports that a second drive was made this morning at Northeast Point. Seven hundred and three seals were killed, and 288 large and 224 small seals were rejected. The weather has been very unfavorable for sealing. The morning proved

close and warm, and 17 seals were overcome by the heat on the drive. The skins of all but 4, which were too small, were accepted.

MR. LUCAS'S NOTES.

I reached St. Paul in the evening and walked over to Lukanin and Kitovi. There are few seals in the harems and no bachelors are hauled out at the angle of Kitovi where a number were always to be seen last year. Everything is remarkably quiet, no growling of bulls and bleating of cows and pups.

JULY 2.

A small drive was made this morning for food from Lukanin. Two hundred and eight seals were killed; 107 large and 90 small were turned away. Thirty skins were weighed and found to average 7.7 pounds apiece. The largest skin weighed 11½ pounds; there were 6 less than 6 pounds. The number of large bulls in this drive was remarkable for Lukanin rookery.

On Lukanin rookery the number of cows was found this morning to be 880. The Amphitheater of Kitovi had 290. Numerous cases of copulation were noted. Many cows were seen to land but none to go out.

REEF.

I visited the rookeries of Reef Peninsula in company with Mr. Lucas. The harems are gradually filling up along the bowlder beach. Where harems exist above the beach they are plainly the result of stealing from larger harems below. The young bulls are wandering about in the rear of Gorbach in the manner of last year. The cinder slope of this rookery is beginning to fill up with idle bulls. On Ardighen there are 5 harems at the foot of the slide. Two are close to the water; 3 lie behind, the furthest up being nearly halfway to the top. It contains a dead pup with the placenta attached. It lies in an exposed place, but it may have been stillborn instead of trampled.

The bachelors on Reef rookery have worked back into their old hauling ground, though they still occupy the runway in the bed of the pond.

This rookery shows well the manner of filling the breeding grounds. Each one of the large masses which extended inland last season is now marked by a miniature mass of cows which already has pushed out into the flat above the bowlder beach. The largest mass has between 200 and 300 cows. Bulls hold positions among them, but the harems are not defined and the cows are as closely packed as they can stand. There are probably many small harems along the beach which are developing slowly, but they are not visible.

At the extreme northern end of Reef rookery was last year a single harem in an isolated position. There are now 3 bulls; one has 3 cows, another 1, and the third none. All the cows have pups.

TOLSTOI.

We walked to Tolstoi rookery in the afternoon and by using care were able to get down among the bulls to the very angle of the rookery, thus gaining a near view of the sand flat. The conditions are singular and interesting. At the sloping foot of the



bowlder incline is the narrowest part of the sand flat. Here the cows are formed in a solid wedge-shaped mass pointing to the foot of the slope and extending to within a few yards of it. After a short break occurs a large harem at the immediate foot of the ascent. Up the slope a distance of a hundred yards are small harems at intervals in a direct line with the mass below. No other part of the flat has been invaded by harems. The bowlder beach throughout its length is filled. It would seem as if the seals were endeavoring to avoid the sand and reach the slope, taking the nearest way across the flat.

The mass of cows is very great, probably numbering as many as 500. There is no differentiation into harems, and the 15 or 20 bulls are rushing about trampling on the cows and knocking them about. A hundred or more pups are podded on the side next us. They are safe from the rushes of the bulls within the mass, but not from the trampling of those hanging on the outskirts trying to steal cows. At a distance of a few yards on all sides are small harems which have been stolen. Cows are landing rapidly, and wet cows are to be seen distributed to the very foot of the slope. It is after the wet cows that the bulls make their rushes. One trampled pup was seen on the edge. It is impossible to see within. Seeing this place at the present time, it is not difficult to understand why the terrific mortality found last year occurs here. It will surely be repeated this year. The remedy is simple. A number of blasts properly distributed over this area would break it up and prevent the formation of the compact mass, allowing the seals to seek the slope, above which is a very favorable rookery ground.

MR. LUCAS'S NOTES.

There are a few hundred seals on Zoltoi bluffs; many of these are large, some half bulls and many full-grown bulls. Seals are comparatively few along Gorbateh rookery, the harems being small and scattered. The usual idle bulls are stationed on the cinder slope. There are no harems in the upper part of the slide. The bulls are waiting, among them the one with the scar above his left flipper which was so familiar last year. The harems at the base of the slide are moderately full. In one of 21 cows are 13 pups. Old cows are in the majority: but 3 3-year-old cows are to be seen. Two dead pups are seen, one with the placenta attached. Pups are already podding, showing that this occurs soon after birth. Upward of 700 bachelors on the Reef, but many are too large to be killable.

In the afternoon I visited Tolstoi with Mr. Clark, going down close to the angle of the rookery. To the east on the sand are about 200 seals, at least 100 of which are full-grown bulls. The bulls are surprisingly quiet, for we are able to approach within 40 feet. There is a large triangular mass of seals extending from the water very near to the "bloody angle." Other harems extend up the slope in a band. The newly arrived cows are working up through the mass. The bulls try to secure them as they move along, and as a result there is much rushing about. There is a large pod of pups on the outer edge of the mass into which a bull steps. The center of the sand flat is covered with idle bulls, though there are few females near it. Pups are beginning to stray out, and 2 are seen which have been trampled to death.

JULY 3.

A count of Lukanin rookery made to day shows 939 cows. The Amphitheater of Kitovi has 362. The number of cows is therefore still increasing, and the proportion of arrivals outnumbers the departures, if indeed any great number of cows are leaving.

Under the cliffs at Lukanin a pup was seen to start up calling and leave its harem. It roused up a sleeping pup at some distance away and then wandered off past 4 harems, a distance of at least 250 feet. It stopped occasionally to play with pups. The second pup followed at some distance, going about half as far, and entering a harem. The first pup turned about, passed down through a large harem to the water's edge, and returned home by an entirely different route. The second pup also got home safely. It is difficult to understand what prompted this wandering.

A small animal already noted which looks like a yearling or possibly a small 2-year-old is in a harem of 16 cows under the cliff. She was alone for some time with the bull, which afterwards gradually made up his present harem. The young animal was observed to pass into a harem below and take up its place there without any attention being paid to it.

Mr. Chichester will photograph the Amphitheater every other day during the season. These photographs should, together with the daily counts, show the condition of the rookery from day to day. From present indications it would seem as if there was a gradual ascent to a maximum, and then either a gradual decrease or else a general breaking up.

The Fish Commission has made arrangements with Mr. Chichester to duplicate its regular series of rookery photographs.

## MR. LUCAS'S NOTES.

The first harem on Gorbateh lies beside the rock bearing No. 25. It has 21 cows and 12 pups. A cow probably from this harem is seen to enter the water and go out. To the south is a harem of 4 cows and 5 pups. Perhaps the missing cow is the one seen to slip into the water below. With one exception all these cows are over 3 years of age.

There are 6 bulls in the slide, all without cows, though below them are harems of the ordinary size. The bull with the scar above his flipper crosses over and takes his place on the shelf, getting as near me as possible.

In the afternoon I spent some time in watching the harems on Lukanin and Kitovi. Quite a number of cows were seen to arrive—15 or 20 in all. The bulls do not seem to be aware of the presence of the cows until they are close at hand, sometimes until they are actually in their harems. The cows come out at the easiest places and to a great extent select their own harems, preference, as a rule, being given to the one containing the largest number of cows.

In many of the harems pups and cows are equal in number. Pups are being born; one recent arrival is firmly anchored by its placenta. Pups get knocked about by excited bulls, but are not seriously injured.

By Kitovi is an old bull blind in the left eye and very timid. Can this be the bull apparently recently blinded seen last year at this place?

## JULY 4.

Mr. Chichester and myself walked to Tolstoi to get a photograph of the sand flat. Mr. Lucas and Mr. Stanley Brown accompanied us.

The mass on the eastern end of the sand flat has increased in size and is solid up to the foot of the slope. The harems on the slope have all increased in size and are now practically continuous, extending nearly to the top. There is thus a continuous highway from the water's edge to the top of the rocky slope. At the extreme western end of the sand flat another mass of cows is projected across, and many harems are formed on the rocky slope at that point. The rest of the flat is still vacant. The same turmoil and fighting goes on in the massed portion.

On the way home a count of the cows in Lukanin rookery was made. There were 1,088 to-day. The Amphitheater has 414.

One of the branded cows with a pup is located under the cliff at Lukanin rookery, opposite where she was seen on one occasion after the branding last fall. The brand is very plain, extending fully across the back and certainly spoiling the skin. There has been no replacement of fur on the branded part. The cow was also seen by Mr. Lucas. There were but 2 cows branded on St. Paul. The date of the branding was September 2.

A case of cow stealing was witnessed where the trespassing bull entered the harem before its owner's eyes and carried off the cow. It took some seconds for the bull being robbed to take in the situation, but when he did he lost no time in attacking the thief, getting him by the foreflipper and shaking him vigorously. In the struggle the cow escaped back to her harem, and all that the thief had for his pains was an ugly cut.

Two dead pups, evidently trampled, were seen on Lukanin. There are not and have not been any bachelors out on Kitovi rookery this season.

The increase still goes on in the counted rookery portions. Some departures, however, must occur. Mr. Lucas reports several on Gorbatch this morning.

## MR. LUCAS'S NOTES.

The seals have greatly increased on Tolstoi sand flat since the 2d. They now extend in an unbroken band from the water to the angle, while there are many more harems on the slope.

A bull located in the slide which forms the western approach to the cinder slope on Gorbatch has 50 cows in his harem. This is a good illustration of the advantage of location.

## JULY 5.

A killing was made this morning from Reef and Zoltoi; 703 seals were killed and 229 large and 175 small were turned away. In company with Mr. Stanley-Brown, I weighed 163 individual skins, taking them as they came on the field, with the following results:

Skins over 5 and under 6 pounds.....	35	Skins over 10 and under 11 pounds.....	9
Skins over 6 and under 7 pounds.....	59	Skins over 11 and under 12 pounds.....	3
Skins over 7 and under 8 pounds.....	29	Skins over 12 and under 13 pounds.....	1
Skins over 8 and under 9 pounds.....	20		
Skins over 9 and under 10 pounds.....	7	Total.....	163

One hundred skins weighed in lots of 10 each in the salt house gave an average of 7.8 pounds per skin for the killing.

I visited Lukanin and Kitovi in the afternoon. Under the cliffs at the former rookery a young water bull made a dash up through the harems as if to gain the rear of the rookery. He was attacked by all the bulls within reach, but was not stopped until he came among the idle bulls in the rear. He nearly escaped through these, but his courage failed and he turned again for the water, getting torn and bitten by all the bulls in the way. At the water he was hardly able to stand. This thing occurs nearly every day on some rookery. The peculiar thing about it is the stupidity of these young bulls, not only in attempting to break through in this way but also in not seeing that half the exertion necessary to retrace their course would carry them to safety. They seem to start out with an utter disregard for consequences and becoming discouraged they know nothing but to return the way they came.

During the excitement occasioned by an episode like the above the harems are more or less disorganized. Several cows have left their own harems to enter others. A small harem of 2 cows, behind a large one, loses 1. She probably goes back to the place from which she was stolen. The bull seems to be much excited about her loss and in a few minutes makes a raid on the big harem, carrying off a cow. The owner attacks him, catching him under the fore flipper and tearing him frightfully. He holds to the cow and gets her safely to his harem. The blood runs down his fore flipper in a stream and in a few minutes he has made the rocks for a space of 6 feet square red with his blood.

#### DEPARTURE OF COWS.

Many cows in all the harems to-day are restless and plainly desirous of going into the water. The bulls are constantly rushing about to prevent them. They are gaunt and thin. When anything engrosses the bull's attention elsewhere they slip away. One has just gone in. She spends a few minutes looking about and playing in the water, then swims off along down shore.

A cow left the same harem, but passed into the adjoining one to avoid a young bull on the water's edge. She passed into a third harem, neither bull paying any attention to her. Finally she went into the sea.

During a fight, in which the master of the large harem from which these 2 cows left was engaged, 3 other cows started off together. One got off to sea without difficulty. The second took refuge in a small harem near the water to escape a water bull and has been held a prisoner by the bull. The third was caught by a vigorous young bull without cows and held in an angle between two rocks. She is fighting hard but not making much progress. The bull has torn her in several places. He is bound she shall not escape. After fighting with her for half an hour and completely tiring her out he is now copulating with her. This would seem to be a case of rape, pure and simple. The cow still continues to struggle but it is impossible for her to get away. Yesterday Mr. Lucas and I witnessed a case of copulation where the cow seemed wholly unwilling but could not escape.

A wet cow comes in from the sea calling, as if looking for her pup. She does not find the pup during the time she is watched. She is not gravid, and must be one of the earlier cows returning from her first trip to sea.



The branded cow is present and has two companions in her harem to-day. She was alone when seen before.

A bull steps on a little pup and squeezes it against a rock, causing a stream of milk to gush out of its mouth. The pup was protected by the rocks, so that the full weight of the bull did not come on it. It does not seem badly hurt.

A little animal, which must be a 2-year-old cow, is in a harem under the cliff. It was alone with a bull for a number of days, and because of its restlessness we supposed it was a bachelor. There are now 9 cows in the harem. It is probably a 2-year-old cow. Before leaving, I find that the little cow has gone down into a larger harem below.

Wet cows, when they land, spend the first hour in rubbing and scratching themselves as if infested by parasites. The pups and all classes of animals spend much of their time in the same way.

Two wet cows are seen to land on the Amphitheater, calling for their pups. One finds hers and nurses it immediately. The other continues to call. They belong to the first harem established at this point. There can be no doubt that many cows have already gone and that some are now returning from their first trip to sea. That none of these early departures should be noticed is not strange, considering the small number of events on the rookeries that one can get eyes on.

Of the hundreds of pups born on these two rookeries, which have been kept under the closest scrutiny, probably not 10 births have been witnessed.

A count of Lukanin rookery shows 1,197 cows present. The Amphitheater has 499 cows to-day. Both show a steady increase, notwithstanding the fact that many of the cows are now going to sea.

#### MR. LUCAS'S NOTES.

At the killing this morning from the Reef the smallest seal measured 3 feet 4 inches in length. The stomachs of a few seals were examined for parasites and food. Three pebbles were found in one stomach. The livers were in fine shape and without trace of parasites. The lungs were not congested.

Harem No. 25 on Gorbatch has now 26 cows and 21 pups, 2 very recently born. There are no young cows. The seals are working up all along Gorbatch and on the slide. I see only 2 wet cows on the whole extent of ground visited and no cows are going out.

#### JULY 6.

Lukanin rookery to day has 1,264 cows and the amphitheater 518. Three departing cows are seen. There are many young bulls along the water's edge, and these invariably give chase to the cows. About 10 are following 1 out to sea. She is a few feet in the lead and is going as fast as she can. They can be traced for half a mile out by their dolphin leaps. The 4 or 5 young bulls make the water boil.

Many cases of copulation were observed. One bull in a large harem served 2 cows within an hour. There was no evidence of strain on him, as he was able to repel the attacks of an envious rival and get the better of him within five minutes of the second copulation. A bull was seen to serve a cow in a harem newly formed of 3 cows, all wet. The cow served must be one caught and detained while trying to go to sea. There is certainly no pup for her in the harem. In this case the question

arises whether this is another case of rape, or whether both these cases were those of cows attempting to leave before they were served. The young bull seen to catch the departing cow and serve her is now alone. He is, however, in fighting mood and is keeping the shore clear of water bulls for a space of a hundred yards or more.

When a cow is trying to escape from a bull she often turns when one would think escape was certain and faces the bull. She then keeps her head toward him all the time. The purpose is evidently to avoid being caught by the back, which is the favorite place for the bull to catch the escaping cow.

The branded cow is gone to-day. She was here yesterday. It should be possible, by keeping watch of her, to get some information about the time of absence.

