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SECOND PRELIMINARY REPORT

OF THE

BERING SEA FUR SEAL INVESTIGATIONS

BY

DAVID STARR JORDAN

ASSISTED BY

LEONHARD STEJNEGER, FREDERIC AUGUSTUS LUCAS,
AND GEORGE ARCHIBALD CLARK.

1897.



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149
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TREASURY DEPARTMENT.
Document No. 1994.
Office of Secretary.

By transfer
MAY 10 1913

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LETTER OF TRANSMITTAL.

LELAND STANFORD JUNIOR UNIVERSITY,
Palo Alto, Cal., November 1, 1897.

DEAR SIR: I have the honor to submit herewith a second brief preliminary report on the work of the Bering Sea fur-seal investigation for the season of 1897. This will be followed in the course of the coming year by a final report, monographic in character, which will take up in detail all phases of the fur-seal question.

Very respectfully, yours,

DAVID STARR JORDAN.

HON. LYMAN J. GAGE.

Secretary of the Treasury, Washington, D. C.

SECOND PRELIMINARY REPORT OF THE BERING SEA FUR-SEAL INVESTIGATION.

SCOPE OF THE INVESTIGATION.

The work for the season of 1897 represents a continuation of the investigations of 1896. The same comprehensive outline of inquiry suggested in 1896 by Hon. Charles S. Hamlin, then Assistant Secretary of the Treasury, in his letter of instruction under date of June 13, has this year been followed out. This letter was published in full in the preliminary report of last year. It is only necessary here to repeat the following paragraph, which contains the gist of the whole subject:

“The principal object of this investigation is to determine by precise and detailed observations, first, the present condition of the American fur-seal herd; second, the nature and imminence of the causes, if any, which appear to threaten its extermination; third, what, if any, benefits have been secured to the herd through the operation of the act of Congress and act of Parliament based upon the award by the Paris Tribunal of Arbitration; fourth, what, if any, additional protective measures on land or at sea, or changes in the present system of regulations as to the closed season, prohibited zone, prohibition of firearms, etc., are required to insure the preservation of the fur-seal herd.”

The most important part of the work for 1897 has been to ascertain, by a duplication of the census of 1896, the changes which have taken place on the rookeries of St. Paul and St. George Island and to trace their causes. In addition to this work of making the census, the commission has taken up the following general matters relative to the fur-seal question:

1. The changes, if any, which have taken place on the Commander Islands since 1896.
2. The formation of the rookeries in the spring, including the observations necessary to complete our account of the life history of the fur seal.
3. The value and significance of counts and photographs in determining the population of the rookeries, and especially the degree of permanence in rookery outlines during the so-called height of the season.
4. The corrections which should be made in the provisional census of 1896.
5. The condition of the bachelor herd, as shown by the quota of killable seals, considered with reference to the changes which have taken place since 1896, and the causes of such changes.
6. The investigation in greater detail of the causes of early mortality of fur-seal pups.
7. Experimentation on a larger scale in the branding of female pups and adult cows for the purpose of depreciating the value of pelagic skins.
8. Further experimentation in the herding of young bachelors in the salt lagoon of St. Paul Island during the season of pelagic sealing for the purpose of protecting them from the pelagic fleet.
9. A reconsideration of all causes which have contributed to the decline of the herd.
10. A reconsideration of the effects of the Paris award.
11. An investigation of the methods of hunting the sea otter, with a view to devising means of saving these animals from extermination in Alaskan waters.
12. An investigation, so far as time might allow, of the present condition of the salmon fisheries of Alaska.

PERSONNEL OF THE COMMISSION.