#### MR. LUCAS'S NOTES.

Harem No. 25 has this morning 26 cows and 25 pups. Near rock 24 a cow comes in from the sea and nurses her pup. The harems on the slide are working up. The number of fresh cows coming in seems small; during all the morning only 2 are seen. So far this season we miss the fringe of seals swimming in the water off the rookery front. The only seals to be seen there this year are young bulls which hang about teasing the cows.

There is scarcely a bachelor on the Kitovi hauling ground, and the harems do not appear to be as far back from the sea as they were last year, but they will doubtless work back in the next week. Cows going out to sea have to run the gauntlet of idle water bulls; some are chased half a mile out.

In walking the pups move their hind legs alternately, as other quadrupeds do. The older animals move both hind legs together, the fore legs being moved alternately.

#### JULY 7.

The Amphitheater has 550 cows to-day and Lukanin rookery 1,371.

A cow came in calling and passed through 3 harems to the farthest one in the rear. She was not disturbed by any of the bulls except the one in whose harem she stopped. He "talked" to her for a time but soon left her to her own devices. Two other wet cows were seen to come in, find, and nurse their pups.

One dead crushed pup lies on the beach of the little cove below the cliff of the Amphitheater. One harem here has 82 cows in it. A pod of its pups are playing in a little pool of water which is deep enough in the middle to cover the pups. They keep out of the deep places and walk about in it. There is no attempt at swimming.

One bull is seen to copulate at 2.45 and again at 3.25.

All the cows in the harems now are of the very dark-brown color. It is very dry to-day and has been almost continuously since June 12. The newly-arrived cows can be distinguished by a sort of olive color. There are none of the light-colored cows recognized as 3-year-olds last year. One only of this class has been seen on Ardiguen.

Mr. Lucas went to St. George on the *Rush* to duplicate the counts of last year.

#### JULY 8.

I walked to Gorbateh and the Reef this forenoon. The harems still keep close to the beach, though occasionally small ones will be found extending up the slopes. The harems fall far short of the foot of Old John's Rock, where they were last year. There is, however, a harem of 2 cows within about a hundred feet of the rock, and

doubtless other harems will be formed. It is not likely that the season has reached its height as yet. There are no seals on the little flat near here which was photographed last August for dead pups. A large harem is located below it and a harem of 2 cows is above it. The cows do not reach the mouth of the slide on Ardiguen. All the large groups on the Reef are growing rapidly and pushing inland.

Under the cliffs at Lukanin I counted a section of harems along the beach as follows: 40, 24, 29, 31, 29, 24, 30, 39, 16, 22, 48—cows. Among and in the rear of these were harems as follows: 3, 6, 2, 3, 4, 8, 10, 4, 1. These latter harems (except, perhaps, the 8 and 10) have all been stolen from the former. On the Amphitheater the harem noted as having 82 cows yesterday now has 90. Thirty-five harems have all the cows on the Amphitheater. There are 12 idle bulls.

The Amphitheater has 585 cows to-day. Lukanin rookery has 1,531.

A bull stole a cow and was carrying her to his harem when an idle bull attacked him, pulling him down the slope by his hind flipper. He then seized the cow by the neck, and the two bulls pulled and sawed over the cow until it seemed she must come to pieces. Finally both bulls dropped her and went to fighting one another. The cow lay motionless for several moments, neither bull paying any attention to her after settling their differences. After a time she got up and hobbled slowly off to her harem. It is in this way that many of the cows found dead on the rookeries are killed.

A cow took up a place with a young bull on a sloping rocky shelf at the foot of the Amphitheater. The space was scarcely big enough for the bull to lie on, and sloped off toward the edge of the cliff, dropping sheer 20 feet down to the water. She had her pup, and a second cow was with her yesterday. To-day the bull and 1 cow are up on the flat above. The cow and pup are gone. Below the cliff a young bull is trying to copulate with something which proves to be the pup. It has fallen over the cliff and been caught in the rocks where the young bull found it. The pup squirms away. He picks it up in its mouth and tries to put it on a flat rock, but before he can get up the pup wriggles off. He bites the pup severely and has torn it in several places. When he lifts the little fellow up in his mouth, though only a day or two old, it bites him in the cheek and clings to his neck. He will undoubtedly crush the pup, and if he does not the rising tide will soon drown it.

#### MR. LUCAS'S NOTES.

A bull with 1 cow lies to the east of North rookery under the cliff. Another similar harem lies close to the passageway leading to the hauling ground. A harem was in almost the same spot last year. There are 150 to 200 bachelors on the hauling ground; some are large, but many small. The proportion of large ones is not so great as that on St. Paul. There are practically no seals swimming in the water off the rookery front.

On account of the slope of the rookery the section which could not be counted last year can not be counted this year without too great disturbance. If there is a drive we will recount this first section. The idle bulls do not appear so numerous as they were last year and the rookery seems to have shrunk some, so that it is now possible to approach and count portions which were estimated last year on a basis of the average number of cows in a harem.

There were 175 harems which could be counted for cows, giving 2,400; in addition there were 21 harems which could only be estimated. On the basis of those counted this would give for the 196 harems on North rookery 2,703 cows.

JULY 9.

I attended the killing from Polovina rookery which was made at Stony Point. Last year a killing ground was established by Judge Crowley at the lake back of the rookery and less than half a mile away. Its discontinuance does not seem necessary or wise. The drive to Stony Point is about 2 miles long, but easy because two-thirds of the distance is made up of a chain of lakes through which the seals swim.

The total number of seals killed was 356; 97 large seals and 115 small ones were driven away.

There is manifestly a great deal less skill or else less care in doing the clubbing this season. Instances where animals are struck on the back and shoulders with blows intended for others are numerous. More of these occurred this morning than ever. Animals are more often struck on the tip of the nose or on the back of the neck and are left to revive, not being clubbed again until the pod is finished. The stickers regularly carry clubs to dispatch the seals not yet dead when they reach them. Several animals stunned so badly as to require half an hour to come to have been seen. One young bull had an eye knocked out this morning, and several were sent away with bloody noses. The fault seems to lie with the clubbers. They are a new set and never seem sure of hitting their mark. The new chief, too, has something to do with the matter. He does not seem to have good control over his men. He has been cautioned severely by Colonel Murray on several occasions.

## DEAD COWS.

A cow came ashore last night on the beach below the village salt house. She was dead, but no external cause of death could be found. This morning another dead cow was found halfway up the lagoon at low tide. Both were brought in and skinned by Jacob Kochuten. In each case death resulted from biting by bulls. All over the back were traces of tooth marks which, while they did not penetrate the skin, loosened it from the blubber. In one case the immediate cause of death was the literal crushing in of the chest by the jaws of the bull. The skin was cut and torn by a dozen tooth marks and the chest cavity was full of clotted blood. In the other case the cow was severely bitten in the throat, but doubtless the injury that caused death was a bite in the small of the back. Both cows had recently borne pups and had an abundant supply of milk. Their pups must become the victims of starvation.

## KITOVI AND LUKANIN.

The Amphitheater to day has 587 cows; Lukanin 1,540. These counts are manifestly less accurate than the preceding ones because of the rain and the mist. Cows and rocks are wet and not so easily distinguishable.

Cows are coming and going. A harem which had 3 cows with their pups yesterday has 5 new cows in it. The young bull noted as catching and serving the escaping cow has now a fresh cow. Several other small harems are formed at various points. The young bull seen to attempt copulation with the pup has now 3 cows in charge. The large harem on the Amphitheater has still about 90 cows, though it is difficult to count it accurately because of the constant moving about of many of the cows. Two large harems, at some distance removed from the sea have plainly



diminished. They are not in a position to receive many recruits and the number of outgoing cows has been considerable.

The cows are uneasy and restless under the rain. The bulls are excited and more fighting is going on than I have seen yet on any rookery.

The pups are becoming very conspicuous as they wander about and play in pods. In 2 isolated harems it is possible to be reasonably sure of the pups. One harem of 35 cows has 24 pups; another of 26 cows has 28 pups, including 3 dead ones. In addition to the 2 seen dead at birth 1 is now present, which, from its thin appearance has probably starved. The harem is two removed from the one in which the stolen cow was observed so long without her pup. To-day she is gone and her bull has 3 fresh cows. No trace of the starving pup has been seen for several days and the emaciated pup may be it.

#### MR. LUCAS'S NOTES.

I go up on the cliff above Staraya Artel rookery, but can not get near on account of a few straggling harems. There can, however, be but few seals under the lower shelf. From the top 42 harems and 30 idle bulls are visible, and 45 harems is probably near the mark. The count of the rookery is extremely unsatisfactory and is practically impossible. Whatever the number, as compared with last year there are now fewer, for the rookery is thinner and more straggling. The few harems that could be separated are as follows: 3, 3, 2, 2, 1, 26, 16. At the upper end are ten bulls with about 250 cows.

On Little East rookery there are 46 harems, with 497 cows and 14 idle bulls. In one place a water bull rushes vigorously into the harems and no less than 4 others follow in quick succession. (See observation of Mr. Clark.) For a few minutes there is great excitement among the bulls and cows. Many of the cows on Little East are much cut.

#### JULY 10.

A count of Lukaniin showed 1,680 cows present. There were 660 on the Amphitheater. In the latter breeding ground are two harems which have been united so that they can not be distinguished. They aggregate 150 cows.

Under the cliffs at Lukaniin are 5 little animals distributed about in as many harems. They look exactly like the 2-year-old virgin cows. They move about like privileged characters, and are certainly not gravid. The one which has been watched for some days has moved to a harem some distance off.

On Tolstoi sand flat the mass of cows has increased, spreading out on either side but still keeping the point of the wedge toward the base of the rocky slope up which the harems extend in a line nearly to the top. At the western end of the flat the seals are just beginning to move up on the slope. At no intermediate point on the sand flat or slope have cows appeared.

A young bull still wet was forced by the idle bulls down the slope into the sand flat. He avoided the harems in the crowded part, and after encountering every bull in the middle portion of that flat was thrown into the sea. Had he gone down through the massed harems, there would have been a line of crushed pups in his wake.

This bull was large enough to be classed among the idle bulls. There were other wet bulls lying about on the edge of the flat. It is evident that some, at least, of

these bulls come and go regularly from the water. This has also been noted on Lukanin rookery. At the killings the relative proportion of rejected seals has changed. In the earlier killings the large seals outnumbered the small two to one. Since the 6th of this month the small ones have been in the majority. Not only have the large ones declined in proportion to the little ones, but the number of large ones from any particular rookery has steadily diminished. For example, 556 large seals were rejected from Reef and Zoltoi on June 23; on July 5 there were 229. These young half bulls are now hanging about the water front or in the rear of the rookeries, and are therefore not picked up in the drives.

MR. LUCAS'S NOTES.

East rookery has shrunk away from its position of last year, judging by photographs and maps. The western portion hardly comes up on the hillside, there being only one good-sized harem there. The beach portion to the westward is very thinly populated. The branded cow with her pup is under the cliff portion of the rookery. There is no question about the distinctness of the brand.

East rookery has 128 harems, 1,533 cows, and 41 idle bulls.

Visiting North rookery this afternoon I find that the aspect of affairs has materially changed during the last two days, and it would seem that the count has been made at the time of the greatest stability of harems and when probably the most cows are ashore.

JULY 11.

This is St. Paul's day and a great holiday for the Aleuts. The *Grant* touched in on her return trip from the Commander Islands and held her anchorage off East Landing during the day. She was joined by the *Rush* in the afternoon.

The Amphitheater has 703 cows on it to-day. For 138 cows in 7 harems there are 150 pups. These harems are so situated as to make the count of pups certain. This evidently indicates a large absence of cows, as many of those present are still gravid, but the steady increase on the breeding ground shows that the incoming cows exceed the outgoing.

A count of cows on Lukanin still shows increase. There are 1,755 to-day. There is a marked change in the appearance of the rookery within the past day or two. The former compact appearance of the harems is gone. The cows are scattering out so that the harems can not be clearly defined. Under the circumstances it becomes difficult to count the entire rookery, and the count may soon have to be discontinued. This thinning out is evidently due in part to shifting of the cows, but also in part to absence of cows from the places they have heretofore occupied.

MR. LUCAS'S NOTES.

The hillside of Zapadni is more dense than last year, and so far as one can judge there are actually more seals. The northernmost patch, however, is now a thin line, and the middle portion has shrunk perceptibly. This year these two sections contain 39 harems and 431 cows. Last year they contained 66 harems and 946 cows. The dense southern mass can not be counted. There are not far from 65 harems altogether. This was estimated last year at 1,260 cows in 75 harems. The idle bulls on this rookery are as numerous and fierce as ever.

## JULY 12.

A drive was made this morning from Lukanin and the Reef. No seals were found on Zoltoi. Eight hundred and four seals were killed; 140 large and 638 small seals were turned back. Those killed represented 50 per cent of the animals driven. Lukanin is again justifying its reputation as the "nursery," as the greater part of the little ones came from it.

## COUNT OF LAGOON.

After the killing Mr. Macoun and myself made a count of the cows, by harems, on Lagoon rookery. Mr. Lucas managed the boat. The following is the count of harems in detail:

1	2	7	4	2	31	51	9	5	3	6	24
16	6	7	7	21	1	19	12	4	1	11	13
6	12	7	6	14	12	13	15	26	5	4	1
1	27	2	27	9	26	2	1	9	1	26	5
15	25	6	32	16	8	1	1	2	33	20	1
23	1	22	41	9	1	3	27	1	11	9	10
11	20	26	3	4	17	5	25	25	19	30	33
11	16	1	2	2	6	20	22	13	1	44	2
20	6	2	1	7	1	2	1	1	7	3	2
2	15	1	3	5	9	3	7				
Total cows .....											1,319
Total harems .....											115
Average harem .....											11.4

The count for Lagoon rookery for last year was made on July 13, but as Kitovi rookery had to be counted and photographed by Mr. Macoun on that date this year, at his suggestion the count of the lagoon was made one day in advance. The weather conditions were very favorable and the count is accurate. The harems on the inner side of the reef are fewer and smaller than last year, there being only 8 harems of from 1 to 4 cows not visible from the water front.

## WALRUS ISLAND.

In the afternoon I was able to visit Walrus Island through the kindness of Captain Roberts, of the *Rush*, who took over Mr. Duffield and his assistants to make a survey. The vessel overran the island about  $2\frac{1}{2}$  miles in the fog, having been carried out of her course by the currents.

Walrus Island is devoid of vegetation except for a small area of seal grass near the northern end. Mingled with the seal grass is the species of wormwood common about the abandoned rookeries. The island is everywhere low. The coast line is for the most part precipitous. There are a number of little coves suitable for landing, the best one on the eastern side. Probably no landing could be effected on the island in any except the smoothest weather.

The island is covered with birds, which on our landing filled the air and made rain coats and sou'westers indispensable articles of wearing apparel. The birds were the ones common to the other islands, the only remarkable feature about them being their great numbers in a small space. The aris occupy the flat tops of the basaltic columns and the ledges of the cliffs. Each one stands above a single large egg resting with its larger end on the bare rock and the smaller tucked under the feathers of the

breast. As the birds took flight by the thousands, these eggs rolled about in hopeless confusion, many of them breaking, and as the season was advanced the odor of rotten eggs soon became very pronounced.

The red and black legged kittiwakes were nesting on the ledges among the arris and in good fellowship with them. On the grassy area the burgomaster gulls had their nests built of grass and seaweed. The young were hatched and hiding among the tufts of grass. Each of the deserted nests, as a rule, contained an unhatched egg which was probably bad. There seemed to be 2 and sometimes 3 young gulls to a nest. The cormorants occupied nicely built nests on rocky points. The sea parrots and chutchkis were nesting in inaccessible places among the rocks. Each of the 3 cormorant nests seen had 3 young ones. In one nest 2 of the young were so pressed upon the third that it had no opportunity to grow and was less than a third the size of its companions. A supply of food consisting of fur-seal placenta near by one of the burgomaster nests suggests the way in which the seeds of the seal grass and wormwood were transferred to Walrus Island.

Near the southern end of the island the cliff breaks down into a rocky slope. This was the old hauling ground of the walrus. Hundreds of skulls lie scattered about.

The recently dead carcasses of an adult and pup sea lion lay on a rock at the northern end. A young bachelor sea lion swam into the bight where the landing was made, but no other living animals were seen. A number of what seemed to be recently occupied fox burrows were seen in the grassy area, but no foxes.

#### JULY 13.

#### OTTER ISLAND.

I was able also to visit Otter Island with the surveying party which were landed there this morning by the *Rush*. As the vessel approached the island, though still at a considerable distance and to the leeward of the hauling ground, the bachelors roused up and ran together in a pod as if rounded up for a drive. The noise or the sight of the white vessel must have scared them. They started in a line slowly down to the rocky reef at their landing place. The pod seemed to number 1,000, as nearly as could be estimated from a distance. On landing 350 were still on the rocks, while the water offshore was full. Among those still on shore were 50 young bulls, probably 6-year olds, and about 20 5-year olds. The others ranged from this age down to yearlings, the ages and sizes corresponding to those to be found on any of the regular hauling grounds of St. Paul. Although this is a much larger showing of bachelors than was seen last year at the time of my visit, no extension of the space occupied as a hauling ground was visible. No trace of any harem of breeding seals was seen. No bulls of the rank of harem masters were present this year, whereas there were several last year.

The bachelors of Otter Island showed more timidity than those to be seen on St. Paul and at the same time more curiosity. When the surveyors approached their hauling ground to carry on their work the seals hastened into the sea, but only to reappear every few minutes above the head of the slide which forms the passageway to the flat above. When the men moved away they came up in small bands parading about, taking fright easily and rushing off every few minutes in a panic to the water.



On returning to St. Paul I visited Lukanin and Kitovi rookeries. A count of the former rookery showed 1,736 cows. The Amphitheater had 654 cows. It will not be possible to keep up the count of Lukanin, as the cows are now greatly scattered. Many new cows still gravid were seen in different harems. Cows are going to sea and returning from feeding in numbers. They receive no attention from the harem masters, though they have to run the gauntlet of the young water bulls posted along the shore. Not infrequently a cow going to sea will be followed a quarter of a mile out by a dozen of these young bulls.

## MR. LUCAS'S NOTES.

In company with Mr. Macoun I made a count of Kitovi rookery. There are in all 179 harems and 2,436 cows. These counts are undoubtedly slightly under the actual conditions owing to cows being hidden by the rocks, but as they were made under similar conditions of those last year they are available for comparison. There are few seals in the water. The number of 3 year old cows has greatly increased within a week. The count of Kitovi rookery for last year was 182 harems, 3,152 cows.

A count of the cliff portion of Tolstoi rookery gives 98 harems and 1,286 cows as against 108 harems and 1,498 cows last year.

## JULY 14.

I went this morning in a boat in company with Colonel Murray and Mr. Adams to make a count of the harems on the water front of Reef rookery and on Sivutch Rock. The count of Reef was much more satisfactory than that made last year wholly from the rear, when the harems on the bowlder beach had for the most part to be estimated. The count showed 354 harems, beginning at the northern end and continuing to the point. The remaining harems must be counted from the land.

The rookery on Sivutch Rock proves to be much larger than was supposed last year. The estimate last year was made on the very imperfect basis of a count of 27 harems with a glass from the parade ground of the Reef, afterwards corrected by a count of bulls about the middle of August. Harems exist in places where they were not supposed to exist last year, the southern shore being also occupied. The only parts not occupied as breeding grounds are the two points which are hauling grounds. A total of 102 harems were counted. The two hauling grounds must have contained from 800 to 1,000 bachelors of all ages. A number of sea lions were hauled out on the southern face of the rock.

The bachelors in the little cove on the eastern side of the neck from Zoltoi went into the water as the boat passed. A cow in charge of a young bull remained behind. Last fall a dead pup and one starving to death were found here. It was thought then that they had landed there while swimming. It may be that they were born there.

Mr. Lucas reports that he and Mr. Macoun counted Kitovi rookery and also the cliffs at Tolstoi. The former contained 179 harems with 2,436 cows; the latter, 98 harems with 1,286 cows. Last year Kitovi had 182 harems with 3,152 cows and Tolstoi 108 harems with 1,498 cows.

## ZAPADNI.

In the afternoon Mr. Lucas and I, in company with Mr. Chichester, visited Zapadni rookery. A count of harem bulls on Little Zapadni gave 176, and 67 idle bulls were counted. Mr. Chichester took the photographs on Zapadni of the regular series for the Fish Commission.

A very large proportion of the idle bulls show ugly scars, the result of recent fights. Contests are constantly going on between them and the harem bulls. Two of these bulls seemed to be engaged in a struggle to the death. One was badly cut about the neck and throat, the other over the back and sides. Both animals were dripping with blood. It is not often that blood is drawn in these wounds. The two bulls noted clinched several times while we were in sight and neither seemed inclined to give up the struggle.

Far back from the shore of Little Zapadni and with numerous idle bulls behind and the harem bulls in front was a fine-looking bull dripping wet and in charge of a harem of ten or a dozen cows. He must have succeeded very recently in ejecting the rightful owner of the harem.

A visit was made to the gully in the main part of Zapadni, which was famous last year for its dead pups. It bids fair to sustain its reputation this year. It seems to be the center of death not only to pups, but also to cows and bulls. One dead bull lay in the gully and four others were on the slopes back from it which are fringed with idle bulls, the most savage thus far encountered on any rookery. Another bull was lying helpless and ready to die. He was badly bitten about the neck.

Thirteen dead pups were counted in the gully, which in its lower part swarms with cows and pups. One pup still breathed, but was unable to rise. It must have been the victim of a recent disturbance. The pup belonging to a dead cow was trying to nurse. Two pups plainly starving to death were seen.

One large harem of over 100 cows, most of which were sleeping under the lee of a cliff, was the only harem at rest in the gully. The occupants of the other harems were in constant commotion. One whole harem decamped into the next one below; the bull only succeeded in recovering one cow by carrying her back bodily. The cows are anxious to get to the water, and are not able to do so without passing down through the whole line of harems and being obstructed by all the idle bulls in the vicinity. This is one great source of the disturbance which results so disastrously for the pups. Here, as at Tolstoi sand flat, the harems seem to show a disposition to avoid the flat bottom of the gully by overflowing on the rocky slope at the northern side. There are more harems there than on the bed of the gully.

The smaller gully, which was fixed last year by covering it with stones, is full of cows and pups. The stones are not big enough to be perfectly satisfactory, but their good effect is plainly visible in the enforced care which the bulls show in getting about. In the other gully they always go with a rush. Here they are more deliberate. Only one dead pup was seen in this gully.

A count of the cows by harems was attempted from land on Zapadni Reef, and for about two-thirds of the distance, where the harems were scattered and thin, the count could be accurately made. It had to be discontinued, however. The harems are bunched about the point at the English Bay end. It will be completed from a boat, and the detailed count of harems will then be given.

The Amphitheater has 556 cows this evening, and under the cliff at Lukanin are 19 harems which can readily be counted. They contain 306 cows. The daily count of these and the Amphitheater will be continued. The scattered condition of the harems is still more marked, though there is no unusual increase in the number of cows. There is a tendency to spread out over the entire space between the water and the foot of the cliff on Lukanin. There is also a harem at the foot of each of the

slides between the different sections of the cliff. Last year these slides were full, and the cows overflowed on the flat above.

Along the water front are a number of small harems which at high tide are submerged. The bulls hold the cows in the surf as best they can. One bull has a gravid cow on a rock at some distance out. The rock is so nearly submerged that both are half under water. What will the cow do if her pup is to be delivered at high tide?

A harem of 4 cows near by is also in the water. The bull is splashing about in the water keeping his cows from getting on dry land. One or 2 pups seem to be trying to get out to the cows. But as I watch I find that other pups are playing in the wash of the surf. One pup pushes another off the rock and then follows, both climbing out on the rocks immediately. On looking about I find other wet pups scattered about. These also have evidently been in the water. There is no attempt at swimming. They simply get into the water and out again. The sensation is evidently a pleasant one and new pups are trying it from imitation.

No pups were seen to go into the water until the 27th of July last year.

MR. LUCAS'S NOTES.

I made a count of Ardiguen this morning with Mr. Macoun. There are 33 harems and 470 cows. Last year there were 27 harems and 550 cows.

Three or 4 bulls with 2-year old cows were seen on Zapadni this afternoon. Zapadni Reef is thin and straggling. Beginning at the lower end near the hauling ground it is as follows: Thin, gap, thick, gap, small patch, wide gap with 1 or 2 cows scattered along in it, large patch at point, thin and broken to cairn 29 and thin about there also, small break, then fairly thick on innermost point including cairns 30 and 31.

JULY 15.

A count of the cows by harems was made on Lukanin rookery this morning. The harems in detail are as follows:

8	7	8	1	1	16	10	2	3	20	21	10
18	19	10	8	3	10	13	7	9	16	2	16
12	24	24	26	12	5	5	28	13	29	18	24
2	26	17	10	24	25	58	22	25	25	4	8
18	4	17	28	12	34	7	14	38	12	18	21
23	39	8	12	1	28	3	1	2	8	4	8
27	20	19	21	14	18	36	9	7	6	8	9
18	11	12	9	10	9	1	18	26	12	38	24
9	23	3	4	6	8	12	3	15	20	10	3
2	20	16	5	7	8	3	30	38	8	2	16
14	1	1	3	31	15						

Total cows .....	1,841
Total harems .....	128
Average harem .....	14.3

This count of cows on Lukanin rookery is accurate within a hundred. It is evident that the estimate of last year was slightly in excess of the actual conditions, owing to the fact that it was based on a count of harems made on the 20th computed at the size of the average harem for Kitovi. Within the past few days many changes have occurred due to the scattering of the cows, and bulls idle two days ago have now small groups of cows.

The branded cow is gone from Lukanin this morning. She was present nursing her pup on the evening of the 13th.

#### GORBATCH AND REEF.

A count of harems on Gorbatch rookery shows a total of 308. The count of harems for last year was 302. The present count is manifestly more complete than that of last season, because it is possible to reach observation points commanding parts of the rookery, which could not be reached last year when this rookery was counted on the 16th. This fact in itself is the surest indication of decrease in the rookery. Therefore, though more harems are shown in 1897, it means simply that in 1896 a portion of the rookery had to be estimated or imperfectly counted, and the result fell below the actual facts.

It was impossible last year, for example, to reach Old John's Rock or the hill to the north of it, nor could the crest of the slope be reached at any point up to where the cinder slope begins because of the presence of idle bulls. A large harem lay at the foot of Old John's Rock and several harems were on the hill. To-day the harems are far from either place, and the line of idle bulls is some distance below the crest of the slope.

At the western extremity of Gorbatch rookery a bull has a harem of 150 cows lying on a flat triangular shelf of rock which breaks off in sheer cliffs on two sides. The bull is able to control the great body of seals because of the particularly advantageous position he holds, having to guard only one side of the triangle.

The count of harems on the Reef is completed this morning. There are 49 harems in the section lying between the western end and the first bachelor runway. There are 51 bulls on the flat in the two large wedge shaped bunches of seals about the ponds. This gives a total of 454 harems for Reef rookery.

There has been a tremendous falling off in the large patches on the Reef. They fall much farther short of the crosses and are much thinner throughout. For these two masses last year 100 harems were estimated where there are only 51 to-day.

The harem between Ardignen and Reef Point is still there with four cows. There is a marked persistency in the way the seals continue to haul out in these places. At the beginning of Gorbatch there was last year a harem with a single cow on the Zoltoi side of the point. There is a single harem there this year with 2 cows.

#### ST. GEORGE ISLAND.

In the afternoon I went on board the *Rush* and was landed in the evening on St. George Island.

I visited Little East rookery in the evening in company with Mr. Duffield, who also visited St. George for the purpose of planning the work of the survey for this island. A count of cows on this rookery by harems gave the following results:

5	12	6	8	10	12	16	4	6	10	18	10
4	4	10	11	27	4	12	16	3	8	14	6
4	2	10	18	11	18	11	6	4	6	5	11
9	11	7	5	3	13	50	12	1	14	16	4
Total cows .....											487
Total harems .....											18
Average harem .....											10.1



Mr. Lucas's count of this rookery on July 9 gave 497 cows and 16 harems.

It is easy to see that this rookery was underestimated last year. The count of cows on July 9 gave only 355, whereas 1,350 pups were counted in August. Last year when Dr. Jordan and I counted this rookery we saw it only from a point midway of the rookery. Seen from the jutting cliff which marks the western end of the rookery it is entirely different. Almost a third of the harems must have been out of sight from the point where the count was made last year, and the number of seals on little east last year must have been more nearly 600 than 355. That the rookery has plainly shrunk away from the slope above the boulder beach is very evident.

#### MR. LUCAS'S NOTES.

The large mass of seals on Polovina as compared with the photograph of last year is thinner and narrower on the left, while to the right and up the center the conditions are much the same as last year. An attempt was made to count the cliff portion of the rookery, but without much success. There are 61 harems and 747 cows, which is probably an underestimate.

On Zapadni Reef a bull is seen to land and seize the nearest cow, carrying her out and swimming 75 or 100 yards with her, most of the time under water. He lands in a break in the rookery, but fails to hold the cow.

#### JULY 16.

I made a count of harems on North rookery this morning, finding a total of 214. The increase in harems over Mr. Lucas's count of the 9th is doubtless due to the formation of small harems. The scattering out of the cows already noted on St. Paul is plainly marked here. Twenty-five harems of single cows were noted. Most of these with many of the 2 and 3 harems have been formed since the 9th. The appearance of North rookery at this date is in marked contrast to what it was last year when first seen on the 8th. No diminution could be detected under the cliffs, though it may easily be present in a general thinning out. There are now no large harems like the one of 135 cows counted last year. The cows are scattered and the identity of individual harems is not clear except from the presence of the bulls. On the western end, where the harems extend up the slope, a diminution is apparent, if a shrinkage in the outer line of the band of bulls could be taken for a guide.

Zapadni rookery of St. George shows the beach portions very much broken and scattered. One only extends above the line of the boulder beach, and there are but 3 small harems on the flat. The northern portion, which was counted last year by Dr. Jordan and Professor Thompson and found to contain about 30 harems, had this year only 21. The slope portion of the rookery at the southern end is densely covered with cows. A number of harems are in the bench at the top and beyond them a great pod of pups, which must have come up from the harems below. I did not see Zapadni rookery in the season last year and can therefore give no comparative estimate. There are apparently 133 harems on the rookery to-day.

There are about 700 bachelors in the hauling ground, which runs out in the ravine at the foot of the hill.

Staraya Artel shows a very different aspect from that seen by us on July 9, 1896. The dense mass of seals is broken up and evenly distributed among the rocks. Undoubtedly a large proportion of the cows are away. A count of the harems from

the foot of the rookery gives 57 as a total, about the number found at the earlier date of July 9, in 1896. There are undoubtedly a few harems hidden from view, but it is not possible to view the rookery from the top without disturbing the pod of bachelors, some 300, which are lying at the foot of the hill.

This rookery certainly seems much thinner and more scattered than it was last year. The appearance is in part due to the difference in date.

The skeletons of 2 dead pups were found washed up on the beach at some distance below the rookery. A dead bull was washed in at the same place.

#### THE KILLING.

A drive was made from East rookery this morning, or rather it started last night at about 10 o'clock. The seals arrived at the village about 8 o'clock this morning. The weather proved very unsuitable for killing, there being no fog and not a breath of wind stirring. Captain Webster would not allow the killing to proceed, and as the weather did not improve during the day the seals were simply herded all day. About 8 o'clock in the evening, when it became cooler, he ordered the killing. Two hundred and nine seals were killed out of a total drive of about 700. One hundred skins were weighed and averaged 7.05 pounds each, practically the same grade as taken on St. Paul. The proportion of large seals turned away is much less than on St. Paul. The force of men on St. George is much smaller and the work less expeditiously done than on St. Paul. It is, however, done as skillfully and with even greater care.

A young bull almost fully grown died from exhaustion during the day while the seals were being herded, and 2 smaller ones were smothered. These were the only casualties.

Only about 1,300 seals have been taken on St. George since last August, scarcely enough to supply the natives with food. The hauling grounds are practically exhausted, and if they yield the necessary food drives for the rest of the season it will be all that can be expected from them. Mr. Judge is desirous of obtaining salted carcasses from the killing grounds of St. Paul, to preserve for winter fox food. These will probably be furnished.

Concerning the weights of the skins taken on St. George, Mr. Judge supplied the following data for the skins taken in a drive from North and Staraya Artel rookeries on July 13:

	Pounds each.		Pounds each.
59 skins.....	6	8 skins.....	10
86 skins.....	7	6 skins.....	11
70 skins.....	8	2 skins.....	12
21 skins.....	9	1 skin.....	20

By comparing these with the weights taken on July 5 on the village killing ground of St. Paul it will be seen that the grade of skins taken runs about the same for both islands.

#### MR. LUCAS'S NOTES.

The part of Morjovi about Sea Lion Neck shows a decided falling off, which is corroborated by the count. On the point south of the neck are 60 harems and 566 cows as against 81 harems and 911 cows. On the neck itself the thinning out is less conspicuous. On the south side there are 9 harems and 57 cows as against 8 with 87 cows last year. On the north side there are 15 harems with 143 cows as against 17 with 140 cows last year.

Under Hutchinson Hill the seals do not come within 75 yards of the north cross and not within 100 yards of the south cross. It is evident from the scarred appearance of the bulls that there has been much heavy fighting, more than was noted last year, and there are more torn cows.

## JULY 17.

East rookery gives the following count of cows by harems to-day:

3	5	26	6	10	8	7	5	4	18	1	35
1	13	3	14	5	40	9	8	16	17	7	6
4	3	5	3	4	6	4	18	17	18	2	8
20	18	18	9	14	22	34	10	15	17	8	12
20	8	5	6	11	17	14	12	10	18	22	14
20	6	12	10	4	1	16	8	4	7	6	9
10	14	4	18	14	3	7	15	7	32	2	4
2	16	7	8	4	4	3	1	9	12	6	9
6	12	22	18	6	10	6	2	17	8	10	18
6	5	8	1	1	2	8	10	1	20	28	10
4	8	32	8	25	20	8	22	24	12	4	4
14	26	1	6	8	3	2	1	10	12	10	4
6	9	8	10	3	11	8	10	9			

Total cows .....	1,606
Total harems .....	153
Average harem .....	10.5

The dense mass of seals so noticeable on the slope of the hill is broken up this year and the cows are scattered about among the rocks. The beach portion around the point toward Little East rookery has thinned out and the break through which the bachelors haul out has widened. That the count of this year shows more cows than that made on July 9 last year is in part explained by the fact that the latter count did not extend beyond the hauling ground near the western end of the rookery. This area this year (and probably last) contained 10 harems numbering something like 100 cows. Last year the count was begun at Sea Lion Point. It is evident, also, that since the 9th, when Mr. Lucas found 128 harems and 1,533 cows, this rookery has increased both in harems and cows, showing that it had not at that date reached its breeding height.

A large number of sea lions were on the point. They were mingled cows, bulls, and bachelors. One pup was among the number.

Both hauling grounds of East rookery were occupied, apparently by the seals turned back at the drive of yesterday.

The trail over which the drives are made from east rookery to the village is distinctly marked from the mixed vegetation of the rest of the valley by the fact that it is covered exclusively with "seal grass."

## ST. PAUL.

At 12 o'clock we went on board the *Rush* and were transferred to St. Paul Island. In the evening Kitovi and Lukanin rookeries were visited. The Amphitheater contained 698 cows, and 19 harems selected for daily count on Lukanin contained 338 cows. It is very evident everywhere that the pups are in excess of the cows. At the same time gravid cows are present and a considerable number of 2-year-olds.

Mr. Adams reports the following counts for the amphitheater: July 14, 556; July 15, 703; July 16, 678. For the same dates the totals for the 19 harems on Lukanin were as follows: 327, 325, 338.

MR. LUCAS'S NOTES.

Harem No. 25, on Gorbateh, has to-day 34 cows and 34 pups, 2 recently born, as shown by placentas. The harem next below has 12 cows and 10 pups. A recount of Ardignen gives 33 harems and 462 cows, including 1 dead one. At this time last year there were many cows and pups on the flat above the slide. There are none there now.

There are no cows on top of Lukanin at photo station 12, where there were cows last year. This lack of cows at positively known points, and the ability to approach with ease places that could not be visited last year except with great difficulty, shows conclusively the general shrinkage of the rookeries.

JULY 18.

Mr. Lucas and I went in a boat to Tolstoi and Zapadni Reef. A count of harems for the main part of Tolstoi gave a total of 295 harems. The count was made from a boat offshore, and is fairly accurate. Seen from the water, the population of Tolstoi sand flat loses its compact and dense form. It is intersected by numerous vacant spaces, on which are no cows, but which are black with pups. One large harem is isolated in the western end of the flat. The harems are climbing the slope at the very end. The middle portion of the slope is wholly devoid of cows. The boulder beach is thickly lined with harems. At the eastern end the wedge of cows extends up to the foot of the slope and harems are scattered along in a band to the top. The usual commotion and excitement are visible. The bulls are fighting and rushing about recklessly among and over the cows and pups.

The count of cows on Zapadni Reef, which was begun but not completed on the 14th, was finished from the boat to-day. The completed count for this breeding ground gave 1,049 cows in 114 harems. This shows a singularly great decrease. It will remain for the count of live pups to show whether this is due to some peculiar condition at this time or whether in reality the number of cows has so largely decreased. The count of last year gave 176 harems and 2,256 cows. The count of this year is certainly very accurate for the conditions prevailing to-day and on the 14th.

In the evening Lukanin and Kitovi were visited. There are 566 cows in the Amphitheater and in the 19 harems chosen for daily count on Lukanin there are 228 cows. For these 19 harems 416 pups can be counted, and they must with very few exceptions belong to the harems counted.

JULY 19.

I made a visit to the Reef and Gorbateh rookeries this morning in company with Mr. Lucas. Gorbateh everywhere on the rocky slope falls short of the conditions last year. No harems are on the hill and the harems do not reach within 100 feet of Old Johns Rock. There is also a marked thinning out on the point where the hair seals haul out. The conditions at the present time on the rocky slope do not compare with those of this time last year any more than did the conditions of the 15th instant with those of the same date last year.

The large harem of 150 cows noted on the 15th instant is now broken into two,



and several small harems are located in the rear, plainly stolen from the large one. The original bull, however, has still between 90 and 100 cows.

The two harems noted in 1895 by Mr. Townsend as located just beyond the break at the end of Gorbach are now represented by a single harem, but at some distance beyond there is another harem with 2 cows. They were not looked for last year, but were doubtless present. This persistence in maintaining even isolated single harems has already been noted.

It is on Ardignen that the shrinkage of seals is most noticeable. There is to-day a single cow on the surface above the mouth of the slide, and a large harem is wanting in the slide itself. On the 14th of July last year there were 3 harems of 7, 24, and 42 cows, respectively, on this flat. The bulls are in their places, but the cows are wanting. The slide itself in the lower part is still occupied much as it was last season.

#### REEF.

The patch under the point of Reef rookery falls farther short of the cross of 1895, but what is more noticeable still is its thinness. It is possible to get down to the two piles of rocks which furnish observation between the rookery itself and the hauling ground in the rear. It was impossible to reach these points last year because of the idle bulls. It is not that the idle bulls are absent this year, but they lie below the rock piles, the harems having shrunk away to the edge of the bowlder beach everywhere except in the two large wedge-shaped masses about the ponds. The dried bed of the larger pond is covered to-day with idle bulls. The two great masses which could not be counted even by harems last year can now be easily counted from the rocks in the rear, and for the 100 harems each—estimated for these last year—there are only 50 harems all told above the bowlder beach. The number on the sand can not exceed this. The masses bid fair to reach nearly the same points as last year, but they are very thin, and the cows are scattered. There is none of the dense massing to be seen last year at this time. We can stand to-day where the little 2-year-old cow was shot last year without disturbing any harems at all. This was the terminal point of the breeding mass last year.

Although the Reef was driven from this morning there are now a large number of bachelors hauled out. Most of these are seals returned from the killing, which has been going on since 6 o'clock this morning. It is now nearly noon. Some of the seals, chiefly young 5-year-olds, are dry enough to have been out of the water for a week. They have doubtless drawn back from the region of the pond where they could not be reached in the morning by the drivers.

At the killing this morning from the Reef, Lukanin, and Zoltoi 988 seals were killed: 377 large and 1,174 small seals were turned back. One hundred skins weighed on an average 7.05 pounds each. One 7-year-old bull and 2 bachelors were overcome in one of the pods and died. The weather this season has been very unfavorable, as a rule, for sealing. At each drive one or two seals have fallen by the wayside. The wonder is that the number has not been larger.

The weight of the young bull which died this morning was found to be 419 pounds. He was in good condition, belonging to that class of young bulls which seem, like the bachelors, to go to sea and return, probably feeding more or less regularly.

The skin of the bull was taken for a museum specimen.

## LUKANIN AND KITOVI.

Lukanin and Kitovi rookeries were visited in the evening. The 19 typical harems under the cliffs of the former contain to-day 290 cows. Two dead cows are lying at the foot of the cliffs, and there are 17 dead pups. These are on the ground most closely watched, and yet none of the deaths have been observed. One of the dead cows has died since the morning of the 15th, when the count of cows was made on this rookery.

The Amphitheater of Kitovi has 556 cows this evening in 46 harems. This was the original number of bulls in the space. There are, however, now about 10 unoccupied bulls. Some of these are the old stagers present since the first. A number of the harems have been formed near the beach by younger bulls, which have established themselves since the season started. The harems are climbing back or "spreading," so that they occupy much more space, though there are fewer cows.

On Lukanin is seen a feature which did not appear last year, namely, the establishment of harems at low tide, which, when the tide becomes high, are partially submerged, sometimes wholly so, in water. There are 5 of these to-night under the cliffs. The wet shivering pups are on the rocks calling their mothers, which are held by the bulls in the water.

This has evidently attracted pups to the water earlier this year. There are wet pups by the dozen, and in two places they are playing in the water. Occasionally a pup gets out a little distance, but for the most part they take a dip and then sit scratching themselves on the rocks.

## MR. LUCAS'S NOTES.

Harem No. 25 has now 31 cows. In this and 2 adjoining harems there are 60 pups. The total number of cows present at any one time has been 50.

There are no cows on the hill to the north of Old John's Rock, where there were harems last year. Reef Rookery shows everywhere shrinkage from the points last year. The largest mass near the big pond is very thin and has a break in it. The seals fall far short of the crosses on the Reef at every point.

## JULY 20.

Mr. Lucas and I went this morning to make a count of the harems in Zapadni rookery. By dint of much stone throwing and clubbing we were able to reach points of observation from which a fairly accurate count of the harems could be made. The total number of harems found was 458. This large falling off is in part due in all probability to greater accuracy in counting the harems on the flat above the beach. The count in this respect for last year was unsatisfactory, as near approach was cut off by the idle bulls.

The greater part of the decrease in number of harems is, however, plainly due to shrinkage in the rookery. Where the harems were noted as falling away from Mr. Townsend's crosses 100 to 200 feet last year, they this year fall away 100 to 200 yards. In most cases there is only a slight thickening of the narrow line of harems at the top of the boulder beach to indicate the masses of seals which extended back to the crosses. There are but 4 masses of seals of any considerable size above the line of the beach. The most important of these are the 2 gullies, characterized last year as "death traps."

There is no scarcity of idle bulls at Zapadni and there are even more than last year, but they have moved down to fill the breeding space vacated by harems. Their places of last year are in turn filled with younger bulls. The intermediate hauling grounds of the rookery are full of a still younger class of bulls, which in a year or two will still further augment the idle bull class. Scarcely a killable seal was to be seen among them; such as were on the hauling grounds of the rookery occupy the extreme point just south of Southwest Bay.

On the rocky reef which extends out from the foot of the cliff at Zapadni Head were 400 or 500 seals, representing all classes of bulls and bachelors. This hauling ground, which can not be driven from, must be added to those tending to furnish bulls for the breeding grounds, whether special provision be made for them or not.

Between this reef and the beginning of the rookery at some distance to the east is a group of 3 harems in an isolated position. Their presence last year was noted by Dr. Jordan.

A dead seal lies among the bachelors on the reef. A dead cow is in the first bunch of harems. Three dead cows, 2 dead bulls, and 35 dead pups are in the largest gully. Two of the cows, 1 bull, and 22 pups have been added since the afternoon of the 14th, when this place was last visited. Five other dead bulls lie on the slopes about.

#### ZAPADNI GULLY.

This gully bids fair to maintain its reputation as a "death trap." We are able to approach it sufficiently near to get a good view and watch it for an hour. Everything is in confusion. The bulls are continually fighting, and in their mad rushes pups are knocked about and trampled upon. None are seen to be actually killed, though that fresh victims are constantly being added is shown by the fact that since the 14th the number has increased from 13 to 35. Many cases of cow stealing were witnessed. In two instances cows were almost torn asunder, 2 bulls having hold of each at once.

The greatest trouble occurred at the sand flat where the gully connects with the beach. Only half of this space was occupied by harems, which were crowded in a dense mass. The other half was covered with idle bulls, which were constantly making inroads upon the harems. When a cow was stolen all the bulls were at once in an uproar and began fighting.

A large bull, blind in one eye, has the largest harem in the gully and easily holds his own with his neighbors. At the second gully an idle bull, likewise blind in one eye, is the most troublesome of all to get around. This gully shows none of the confusion and turmoil of the other. It was filled with rounded bowlders, brought up from the beach by the natives, last fall. They are not as big as they should be, but they stop the mad rush of the bull, and the pups lie curled up beside them. In the other gully the bull moves with astonishing swiftness and always in a direct line. In this one he must dodge the stones and there is time for the pup to get away. Considering how easy it would be with dynamite to blow up the whole surface of this gully and all other dangerous pieces of rookery ground, it will be a piece of criminal negligence if this is not done.

The condition of this rookery, as well as others, shows the urgent necessity for reduction of the present force of idle bulls, and steps should be taken to see that the number of bulls is limited to the needs of the herd. It is safe to say that if only

the harem bulls were in and about the gully of Zapadni there would be practically no fighting. If the flat surfaces were broken up or filled with stones, this breeding area would become as safe as that of Kitovi, for example.

On the edge of the second gully is a branded cow, in all probability the second of the 2 branded last year on Lukanin. She is alone in charge of a bull. All along the rear of Zapadni are these small harems of 1 and 2 cows, plainly the advance guard of 2-year old cows. They have no pups and are restless.

There is nothing in the condition of the harems to warrant the supposition that the 3-year-old cows are the cause of the "height of the season" on the rookeries. It is evident also that the 2-year-olds are already present in considerable numbers. It seems more likely that the advent of these classes of seals is dependent upon their ages, the earlier coming in heat earlier as 2-year-olds, and bearing their pups earlier as 3-year-olds. In like manner the later-born pups come in heat and bear later in the season.

While coming along the sands of English Bay this morning we found a starving pup traveling toward the end of Zapadni Reef. It was fully half a mile from this rookery and more than that distance from Tolstoi, to one or the other of which rookeries it must have belonged. This instinct for wandering is plainly the cause of instances of starvation, or else starvation is the cause of the wandering. A similar instance of wandering has already been noted on the Reef.

Mr. Adams reports but few cows on the Amphitheater and in the typical harems. The rain is probably the cause. But few cows were seen to land and many took to water. Two bulls in the Amphitheater are without cows but are surrounded with pups. In a little ravine which has had 3 harems are to-day only 2. Thirteen cows were seen to take to the water in a body. Many seals are in the water offshore; more than has been noticed at any time this season prior to this time. So far there has been a noticeable absence of swimming seals along the rookery fronts.

A count of harems on Lukanin was made to-day. There were 139. This is the date on which 147 were counted last season. On the 15th this rookery contained 128 harems, showing an increase in families, though the population of cows has diminished considerably.

#### JULY 21.

I went to Northeast Point with Mr. Lucas and Mr. Adams to make a count of the harems after the drive. On account of the rain, however, no drive was made, and the count had to be postponed. Mr. Lucas and Mr. Adams returned to the village.

Mr. Adams reports an increase of cows to-day on the Amphitheater, there being in all 528 as against 429 yesterday. The rain was plainly the cause of their absence yesterday. In the typical harems under Lukanin cliff 215 were present to-day; 114 yesterday.

#### JULY 22.

##### NORTHEAST POINT.

The drive of last night brought in a large number of seals, and killing was begun at 5 o'clock. This season, instead of making separate drives on succeeding days from



the two sides of the peninsula, all the hauling grounds are brought up in one drive. The lessened number of bachelors makes this possible.

The absence of bachelors to be disturbed made it possible to count the harems on the Northeast Point rookeries with reasonable accuracy. The only place where estimates were made was along the shore line of the mass under Hutchinson Hill and the other mass to the south near the western end of the rookery. Less than 100 harems were so estimated.

The first section of Morjovi, just opposite Webster House, has 67 harems now. Last year there were 87 harems. On Sea Lion Neck there are 24 harems to-day where 25 were counted last year on the 16th. All the harems are small, many having only 1 cow. These have plainly been formed since the harems have begun to scatter.

For the remaining part of the rookeries comparisons can not be instituted, but for Morjovi there are a total of 233 harems and for Vostochni of 910.

The mass of harems under Hutchinson Hill is no longer a wonderful one. From the irregular but compact form of a week ago, as seen by Mr. Morton, it has now spread out thinly over the whole space above the beach. But on this flat are only 92 harems. This portion of the rookery is really smaller than either the mass beside Walrus Bight or that near the western end of the rookery.

#### THE COUNTING.

By going down in the empty bachelor runways it was possible to see the beach portions of the rookery. In the great continuous patch extending from the foot of Hutchinson Hill nearly a mile to the westward the presence of a great drove of idle bulls would have prevented approach, but it was found that by starting up a drove of young bulls and keeping them moving along the rear the idle bulls gave ground and gradually became absorbed with them, so that the edge of the beach could be reached at every point.

Ten dead bulls were counted in the rear of the harems on the 2 rookeries. They were not on ground occupied by harems, but in the region of idle bulls, showing the fierce fighting that has taken place among them. Last season the bulls found dead were among the harems or on the water front, for the most part. There were 3 dead cows on the flat below Hutchinson Hill. Numerous dead pups were seen. One pup had a suppurating eye. Two bulls were seen in a dying condition. Two were so injured in the front flippers that they could scarcely walk. Almost every bull in sight was seamed with scars. Occasionally, in the disturbances created during the count, fights would be started between bulls, which soon appeared to lose their senses and continued to fight until lost sight of. The scarred condition of the bulls is a noticeable feature of this year, due without doubt to the diminished number of cows and sharper rivalry among the unoccupied bulls. Some of the bulls nearest the harems are so much more savage than the idle bulls, as a class, that it seems likely they had harems last year and are furious because they can not get any this year. In the drives are many old bulls and many young ones fully grown. Some of these are scarred, showing that they had attempted to secure places on the rookeries. A large number of the smaller bachelors have shown fresh cuts, in all likelihood made by bites from these bulls while on the drives.

## SEA-LION ROOKERIES.

There are 3 sea lion rookeries on Northeast Point. The third I did not see last year. The largest one is on Sea Lion Neck. I counted 50 pups which had not taken to the water, and seemingly did not like to go. Many of the larger ones were swimming with their mothers. I counted 27 dead pups which had apparently been trampled.<sup>1</sup> One was freshly dead, and its skin was taken for a museum specimen.

The sea lion rookery on the point is the smallest. At the one midway between the point and Hutchinson Hill 47 pups were counted in the water. Only 1 or 2 dead pups were seen in these last 2 rookeries, though they were not as closely inspected as the one on Sea Lion Neck.

Along the beach portion of the rookeries of Northeast Point the harems were in many places very much scattered, and many were small. The single harems were numerous. In a number of cases pups only remained with the bulls, the cows having disappeared.

At the killing this morning 1,322 skins were taken; 500 large and 2,047 small seals were turned back.

Mr. Adams reports 46 cows in 50 harems on the Amphitheater. There are 5 idle bulls. There were 219 cows in the 19 typical harems under Lukaniin cliffs. It is plain that there is a steady diminution of the cows.

## MR. LUCAS'S NOTES.

A recount of the cliffs of Tolstoi gives 113 harems and 834 cows. The increase in number of harems is due to the entrance of new bulls who force themselves in and establish small, often temporary harems. On July 13 the majority of harems contained over 10 cows each; on July 22 the majority contained less than 10. At the earlier date there were 21 harems with 5 cows or under; to-day there are 41 harems with 5 cows or under. The massed portion of Tolstoi is to-day very sparsely occupied; at the same time there are very few animals in the water. This absence of the swimming seals is one of the noteworthy evidences of shrinkage.

The white cow on Tolstoi head is present to-day near the place she occupied last season.

## JULY 23.

## POLOVINA.

A force of men was left at Halfway Point last night to make a drive this morning from Polovina rookery. Two hundred and seventy-four skins only were obtained out of the drive; 161 large and 698 small ones were turned away. One hundred skins weighed in the salt house averaged 8.5 pounds each. The killing was made at the salt house at Stony Point.

Mr. Lucas and I went up to Polovina and made a count of the harems on the main part of the rookery and on Little Polovina. A correct count of the main rookery was not secured last year. The estimate given for it was slightly high, but still not far out of the way. There are 139 harems this year where 138 were estimated last year. The rookery is, however, plainly much reduced. Only a

<sup>1</sup>They may have died of *Uncinaria*. This rookery in part occupies a sandy bed.

narrow fringe of harems occupy the slope back of the boulder beach. In the hollow depression near the eastern end of the rookery the cows fall 100 feet short of the limit of last year at this date.

One peculiar thing about this rookery is the presence of a large number of harems, some of them large, out on the reef which projects from the point. No harems were here last year, and probably for the reason that the high surf prevented their forming there. When even a moderate surf is running the water sweeps over the reef. There has been no surf whatever to speak of on the east side of the island this season. This doubtless accounts for the harems here, as well as at Lukanin, where a number are awash at high tide. The "oldest inhabitants" have not known such a season on the islands. Here, as on Lukanin, numerous pups were playing in the tide pools of the reef.

The cliff portion of Polovina is very much scattered and broken. In two places the harems extend out on the flat. They are represented chiefly by pups now, the cows having gone.

At the eastern end of Polovina by the sand beach there were several harems from which all the cows were gone, only the pups remaining. The bulls were in the water, but upon our approach they went back to defend the places where their harems were located.

A case of copulation was taking place in the water—shallow water. A dead bull lay among the rocks at the foot of the slope and several dead pups. The number of dead pups is very much smaller than that seen at this time last year.

Little Polovina has 39 harems. Most of the idle bulls which so thickly surrounded this little rookery are gone and it is possible to closely inspect it. Here, as well as at Polovina proper, the harem system has entirely broken up. The cows shift from harem to harem and are going off to sea in large numbers. They take fright at our presence and the bulls have no control over them. The scattered condition noted in the rookeries after the 15th has grown more and more pronounced ever since.

Mr. Adams's count of cows for the Amphitheater is 469; for the 19 typical harems, 212.

#### JULY 24.

A drive was made this morning from Lukanin and Reef. The seals killed numbered 526; 352 large and 1,380 small were turned back.

The seals from Lukanin, which were as usual small ones, were handled at the salt house by the Lagoon. Their bodies were salted to be taken to St. George to serve as fox food. The killings on that island have furnished but little more than the necessary meat for food for the natives, and it is proposed to take over 1,000 carcasses from St. Paul.

This drive from Reef and Lukanin is just one day earlier than one last season which yielded 1,630 skins and turned back 1,008 too large and 1,177 too small. In the drive of last year a small pod of seals was included from Kitovi. It may be noted that no bachelors have been driven from this hauling ground this season, and not over a dozen, mostly half bulls, have hauled out there.

## MR. LUCAS'S NOTES.

I secure and dissect a dead pup on Lukanin rookery, finding it to be a clear case of death from *Uncinaria*. (The results of dissections of dead pups from day to day will be given under Mr. Lucas's discussion of "Causes of mortality.")

## MR. GREELEY'S NOTE ON NORTH ROOKERY.

Cow died July 22, from unknown cause. Contained a fetus four or five months along. She has probably had one pup, as she was in milk. It was probably a case of superfetation.

## JULY 25.

Mr. Lucas and I went to Lukanin rookery to get dead pups. We were not very successful. The bulls and even the cows stand their ground very determinedly. Two pups were secured, one of which, however, was too much decomposed for dissection.

One pup picked up supposed to be dead was simply a prisoner attached by an unusually strong umbilical cord to the placenta. There are a large number of dead pups under the cliffs, which have been watched so constantly. Notwithstanding the close watch, no deaths have been seen to result from trampling. One of the dead pups is lying under the shelter of an overhanging rock—a position in which it could not possibly have been trampled. A pod of pups lay about this rock for some time. They have now moved back.

Messrs. Farmer and Warren arrived this evening on the *Rush*, reporting that Dr. Jordan and the rest of the party will reach St. Paul on the 28th. The others have stopped for a few days at St. George.

A count of the live pups on Little East rookery of St. George was made to-day by Dr. Jordan and 1,190 found. For these pups only 239 cows were present.

## JULY 26.

## MR. ADAMS'S NOTES.

There were 463 cows on the Amphitheater in 53 harems. At the water's edge under the cliffs of Lukanin a cow with her right eye torn out was seen. The wound was fresh.

One case of copulation was witnessed on Lukanin. Among the typical harems which have been counted daily is a new one formed since yesterday by a young gray bull. It has 2 cows, one of which has not yet had her pup.

Four dead pups are lying in a group under the cliff at the southern side of the Amphitheater. A number of small seals, presumably yearlings, are playing with the pups at the water's edge.

A drive was made this morning from Zapadni and 511 killed; 491 large and 800 small seals were turned back from the drive. One hundred skins averaged 8.23 pounds each.

## NOTED BY DR. JORDAN ON NORTH ROOKERY, ST. GEORGE.

A small 2-year-old cow was seen among a pod of pups receiving no attention from any bull. Pups are playing in little pools of water. Four fresh placenta were seen, and 1 pup dragging a placenta.



JULY 27.

The drive this morning from Tolstoi, Middle Hill, and English Bay furnished 199 skins: 221 seals too large for killing and 515 too small were turned away. The carcasses were salted to be taken to St. George. The killing was made on the flat beside the Lagoon channel instead of at the usual killing ground at Ice House Lake to leave the bodies convenient to the salt house.

In the afternoon I walked to the Reef with Messrs. Farmer and Warren. The shortage on Gorbateh rookery is plain in the neighborhood of Old John's Rock. The harems do not come within 50 feet of the rock even at this date, while they were at its base in the height of the season last year. On the hill to the right no harems whatever have appeared where there were several last year. The little depression which was photographed last year and contained 17 dead pups has only now begun to be occupied by cows and pups which have moved up from the rocks below. One dead pup only lies in the flat.

The idle bulls on the einder slope yield readily. There have not been many at any time and there are fewer now than ever. A few bachelors are scattered at intervals over the upper part of the slope, just as they were in greater numbers somewhat later last season.

There is 1 harem of 4 cows on the flat above the mouth of the slide on Ardiguen. There were no pups and the cows seem to have worked up from harems below. None were gravid. Besides the absence of cows from the flat, the upper part of the slide itself is very thinly populated.

A starved pup was found back of the harems on the Reef. It was dissected by Mr. Lucas and found to have been bitten severely on the head, this being the immediate cause of death. The pup was very thin and evidently starving.

Three other pups were taken from the rear of the Reef rookery toward the northern end. All 3 had *Uncinaria* and in 2 cases this was the cause of death. One of the 3 was crushed. The bitten starved pup first examined had no parasites.

Two bachelors were found on Reef drive which had died from exhaustion on the way and had not been discovered in the darkness. They were ordered skinned for specimens, having been dead since the morning of the 26th and not of any value to the company.

## DR. JORDAN'S NOTES.

The number of 4, 5, and 6 (especially 5) year old bulls on Staraya Artel of St. George is very large. They represent the effect of the *modus vivendi*. Killable seals are scarce. There are many idle bulls on this rookery, but few on East, where, however, the half bulls are numerous.

Firing a gun near the seals startles some a little. They raise their heads, but that is all. None stampede.

On Little East rookery 2 starving pups are found which have been carried away by the bachelors. No starving pups are seen and only 4 dead ones. There are about 56 bulls on the rookery, 12 of them without cows. A very close count of the live pups gives 1,190. The count was duplicated with a difference of only 1.

It is reported that three killers were seen off St. George on the 25th. They were probably the cause of the injury to the cow which was seen badly torn. One sea lion was seen last year with a flipper bitten off by the killers.

JULY 28.

I accompanied Mr. Lucas to Tolstoi rookery to get dead pups. Two were secured. One had *Uncinaria*, which was evidently the cause of death. The second had a few worms, but evidently died of starvation. The pup which had died from the *Uncinaria* had practically no blood and the flesh had a peculiar whitish color.

A sickly pup was taken and killed. It looked sleepy. The eyes were dull. It had no fight in it and allowed itself to be handled without protest, something very unusual even with a pup dying of starvation. Scarcely a spoonful of blood flowed from the heart when it was stuck. The flesh was of the same color as the other pup. It was found to have *Uncinaria* in the median portion of the small intestine. The pup was fat, but was evidently dying from the attacks of the parasite.

Looking about over the point of Tolstoi sand flat a large number of similar pups were to be seen. Yesterday on Reef rookery a pup which looked thin and had no ambition, allowing itself to be petted, belonged to this same category.

During the afternoon Dr. Jordan, Dr. Wood, and Messrs. Snodgrass, Greeley, Kincaid, and Edwards arrived on the *Rush*.

## DR. JORDAN'S NOTES ON ST. GEORGE.

The day is a most beautiful one, almost clear and perfectly dry. I walked to Zapadni. On this rookery not one of Townsend's crosses have been approached within two rods. The small plateau above the beach is now wholly abandoned.

Orcas were again seen about the island.

A 3-year-old seal was found with a broken fore flipper, another was partly paralyzed in the back. Two other bachelors were found that seemed to have been injured in the lumbar region. They walk in a one-sided fashion, but swim all right in the water.

The paralyzed 3 year-old was killed. It was found to have received a severe blow on the shoulders. The whole region was congested. The animal was very lean and would have died.

Peter Rezanof, a native of St. George, thinks that the rookeries are all right, since the old bulls come back. This serves as a gauge to the value of the judgment of natives in these matters.

## ST. PAUL.

I visited Ardiguen this afternoon immediately on my arrival at St. Paul. Harem A is wanting, bull as well as cows. A half bull alone lies in B's place and a young grown bull is in C's place without cows. There are no cows whatever above the mouth of the slide.

A bull is in D's position without cows. E has two or three cows. There is a marked contrast here over last year. Then harems A, B, and C, with an aggregate of 78 cows and 135 pups, were on the flat or in the edge of the slide. It is reported by Mr. Clark that this rookery has at no time extended above the ravine except for 4 cows which apparently hauled out only temporarily, and it is only of late that the upper part of the ravine has had any cows.

JULY 29.

## TOLSTOI SAND FLAT.

I accompanied Dr. Jordan to Tolstoi. The sand flat is very much thinner than usual. It is dotted here and there in the vacant spaces with dead pups. One can easily see that the space when cleared will show a mortality proportionate to that of last year. Many pups are lying outside of the portion occupied by harems showing that they have either been trampled after wandering away, or else that they have crawled out of the mass to die.

A portion of the wedge of harems extending along the boulder beach toward the sand beach was cleared off. The rocks are full of dead pups. Ten were taken out in a condition fit to be examined and left for Mr. Lucas to dissect. Two pups in a sick condition were killed for dissection also. They showed the presence of worms.

In passing along the sands of English Bay toward Zapadni Reef, the seals on Middle Hill roused up and stampeded toward the water. We were not on the windward side and no apparent cause of their alarm existed, unless they took fright at the movement of the seals near the water or at ourselves. They were at least an eighth of a mile from us.

At Zapadni Reef we found a few dead pups among the pods. The cows take to the water readily now, but the bulls hold their ground. The pups are not swimming to any extent, and it seems likely that a count of live pups can be made as well now as later. The bulls will give some trouble, but they will serve to keep the pups separate. If this calm weather keeps up after the pups learn to swim it will be impossible to count them.

Returning, we followed the course of the recent drive from this place. At the foot of one of the sand dunes a dead bachelor was found which had evidently fallen from above. The skin was still fit for museum purposes and so it was taken off. On climbing to the top of the hill a trail was found where the seal had apparently been dragged to the edge of the hill and thrown off. Following back over the drive 7 carcasses of seals which had died on the drive and had been skinned were found. This drive, which was brought in to the side of the lagoon, was a long and hard one. At one place near Lukanin the seals were forced to climb the steep side of a sand dune, which must have been worse on them than half a mile of straight going. It would seem that this might have been avoided. The drive from this hauling ground to the lagoon head is too long. It is an unusual drive, made at this time to obtain carcasses to send to St. George.

## LUKANIN AND KITOVI.

In the afternoon we went to Lukanin and Kitovi rookeries. In the rear of these rookeries were practically no idle bulls. It is noticeable that a number of new bulls are located among the cows. There can be little doubt that many of the regular harem masters have gone to sea and that the idle and young bulls are taking their places. Under Lukanin the cows were very few in number. The pups are growing conspicuous and are scattered everywhere. A feature worthy of notice on Lukanin is the fact that no harems whatever have entered the slides which make breaks in the cliff. Last year these were full of cows and pups, which hauled back on the flat above at this time.

The pups are in the water by hundreds along the front of these rookeries. None are seen to do much in the way of swimming, but they paddle about and occasionally one gets out where the water is deep. Wet pups are to be seen wherever pups are, even to the outermost line of them.

One case of copulation was witnessed, and several fresh placentæ are to be seen.

DR. JORDAN'S NOTES.

The northeast corner of Tolstoi rookery does not reach within 5 rods of either of the 2 crosses which Townsend marked in 1895. A much greater extent of the sand flat is bare.

*Uncinaria* seems to be the cause of many deaths, especially on crowded rookery spaces, as on Tolstoi. The eggs of the parasite must be held in the sand and taken into the mouth of the pup from the fur of its companions, or perhaps while nursing.

The pups on Tolstoi sand flat are certainly much less vigorous than on rocky rookeries. Those dead are not emaciated. The eyes of the sick pups are dull: the skin of the belly is flabby.

A pup growing gray and evidently starving was killed. It had a few *Uncinaria*. On English Bay the pups are apparently much more healthy.

A young seal with 1 broken flipper hastens into the water on 3 flippers. He swims off, using his 2 hind flippers, striking out with both together. Seals usually put their hind flippers together and use them as a sort of rudder.

A cow on Zapadni Reef has a big patch of skin off the shoulder, doubtless due to the bite of a bull. There are many torn cows this year, and nearly every bull is seamed with scars and bites.

On Kitovi there is a whitish bull with a harem which looks very much like our white friend of last season on Gorbateh. In several large pods of pups on Kitovi no sick ones are to be seen. One female has a piece 6 by 8 inches torn from her shoulder and the flap skin hangs down.

JULY 30.

We all went this morning to Zapadni rookery, landing at Southwest Bay. Six bulls were driven up from beyond the end of Little Zapadni rookery and shot for dissection, their skins being saved for museum purposes. These bulls were idle, and at a distance from the harems. Some were scarred and torn, showing that they had at some time during the season sought places on the rookeries.

SOUTHWEST POINT.

I walked to Southwest Point to examine the old hauling ground there. At a point about halfway between the watch house and the point there was a group of about 30 old bulls hauled out. At the point itself were 60 bulls of all classes, from those old and brown enough to have been harem masters down to young half bulls. There were no bachelors hauled out, though a number were seen swimming about in the water. They apparently came from the direction of Northeast Point.

On a rock just below Southwest Point were about 75 to 100 hair seals. They sighted us at very long range and went into the water, swimming about, watching us curiously.

The bulls on Southwest Point were not hauled out on what was evidently the regular hauling ground, but lay on the sand in a little cove.



## LIVE PUPS ON ZAPADNI REEF.

Mr. Macoun came over during the afternoon and a joint count was made with him of live pups on Zapadni Reef. The total number of live pups found was 2,971. When this place was counted on the 14th of the month only 1,049 cows were found on it. At the same time last year 2,256 cows were counted. The total number of pups found on this rookery last year was 3,862. This would indicate a falling off of something like 20 per cent.

The count is as accurate as can be made at any time during the season. It will vary by less than 50 from the actual facts. A number of dead pups were counted, but the count of both classes could not be accurately made at the same time.

Two dead bulls and 1 dead cow were seen on the rookery. The cow and 1 bull were not long dead, but were still in a condition unfit for handling. The warm weather causes decomposition to set in very quickly.

A number of dead pups were dissected by Mr. Lucas, who will give the results under his discussion of "Causes of mortality."

On the flat at the junction of Little Zapadni with Zapadni Reef was a pod of young bachelors, but practically no killable seals among them. This hauling ground, like Lukauin, is noted for its proportion of small bachelors.

## DR. JORDAN'S NOTES.

On Zapadni rookery the seals at all points fall hundreds of feet short of Townsend's crosses of 1895. The idle bulls are more numerous and fiercer than ever before. There is constant fighting in Zapadni gully, which is also a bad place from *Uncinaria*. Many sick and weak pups are to be seen. These are dying of the worm, but may be killed by trampling in the meantime. They have not the energy and strength to keep out of the way of the bulls. Old bulls which have evidently had harems in years past are now without cows and are intensely fierce.

One case of copulation was seen. A few 2-year-olds are to be seen in harems in the rear, but the number does not seem so large as last year.

## DEAD PUPS.

A large male pup was found dead alone on the rocks near the hauling ground. The body was fresh. Death was not due to trampling. The intestines were full of knots of *Uncinaria*. The liver was dark and mottled; the lungs normal, crepitating the skin of the belly flabby. On the head were gray hairs. There was little blood; the stomach was empty and its walls contained worms.

Near by was a female pup plainly dead from starvation. The liver was black, the flesh livid, the body wasted, the intestines full of bile, their walls shrunk. There was plenty of bad blood. No worms were present.

A male pup was found drowned on the beach of Zapadni. It was fat and in a healthy condition. No worms were present. There was but little bile in the intestines. The small intestine measured 33 feet in length.

*Uncinaria* is the cause of death in many pups. The weak and sickly pups visible on the rookeries are due to the worms. They are not seen in starved pups nor in strong, healthy pups, only in weak, sluggish pups, with flabby bellies, dull eyes, and thin backs. These weak pups die of trampling when a strong pup would resist the

pressure or get out of the way. They are wholly unlike starved pups, for before a pup can become emaciated these worms will cause it to die from lack of blood.

The places that favor massing of cows and fighting of bulls also promote the propagation of the worms. On rocky rookeries, where pups are not massed and no sand is present for worm eggs to collect in, no sickly pups and few trampled ones are to be found. Many sickly pups are to be seen on Zapadni; none are on Little Zapadni, few are on Kitovi, and almost none on Zapadni Reef.

The early dead pups from which the hair is now worn off are probably all trampled. The victims of *Uncinaria* die from July 15 to August 15. By the latter date pups affected by the worm recover or succumb. Only two dead pups not starved were found after August 14 last season.

#### MR. LUCAS'S NOTES.

Three of the 6 bulls killed at Little Zapadni to-day were examined carefully for parasites. Nematodes were found in one stomach. No tapeworms were present or trematodes in the liver. All viscera were in a healthy condition.

#### JULY 31.

##### LIVE PUPS ON POLOVINA.

In company with Mr. Macoun I made a count of live pups on the cliff portion of Polovina rookery. The total number was found to be 2,149. A number of dead pups were noted, but no concurrent count could be made. It is doubtful whether a full count of the dead pups is worth while this season. My impression is that the dead are about as numerous as last season on this rookery, and it will probably be sufficiently accurate to estimate the number as the same. This would give to this breeding ground a total of 2,200 pups born this season.

One case of copulation was witnessed. The bulls give much more readily than on Zapadni Reef. Many young bulls were occupying places on the breeding ground, showing that some at least of the old harem masters have left.

Some gulls were shot on the reef of Polovina Point for the purpose of determining whether they were infested with *Uncinaria*. The sound of the shotgun startled the seals for a moment. Some of the bachelors were frightened and took to the water. The cows and bulls did not take fright. In the water the seals swam about the reef in their curious fashion while the shooting was going on. The effect of the firing was the same on the seals as it would have been on a herd of sheep, pigs, or cattle under similar conditions. They roused up, were restless for a few minutes, and then settled down again.

The gulls were found not to contain *Uncinaria*. It was thought that they might get the worm from feeding on the intestines of the dead pups.

A number of dissections of dead pups was made by Mr. Lucas, assisted by Mr. Snodgrass. Dr. Jordan and Dr. Wood examined Little Polovina. *Uncinaria* were found in the dead pups on Polovina.

Mr. Adams counted the Amphitheater, finding 375 cows present. He witnessed the birth of a pup on Lukanin rookery. The cow, an old one, had landed on the 27th.

#### AUGUST 1.

I visited Lukanin rookery this afternoon in company with Dr. Jordan. We entered the rookery and found a good many dead pups under the cliffs. Very few of

them were fresh enough for examination. Three or 4 were secured and afterwards dissected by Mr. Lucas.

The branded cow was found in a harem below her former position. The brand is larger than when made and very distinct. It consists of one band on the back just behind the shoulders. The cow is in good condition and has a pup. She has been badly torn under the right shoulder, but the wound is healing.

#### AUGUST 2.

##### LIVE PUPS ON LAGOON.

I counted Lagoon rookery this morning with Mr. Macoun. The bulls seem to grow milder every day. Only a few made any trouble, but these few were as fierce as could be expected. It may be that they are hitherto idle bulls which have recently come into possession of harems deserted by the regular bulls. A total of 2,528 live pups were counted. A count of dead ones was afterwards made and 70 found. This is 4 less than last year.

The count of live pups for this season exceeds that of last year, which was 2,484. It was, however, much more accurately and easily done this year, as at the time of the count in 1896 the pups had spread over the point in a mass and were taking freely to the water, making it very difficult to count them. It may therefore be that the count of last year fell short of the actual conditions.

Five dead cows were found on the rookery. Adding the two which floated ashore in the lagoon, we have a large death rate for this small rookery. The number of torn cows was also unusually large. Four pups with suppurating bites in their backs were seen. Everything gave evidence of a good deal of rough treatment on the part of the bulls.

One live pup, anchored to a rotting placenta among the stones, was released. A pup imprisoned by having one of its fore flippers pinched between two rocks was also released; but it was so near dead that it may not recover. In two instances dead pups were seen with howlders resting on them in such a way that death must have resulted from the rolling of the stone on the pup, or else the stone was rolled there afterwards. Considering the fact that there has been no surf on this rookery this season, the stones must have been moved about by the bulls.

Four dead pups were brought home for dissection. In none were *Uncinaria* found. All had starved.

A large number of the pups on Lagoon had crossed over the point and were paddling in the water of the channel, seeming to prefer it to the sea front. Two starving pups were seen. No weaklings from *Uncinaria* were observed.

A small cow, blind in the left eye, was seen among the cows on the Lagoon. She was of the "moon-eyed" variety. A case of copulation was disturbed.

##### LIVE PUPS ON KITOVI.

In the afternoon a joint count of the live pups on Kitovi rookery was made by Mr. Macoun and myself. The bulls here were more troublesome than on Polovina or Lagoon. A total of 5,163 live pups were found. The dead pups on this rookery will be counted to-morrow morning.

The count of pups on Kitovi rookery for the two seasons is very satisfactory. Last year, though the count was made late, a tremendous surf was beating against the water front of the rookery, and the pups could not take to the water. This year they had not begun to swim to any extent, and the very moderate surf kept such as might be inclined to paddle in the water away from it. The bulls were not present last year, but this year they offered no serious difficulty beyond the danger involved in getting about among them. In fact, they served as a help in keeping the pups broken up in pods.

Four dead cows were seen on this rookery. The number of pups dead seemed about normal compared with last year. Few sickly pups were seen. This is in contrast with the conditions of last year. Then the first victims of starvation from pelagic sealing were about ready to die, and in each pod of living ones drawn off there would be left in the wake a lot of stragglers half dead. There were practically none of these this year. Such weak ones as were seen were more likely to be victims of *Ucinaria*, or lost mothers. But they were few in number, not more than a dozen all told being observed.

At the killing this morning from Reef and Lukanin 418 seals were taken; 350 large and 1,140 small ones were turned back. One hundred skins weighed an average of 8 pounds each. Two seals died on the drive, one on Zoltoi sands and the other at the edge of the killing grounds while one of the pods was resting.

#### DR. JORDAN'S NOTES.

Dead pups on the Reef are much fewer than last year. Only 1 was found at the north end of the larger of the two ponds. It had starved.

A cow when alarmed seized her small pup in her mouth and ran a few steps with it. I have not seen this occur before. The pup seems weak and is probably very young. The mother is very attentive to it.

Two small weakly starving pups were killed. One had sore eyes. The pups showed great vitality.

The great rookery patches on the Reef are much shrunken from last year. The largest is 200 feet below its extension in 1896. The bulls are weakening rapidly. A recently dead cow was found on the Reef. She was old and in milk. Examination showed an unborn pup, breech presentation. The uterus was ruptured and the placenta was outside of it. To the uterus was attached a superfetus in bad condition, in size about twice as long as an egg. Gangrene had set in at the mouth of the uterus. The ovaries were normal. The large pup was also normal, except for the wrong presentation.

#### ARDIGUEN.

I went down on the shelf which was last year occupied by bull A. No seals have been there this season. The places of B and C are occupied by an old idle bull each. In D's place are two pups only. In E's place is a water bull. F has 5 pups and 2 cows. There are 21 pups about G's place. One starved pup is present. The upper part of the slide is practically deserted. The idle bulls at its mouth are very fierce.

A cow with a wound on her shoulder from which pus was running was seen. She had probably been shot.



## MR. GREELEY'S NOTES.

Dissected several bachelors after killing this morning. Contained nematodes and tapeworms, but no *Uncinaria*. One bachelor, 4 feet 3½ inches long, had following dimensions of alimentary canal:

	Ft.	in.
Length of entire canal.....	66	10½
Small intestine from pylorus.....	60	10
Large intestine from caecum.....	2	9
Esophagus and stomach.....	3	3½

An old bull had 115 feet of alimentary canal.

## AUGUST 3.

Mr. Macoun and myself made a count of dead pups on Kitovi rookery, finding 126 in all. This is an increase over last year. I was not present at the count in 1896, but Mr. Macoun, who made the count with Dr. Jordan, says that the part before reaching Kitovi Point was not closely inspected last year, the count being made from the outside and not many dead being found. On this space 28 dead pups were found to-day.

In all our counts of this year we are slightly at a disadvantage on the score of increased accuracy.

The bulls are this morning much more easily managed. A few are still stubborn, but most move off readily. The number of young bulls has increased since yesterday. Doubtless many of the old bulls have not returned.

A young gray bull was seen with a stream of pus running down his shoulder and over his flipper. His exertions have broken the festering in an old wound.

A number of dead bodies fresh enough for dissection were turned over to Mr. Lucas and found to contain *Uncinaria*.

Ten old bulls were driven up from Zoltoi sands and shot, their skins to be taken as museum specimens.

*Counts of cows and pups.*

Rookery.	Cows present.	Pups.
Kitovi .....	2,436	5,289
Lagoon .....	1,319	2,598
Zapadni Reef .....	1,049	3,041
Polovina (cliffs) .....	747	2,200
Ardiguen .....	470	736
Little East .....	497	1,190
Total .....	6,518	15,056

## CENSUS OF 1897.

The results of the above counts show that in last year's correction for absent cows they were largely underestimated. In completing our census for 1897 we may take the average harem of Kitovi, found by dividing the total number of pups by the

number of harems, and apply it to those rookeries on which pups were not counted but on which harems were counted. This completed census is as follows:

*Census, 1897.*

Rookery.	Harems.	Pups (cows).
ST. PAUL.		
Kitovi.....	179	5,289
Lagoon.....	115	2,598
Polovina (cliffs).....	61	2,200
Zapadni Reef.....	114	3,041
Lukanin.....	139	4,100
Tolstoi.....	393	11,593
Zapadni.....	458	13,511
Little Zapadni.....	176	5,192
Gorbateh.....	308	9,086
Ardiguen.....	33	736
Reef.....	454	13,393
Sivutch.....	102	3,009
Polovina.....	143	4,218
Little Polovina.....	40	1,180
Vostochni.....	910	26,845
Morjovi.....	233	6,873
Total.....	3,858	112,864
ST. GEORGE.		
North.....	196	5,782
Little East.....	46	1,190
East.....	128	3,776
Zapadni.....	133	3,923
Staraya Artel.....	57	1,681
Total.....	560	16,352
RECAPITULATION.		
St. Paul.....	3,858	112,864
St. George.....	560	16,352
Total.....	4,418	129,216

#### AUGUST 4.

I made a count of the live pups on Ardiguen rookery this afternoon, finding 736 in all. These figures are very nearly correct, though it is difficult to get all the pups because of their hiding under the rock piles.

The count of this rookery last year made by Mr. Townsend and Mr. Crowley must have fallen short of the actual conditions. The rookery has certainly thinned out, and whereas 78 cows were above the mouth of the flat last year on the 14th of July, this year not a cow or pup is visible on the flat and only 4 cows have been there at any time during the season. The count of pups last year gave 650, which probably represents not more than four-fifths of the pups present. Ten dead pups were found.

Ten additional bulls were killed from Zoltoi sands for museum purposes. Mr. Lucas killed a 2-year-old cow for dissection. He dissected a number of dead pups from under the cliff at the northern end of Gorbateh and found *Uncinaria* present. A little flat which last year's photograph shows to contain 17 dead pups has to-day only 6. It has not been occupied to any extent this season. A few pups pod there but no cows were there in the season.

A line of pups extends up to the very edge of the slope at some distance this side of Old John's Rock. No cows are among them yet, but eventually the cows will haul back. At this time last year the entire slope was filled with cows and pups.

Dr. Jordan finds the original white bull of Gorbatch at the foot of the cinder slope with a harem. The bull on Kitovi, therefore, is a third white one. The one noticed so frequently on Zoltoi Sands in 1896 is there to-day.

#### AUGUST 5.

Dr. Jordan went to Gorbatch and Reef rookeries to mark the terminal boundaries and limits of the hauling and breeding grounds. The numbers marked by the surveyors do not distinguish between breeding and hauling grounds, and the numbers begin in advance of the rookeries and extend beyond the end. To correct this, special terminal marks will be located on the maps.

An especially large cow seen yesterday on Gorbatch is present to-day also. A few yearlings are to be seen. Many harems of 2-year-olds are being formed. On these two rookeries certainly half of the pups dead have died from *Uncinaria*.

The British cruiser *Rainbow*, from the China station, arrived this afternoon, bringing Professor Thompson and his assistant, Mr. Rogers. They came from St. George, where Professor Thompson has spent the time since Sunday. The *Rainbow* came directly from the Commander Islands and reports that Dr. Stejneger and Mr. Barrett-Hamilton are still there.

Professor Thompson intimates that the rookeries on the Commanders are looking well but that killable seals are very scarce.

#### AUGUST 6.

We all went this morning to Northeast Point to inspect the rookeries there and mark the boundaries for the surveyors. Professor Thompson accompanied us.

#### NORTHEAST POINT.

Numerous dissections were made by Mr. Lucas and by Mr. Snodgrass. A dead cow was found on Walrus Bight. She died in parturition. A blind pup was killed to secure the eyes. The pupils were dilated and greenish in color.

The sea lions had left the rookery on Sea Lion Neck. A small pod of about 35 seal pups is on the southern side of the neck. The bulls of 3 of the harems here still remain. On this area last year Mr. Lucas and Dr. Stejneger counted 87 cows in 8 harems. No count of the northern side was made, but it has very many fewer seals than last year, as represented by the pups.

The massed portion beyond Walrus Bight is very dense and at this season the diminution is not noticeable. Earlier in the season it was very plain and the area could easily be counted this year, whereas it could not be reached at all last year.

The sea lions seem to have hauled out at various new points where they were not seen earlier in the season. There were absolutely none on Sea Lion Neck. It seems probable that the animals simply pick up and move about in a body. The pups are with the cows and occasionally bulls and bachelors are among the groups.

The flat below Hutchinson Hill is covered within about 100 feet of the beginning of the rocky slope. Pups and cows are scattered thinly about over the area and a certain number of them are spread over the slope to the top of the hill. Most of the cows here are young ones. Such old ones as are present have followed their pups.

There is a general backward movement from the bowlder beach to the flat above in many places. On the 20th of July there was none of this and no seals were on the slope of Hutchinson Hill.

Comparing the condition of the rookery to-day as viewed from the hill, no difference can be detected over the conditions shown by the photograph of last year taken in August. Professor Thompson therefore does not find much difference in the rookery. It must be remembered, however, that the conditions of this part of the season do not represent the rookery at all. Everything is confusion. Cows and pups are scattered about, but everywhere more thinly. It is only where an actual count, as on Sea Lion Neck, can be brought to bear that the difference can be shown, but in such places the decrease is incontestable. It is only when the harem system is rigidly and compactly adhered to as before the 15th of July that any adequate notion of the real condition of the breeding grounds can be formed. Observations therefore at this time are made at a decided disadvantage.

On the patches at the western end of Vostochni the shrinkage is clearly marked by comparison of the pups of this year with those present last season. I made a count of live pups on the three southern patches, therefore it is possible to form a reasonable judgment as to relative numbers.

The large patch which extends back on the flat to the south of Hutchinson Hill is black with pups and shows up plainly as the largest group of seals on this rookery.

The dead pups on the flat under Hutchinson Hill are conspicuous and would bear a fair relation to those of last year. They seem here, as at Tolstoi, to be chiefly the victims of *Uncinaria*, and dissections show the worm to be present.

#### AUGUST 7.

Dr. Jordan and Professor Thompson went this morning to Zapadni to count dead pups in the "death traps." Dr. Jordan reports that the gully which was covered with stones has very few pups that seem to have been trampled. Most are apparently the victims of *Uncinaria* or starvation. Of the 103 pups here, the following classification of deaths is probably about correct: Starved, 15; *Uncinaria*, 65; trampled, 23.

Last year's photograph shows 30 bodies worn bare. Doubtless as many as 45 of the dead for that season were the result of trampling. The difference in appearance of the bodies may, however, be due to the dry season. Last year there was more wet weather, and doubtless the hair was worn off more quickly.

The bowlders placed in the gully are not of the best kind. They are for the most part small, such as could be carried up from the beach below. What is needed is the larger angular bowlders.

The following comparison of dead pup counts is of interest:

Breeding space.	1897.	1896.
Sands of Southwest Bay.....	18	11
Beach to north gully.....	48	135
In the stone-covered gully.....	239	352
The hill between the two gullies.....	83	153
In the second and main gully.....	135	
The sands at the foot.....	111	
The beach below.....	55	
	301	663



The pups here, as elsewhere, seem infested with *Uncinaria*, and many have died of the parasite.

On the way home a count of the dead pups on Zapadni Reef was made, and 70 found. A dead cow was found on the sands of English Bay. Her death was probably the result of rough treatment by a bull. The bones of the pelvis were broken.

#### DEAD PUPS ON TOLSTOI.

The animals were cleared off the sands of Tolstoi, and a count of the dead pups made by Macoun and myself, finding 593 dead pups: there were 5 dead cows found. Of the pups, 66 were washed up on the sands at the foot of the bay, where 231 were found last year. This season there has been no surf until within the past three days. For the sand flat and the beach below, last year 1,495 pups were found. The decrease seems not to be due to any changed conditions in the flat itself, but in the sparse occupation of it. Only a narrow strip was this season occupied by the seals, and this ground was quite as thickly covered as it was last year. More than three-fourths of the western part of the flat was bare, not only of living seals, but of dead ones also. The line bordering on the eastern side had shrunk back. The rocks of the beach were full of dead pups. This space was closely filled with harems.

The pups seem for the most part to have died from the attacks of *Uncinaria*. The infection is doubtless taken from the sands. The bulls on the sand flat are unusually fierce. Many of them are young, and some are of the idle-bull class. Many cows were held singly by bulls. The cows were approaching heat and could not be moved, and the bulls fought valiantly for them. One case of copulation occurred. The pups are not yet able to swim well, and do not take to the water readily.

The rocky slope behind the sand flat is full of pups and cows which have drawn back within the past few days. In a week or so the sand flat will be deserted for the slope.

#### AUGUST 8.

Dr. Jordan and I went to Lukanin rookery to look for branded 2-year-olds. The hauling ground had a large drove of bachelors. Most seemed to be 2-year-olds, with many yearlings. No branded animals were among them. The rookery was then passed over with a view to determining whether any were on the water front, but none were found, either on Lukanin or Kitovi. Dr. Jordan found a 3 year bachelor apparently choking to death. He poked a cane down the animal's throat, which appeared to give it immediate relief, for it walked off.

In the afternoon H. M. S. *Pheasant* came in and Mr. Macoun went on board for a cruise among the pelagic sealers. Later on the company's steamer *Del Norte* arrived from St. George. The fencing and branding apparatus were found to be deep down in the hold, and it will be a day or two before they can be got out.

#### AUGUST 9.

##### DEAD PUPS ON REEF.

A count of dead pups on Reef and Gorbateh rookeries was made this morning by Dr. Jordan, Dr. Wood, and myself. Professor Thompson spent a short time on the Reef, but took no part in the count.

Beginning at the northern point of Reef rookery 32 dead pups were counted to the first rocky point. In this space were 5 dead cows grouped together in a space of a few rods. One cow was fresh. She lay on her back. There were marks of a bull's teeth in several places. Her skull was broken. Mr. Lucas suggests that the bull may have thrown her over his head in such a way as to break her skull on the rocks. This seems the probable manner of death, though the animal might have been clubbed at sea and washed up dead by the heavy surf of the past day or two.

To the second rocky point 28 dead pups were counted. One dead cow was seen. She was much decomposed, but the cause of death was apparent. The skin over the shoulders covering about one-fourth of the body was stripped off. A living cow with a similar but less extensive flaying was seen moving about and apparently doing well. A pup with a large piece of skin torn from its back was also seen.

In the first triangular mass from this rocky point to the first pond were found 166 dead pups. This is a very large mass. Ten dead cows are in this area.

The long mass lying between the two ponds has 154 dead pups and 3 dead cows. On this flat ground the pups show traces of *Uncinaria*. A few have evidently been trampled. The pups, as a whole, are in good condition and sickly ones are few.

Beyond the second pond is the largest mass of all, but the death rate here is only 77. There are, however, 8 cows grouped together. One of the cows is badly torn about the shoulders and back. Her side is torn open and the pup still partially covered with its membrane is protruding from the wound.

On this space was a young bull in charge of a 3-year-old cow with a newly born pup. The bull could not have been more than 6 years old. He would not leave his post, neither would the cow. Under ordinary circumstances he would have fled instantly, but the responsibilities of the situation seemed to give him the courage of a veteran.

While the cows and pups were passing down over the beach, a cow reeled over and fell in a fit. Her limbs twitched and the whole body quivered. The eyes rolled, showing the whites, and the animal frothed at the mouth. She showed utter indifference when handled and rolled over. After a time she became quiet, and then recovering herself, gave a bark of fright and hurried away. This is a case exactly similar to many seen last fall at the time of the count of starved pups.

The long stretch of beach to the first hauling ground beyond the pond had 68 dead pups and 5 dead cows. This rookery space at no point reached above the bowlder beach in the breeding season. Last year the harems extended a considerable distance back. The first hauling ground noted as terminating this patch was not noticeable last year and must have been much less extensive than it is now.

In the small patch between this runway and the next were 26 pups. No dead cows were seen. To the third runway there were 29 pups and 1 cow. To the end of the rookery there were 62 pups and 10 cows. The cows were in close proximity to one another.

The Reef had in all 25 cows last year. This year there are 42. The presence of this large number of dead cows, for the most part in groups, points to increased fighting among the bulls as the cause. The massed portions of this rookery, while less in extent, were more thickly beset with idle bulls, and the cows have suffered as a consequence.

One pup anchored to a placenta among the rocks was released. A pup very recently born and scarcely able to move about was seen, evidently deserted by its mother, a thing not usual. In most cases it has been impossible to drive the mother away from her newly born pup.

On Ardiguen a young bull in A's place has a young cow. D is the first harem in the slide which is occupied. There are 3 cows and 12 pups in it, and they have evidently moved up out of the wet. E has 3 cows and several pups. Harems F and G are wanting entirely.

A count of Gorbateh gives 382 dead pups and 4 dead cows. That on Reef 642 pups and 42 cows. Of the cows dead on Gorbateh 3, and of the pups 223, are on the rocky portion of the rookery to the north of the cinder slope. For this rookery last year 712 dead pups were found, and for Reef rookery 950. The falling off in numbers is an added evidence of shrinkage in the number of animals.

#### AUGUST 10.

The day was spent in making preparations for departure. Various assignments of work were made to the students left to assist with the branding and the herding of the seals in the lagoon. The work of branding was left in Colonel Murray's charge. It was arranged that Mr. Lucas should remain to await the departure of the *Del Norte*.

Arrangements were made for the removal of the dead pups on Lukanin and Kitovi rookeries, so that a count of starved pups could be made in October.

#### MR. LUCAS'S NOTES.

I examined 3 dead pups and 2 dead cows on Reef rookery. This rookery is thin compared with last year, and the freedom with which one can move about is noticeable. Two-year-old cows are very numerous, and some regular harems are formed of them. It seems likely that the gray-necked cows are the old ones, at least it is certain that the few freshly dead cows we have been able to examine were old, large, and gray necked.

#### AUGUST 11.

The *Rush* arrived this morning, and Dr. Jordan, Dr. Wood, and Mr. Clark immediately sailed for Unalaska.

#### MR. LUCAS'S NOTES.

An old cow with a newly-born pup is held by a bull on Tolstoi. Both stand their ground. Very few seals are on Tolstoi or Middle Hill, and still fewer of those present are killables, showing that a clean sweep has been made of this class. Dissected 4 pups dead from *Uncinaria*, showing that the disease is still running.

#### AUGUST 12.

#### MR. LUCAS'S NOTES.

The dead pups on Kitovi and Lukanin were piled up and counted to-day. On Kitovi there were 202 and on Lukanin 251. The Kitovi count is 75 more than that made by Clark and Macoun, but in the eight days that have elapsed some deaths<sup>1</sup>

<sup>1</sup> See note of succeeding day as to freshly dead pups.

have occurred, and of necessity the present count, in which every carcass was fished out and piled up, must be more accurate. One case of copulation was seen.

## AUGUST 13.

## MR. LUCAS'S NOTES.

I counted live pups on Kitovi with Professor Thompson and Messrs. Farmer and Warren. My figures were 5,577, those of Professor Thompson 5,534.<sup>1</sup> My count of the Amphitheater was 1,318; Professor Thompson's 1,247. Seven pups freshly dead were seen which must have died last night or since the count of dead pups yesterday. The pups are going freely into the water and swim well. They were very active, and difficulty was experienced in counting them because of their hiding under the rocks. Those among the rocks were counted by Messrs. Warren and Farmer.

## MR. GREELEY'S NOTES.

A pup dying of starvation was seen in paroxysms, making irregular, long nervous gasps accompanied by a violent twitching of the body. Its pulse was about 30, but rose to 100 in the spasms. The pup was apparently unconscious.

## AUGUST 14.

## MR. LUCAS'S NOTES.

Mr. Farmer counted dead pups on Zapadni Gully and finds 298. Dr. Jordan's count of August 7 was 301. Last year at this date there were found 663 dead pups on this area.

## MR. SNODGRASS'S NOTES FROM ST. GEORGE.

Mr. Judge and myself made a count of the dead pups on the rookeries of St. George. The dead bodies had been but little molested by the foxes and the count was thoroughly made. The following is the result:

*Dead pups, St. George, 1897.*

Date.	Rookery.	Number of dead.
Aug. 12	North .....	244
	Staraya Artel .....	75
13	Great East .....	93
	Little East .....	34
14	Zapadni .....	112
	Total .....	558

<sup>1</sup>This recount was made on demand of Professor Thompson after Dr. Jordan had left the island, and notwithstanding the fact that he had declined to have a recount made in his presence. Neither Professor Thompson nor Mr. Lucas had had the same amount of experience in counting pups which Clark and Macoun had. This must detract from the probable accuracy of their work. The recount, therefore, can not be held as in any sense binding upon the American commission.



## AUGUST 15.

## MR. LUCAS'S NOTES.

The slide on Ardignen looks deserted, and while there are pups and cows at the top, the bottom part is completely empty.

A cow comes in on Lukanin with a spear through her back just over the pelvis. One spearhead has penetrated the body while the second is dragged after her. The cow was killed.

Mr. Greeley reports that *Uncinaria* examined under the microscope still contain many eggs, which are apparently growing larger and riper.

## AUGUST 16.

## MR. LUCAS'S NOTES.

Professor Thompson and I made a count<sup>1</sup> this morning of Zapadni Reef, finding 2,687.

Mr. Greeley reports that deaths from *Uncinaria* are decreasing rapidly. In the rocky end of Gorbatch where 20 dead pups from this cause were found two weeks ago, only 1 could be found to-day. Many starving pups are to be seen.

## AUGUST 17.

## MR. LUCAS'S NOTES.

In the whole length of Tolstoi I find only 1 fresh dead pup and 1 dying of *uncinaria*. There are many starving pups. Of the large number of dead pups here, almost without exception all are long dead. There are 7 dead pups on Tolstoi.

## AUGUST 18.

## MR. SNODGRASS'S NOTES.

*Summary of all dissections on St. George.*

Rookeries.	Cause of death.						
	Starvation.	Uncinaria.	Inflammation of viscera.	External injuries.	Drowning.	Unknown.	Total.
North.....	20	.....	1	1	.....	1	23
Staraya Artel.....	10	.....	1	1	.....	.....	12
Great East.....	10	.....	.....	.....	.....	2	12
Little East.....	4	.....	.....	.....	.....	.....	4
Zapadni.....	17	1	.....	2	1	.....	21
Total.....	61	1	2	4	1	3	72

Starved pups 84½ per cent of total number dissected.

<sup>1</sup>The widely divergent results reached in this recount from the one on Kitovi makes it impossible in the very nature of things to accept both, and it is probable that both are less accurate than the original counts. The count of Clark and Macoun gave 3,041 to this rookery.

## AUGUST 20.

REPORTED BY MR. GREELEY.

Snodgrass found a cow on Tolstoi which had died of old age, very dark, almost black underneath, cervical vertebrae ossified together and teeth all worn out.

## AUGUST 24.

MR. SNODGRASS'S NOTES.

All of the dead pups on the sand of Tolstoi rookery were collected to-day in about nine piles. They numbered 584. This included a few from the rocks at the base of the slope back of the sand, and also those lying near the sand on the rocks bordering the shore. The sand was thus made bare of dead pups, so that an exact record of the future deaths of pups on this area can be obtained.

## AUGUST 25.

MR. SNODGRASS'S NOTES.

Seven fresh dead pups were found on the sands at 8.30 o'clock this morning, and these must all have died since 11 o'clock a. m. yesterday: 7 in twenty-one and one-half hours.

MR. GREELEY'S NOTES.

The pups are now swimming very freely and are just beginning to take their long trips from the rookeries and congregate on the village point and various places about the Lagoon rookery.

## SEPTEMBER 2.

MR. GREELEY'S NOTES.

The bachelors were only driven into the lagoon to-day, although the fence was ready a week ago. A greater part of the drive, numbering about 750, were from the Reef and Lukanin. These were mostly young bachelors, many 2-year-olds, a few 5 to 7 year-olds, and a good many young cows (mostly 2 year-olds) that mingled in with the bachelors. From Tolstoi about 250, all bachelors, mostly above 5 years old, were driven. It was about 8 o'clock when they were driven through the gate. They manifested only a little fear of the fence, and were readily driven through the gate. The 2-year-olds generally took the lead, and were more easily handled than the 5 to 7 year-olds, which were obstinate. The latter ran into the fence when frightened, apparently unable to see it.

Once inside the fence, most of the seals made a rush for the water, and started aimlessly about the lagoon in different bands. A few made a break down the outlet of the lagoon, but stopped within 20 feet of the fence, and a few went nearer, but none struck the fence at all. Later in the day an occasional seal would run into the fence, but with no violence. A large band started across the lagoon flat toward the base of Tolstoi, but turned back before running into the fence. In an hour they were all quiet, and seemed perfectly at home, hauling out along the rocks at the base of Tolstoi head and on the sands at the head of the lagoon.

A 2-year-old cow was killed by suffocation near the Lukanin salt house. Her age was determined by the fact that, while she was pregnant, she had not borne a pup. An old harem bull also died at the Tolstoi gate. He was a very large fat bull, in splendid condition, but the lungs and parts of the small intestine were badly congested, probably from overheating. Each auricle of the heart contained a mass of peculiar substance somewhat resembling fat. Processes of this substance extended into the blood vessels, but it is impossible to tell whether this had anything to do with the death of the animal or not.

#### SEPTEMBER 4.

##### MR. GREELEY'S NOTES.

This afternoon the seals are much more restless than yesterday. During the noon hour I escaped over a 50 inch fence near the outlet by simply climbing up in the meshes of the wire. Bands of the seals follow the fence all the way around, and even climb up in the steepest places over by Tolstoi head. Yesterday white flags were put about on the fence where the seals congregate. They have the effect of keeping the mass of seals from these spots, but do not deter individuals from investigating them as much as ever. The young bulls rounded up harems of the cows soon after settling down inside the inclosure. These are still kept up, but only in a lazy sort of a way, the bulls allowing the cows to easily escape them. A good many yearlings have been noticed in the lagoon, and 3 or 4 pups.

##### MR. WARREN'S NOTES.

This forenoon we tested the branding machine in the presence of Colonel Murray. A dozen live pups were brought in by the natives in a wagon from Lukanin. Previous to this a considerable amount of work had been expended upon the machine, with the object of getting more power. To this end two crank wheels and connecting links had been attached, so that the power of two men could be added to that of the engine, which was found to be inadequate to keep the cauter hot while in contact with the thick fur.

Several accidents occurred during the trial which conspired to make the test rather unsatisfactory as regards time, the branding of the 12 pups taking thirty-five minutes. First one crank wheel got loose from the framework; again a belt came off; several times the cauter wire burnt out. Each of these accidents contributed to the delay. I am convinced, however, that with certain changes which can be easily made the machine will be successful and capable of making a brand superior to the hot iron.

##### MR. SNODGRASS'S NOTES.

After the middle of August many of the harems withdrew from the sand either to the hills back of the sand or to the edge of the water. Since the 19th the number on the sand has been about constant, and whenever observed pups were constantly going over it to and from the water. The majority of the dead pups were not found near the harems on the sand, so that probably many belonged to the harems on the hillside.

The following is a summary to date of all dissections on Tolstoi rookery:

*Dissections on Tolstoi rookery, August 19 to September 4.*

Date.	Cause of death.					Total.	Ratio of deaths from uncinaria to deaths from starvation.
	Starvation.	Uncinaria.	Starvation and uncinaria.	Disease of shoulder.	Unknown.		
Aug. 19.....	2	5	.....	.....	1	8	2.50
23.....	12	9	.....	.....	2	23	.75
24.....	5	.....	.....	.....	.....	7	.40
27.....	5	.....	1	.....	.....	9	.60
Sept. 1.....	16	.....	5	.....	2	23	.125
4.....	6	.....	2	1	1	10	.00
Total.....	46	21	6	1	6	80	.456

The following is a summary to date of all dissections on Zapadni rookery:

*Dissections on Zapadni rookery, August 24 to September 4.*

Date.	Cause of death.				Total.
	Starvation.	Uncinaria.	Starvation and uncinaria.	Unknown.	
Aug. 24.....	8	11	3	2	24
Sept. 4.....	18	.....	.....	.....	18
Total.....	26	11	3	2	42

*Summary of all dissections on St. Paul Island, beginning with August 19.*

1. SUMMARY BY ROOKERIES.

Rookery.	Cause of death.					Total.
	Starvation.	Uncinaria.	Starvation and uncinaria.	Disease of shoulder.	Unknown.	
Tolstoi.....	46	21	6	1	6	80
Zapadni.....	26	11	3	.....	2	42
Gorbatch.....	15	9	1	.....	1	26
Reef.....	31	1	1	.....	.....	33
Total.....	118	42	11	1	9	181



Summary of all dissections on St. Paul Island, beginning with August 19—Continued.

II. SUMMARY BY SUCCESSIVE DATES.

Date.	Rookery.	Cause of death.					Total.	Ratio of deaths from uncinaria to deaths from starvation.
		Starvation.	Uncinaria.	Starvation and uncinaria.	Disease of shoulder.	Unknown.		
Aug. 19.	Tolstoi	2	5			1	8	.50
23.	do	15	9			2	23	.75
24.	do	5	12			7	17	
	Zapadni	8	11	3		2	24	1.00
27.	Tolstoi	5	3	1			9	.60
Sept. 1.	do	16	2	3		2	23	
	Gorbatch	15	9	1		1	26	.193
	Reef	31	1	1			33	
4.	Tolstoi	6		2	1	1	10	.60
	Zapadni	18					18	
	Total	118	42	11	1	9	181	.356

SEPTEMBER 5.

MR. WARREN'S NOTES.

This afternoon I visited the seals in the lagoon. At the landing, or the place where the fence crosses the neck of the lagoon, about 150 seals are hauled out on the bank on either side of the channel. Others are in the water bumping up against the fence and biting at it but not doing it any special damage. A few seals have escaped. The greater part of the seals are hauled out on the flat near the base of the bluff toward Tolstoi.

There seems to be no doubt that the seals realize the fact that they are confined, and they patrol the fence looking for an opening. Undoubtedly they can get over the 42-inch fence when they set out to in earnest, but few of them seem to care to make the exertion. Most of those which have escaped as yet have done so by crawling through a hole where the wire does not fit closely to the ground. These holes we are fixing as fast as possible.

There is a beaten path around just inside the fence extending probably two-thirds the way around, where the seals have gone searching for an opening. The point where their efforts to escape are chiefly concentrated is near the bluff at Tolstoi. This is the route by which the bachelors released from the killings make their way to the sea. There also the nature of the ground is such that there are many long holes, depressions, hillocks, etc., into which the wire fence does not fit.

SEPTEMBER 6.

MR. EDWARDS'S NOTES.

In accordance with instructions, I counted the dead pups on the amphitheater as they accumulated since the removal of those found on August 13.

Number dead.

Aug. 14.....	3	Aug. 29.....	39
19.....	7	31.....	45
24.....	23	Sept. 3.....	52
27.....	36	6.....	56

## SEPTEMBER 7.

## MR. WARREN'S NOTES.

To-day about noon that part of the fence which crosses the neck of the lagoon gave way. There was a stiff breeze blowing and a strong tide running in. Furthermore, the wire was filled with seaweed, so that the pressure was something tremendous. The posts alone gave way, for the bottom of the wire was securely anchored with rocks.

The seals having been confined for one week, Colonel Murray decided that a sufficient test of the efficiency of the fence had been made, and hence it was not repaired, but was laid flat at this place so that the seals might pass over it.

The result of the entire experiment has shown conclusively that the seals can be successfully confined within the inclosure by strengthening the fence. To render the fence amply strong there is needed 6 more rolls of 58-inch fencing and 200 more posts, 50 of which should be at least 8 feet in length; also about 1,000 staples.

## COLONEL MURRAY'S NOTES.

Branding with hot irons was begun on Lukanin rookery, an effort being made to train the men to do the work; 350 were branded.

## SEPTEMBER 10.

## MR. WARREN'S NOTES.

I made the following counts of dead pups on Lukanin rookery after the removal of the early dead on August 13. The bodies were not removed as counted and the increase between two dates is represented by the difference between the two counts.

*Number dead.*

Aug. 11 .....	0	Aug. 31 .....	28
16 .....	1	Sept. 2 .....	33
20 .....	5	4 .....	33
25 .....	11	7 .....	34
27 .....	22	10 .....	35
29 .....	25		

## SEPTEMBER 17.

## COLONEL MURRAY'S NOTES.

The branding for the season was concluded on Zapadni rookery to-day, a total of 118 cows and 5,371 pups having been marked. I used two forces, with two men to attend each, keeping six irons hot. One man carried the irons back and forth from the forge. With nine active young men to handle the pups I found it possible to brand 300 an hour without special exertion.

## SEPTEMBER 23.

## MR. JUDGE'S NOTES.

Beginning with September 17, I branded pups on the rookeries of St. George as follows:

North rookery.....	443
Staraya Artel .....	404
Zapadni.....	677
East .....	235
Little East.....	121
Total .....	1,880

## OCTOBER 15.

## COLONEL MURRAY'S NOTES.

On this day I made a count of the dead pups on Lukanin and Kitovi which have been added since the middle of August. I found 542 on Lukanin and 515 on Kitovi; making 1,057 pups which have starved to death on the two rookeries.

## OCTOBER 17.

## COLONEL MURRAY'S NOTES.

This afternoon was spent in rolling down stones into the gullies of Zapadni, covering the floor of the long gully with large and permanent boulders.

## OCTOBER 18.

## COLONEL MURRAY'S NOTES.

To-day we rolled stones weighing from 100 pounds to 2 tons on the sand flat of Tolstoi.

(This closes the record for the season of 1897).





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