In the work of 1897 I have again had the assistance of Dr. Leonhard Stejneger and Mr. Frederic A. Lucas, of the United States National Museum. Mr. George A. Clark was continued as secretary of the Commission, and took an active part in the work of investigation. Mr. Elmer E. Farmer, instructor in electrical engineering, and Howard S. Warren, student in electricity in Stanford University, accompanied the Commission to carry out the experiments in electrical branding. They were assisted by Messrs. Robert E. Snodgrass, Arthur W. Greeley, Arthur J. Edwards, students in Stanford University, and Trevor Kincaid, assistant in the University of Washington. Their natural-history collections and observations on the rookeries, after our departure from the islands, have been of value in our work. Mr. Bristow Adams, artist assistant to the Commission, made a very valuable series of drawings from life of the fur seals. Mr. Harry D. Chichester, an employe of the North American Commercial Company, resident on the islands, acted as photographer for the Commission, obtaining a most acceptable series of photographs.

ASSIGNMENT OF WORK.

In the division of labor incident to this investigation the study of the Commander Islands was again assigned to Dr. Leonhard Stejneger, the mortality among the seals to Mr. Frederic A. Lucas, while all matters pertaining to the census of the rookeries and to the condition of the bachelor herd were placed in the hands of Mr. George A. Clark. The experiments in branding and herding were left, as heretofore, to the immediate supervision of Col. Joseph Murray, now chief agent in charge of the Pribilof Islands, Messrs. Farmer and Warren being appointed to act as his assistants.

For my own part, I retained general supervision of the investigations as a whole and witnessed the important work of counting the pups. I also made investigations of the sea-otter problem, with a view to offering recommendations for the protection of this animal. More important work in this direction, however, carried out by Capt. Calvin L. Hooper, commander of the Bering Sea patrol fleet, whose observations have been much more extensive than mine, makes it unnecessary for me to do more here than emphasize the recommendations already made in his report, which has been published by the Treasury Department. The results of my investigations of the salmon fisheries have been incorporated in a joint letter with Captain Hooper to the Department. This letter is attached as Appendix IV to this report. The preparation of the text of the present report is the joint work of Mr. Clark and myself.

ACKNOWLEDGMENTS.

I may here make acknowledgments for favors and assistance to Capt. Jefferson F. Moser, of the United States Fish Commission steamer *Albatross*, to Capt. Calvin L. Hooper, commanding the Bering Sea Patrol, to Capt. W. H. Roberts and the officers of the United States revenue cutter *Rush*, to Col. Joseph Murray, chief agent in charge of the islands, and his associates, Messrs. John M. Morton and James Judge, to Mr. Joseph Stanley-Brown, superintendent of the North American Commercial Company, and to the resident agents and physicians of the company on the islands of St. Paul and St. George.

ITINERARY.

May 22.—Mr. Clark sailed from San Francisco on the North American Company's steamer *Del Norte* May 22. Mr. Bristow Adams accompanied him as artist assistant to the Commission. Col. Joseph Murray, chief agent, Mr. John M. Morton, assistant agent, and Mr. James M. Macoun, Canadian Commissioner, were also passengers on the vessel. The *Del Norte* arrived at Wood Island, Kadiak, May 31, and at Dutch Harbor, Unalaska, on the morning of June 4.

June 7.—The *Del Norte* arrived at St. George Island, remaining at anchor discharging cargo until the evening of the 11th, during which time Mr. Clark visited all the rookeries of St. George, and made daily visits to North rookery near the village.

June 12.—On the morning of June 12 Mr. Clark was landed on St. Paul Island and began daily observation of the breeding rookeries.

July 1.—Mr. Lucas arrived on the *Rush* at St. Paul July 1. Dr. Stejneger, who accompanied him to Unalaska, having sailed directly from that port for the Commander Islands on board the *Grant*.

July 9.—Mr. Lucas examined the rookeries of St. George Island, counting the cows present. Mr. Chichester photographed the rookeries of St. Paul. Messrs. Clark and Macoun counting Lagoon rookery. On the 13th Kitovi rookery was counted by Messrs. Macoun and Lucas. The other rookeries were counted in order, chiefly by Mr. Clark. Mr. Chichester photographed the rookeries of St. Paul for the Fish Commission.

July 25.—Dr. Jordan arrived at St. George Island, and after visiting the rookeries there, was landed at St. Paul July 28. The following week was devoted to inspection of the rookeries of this island.

July 30.—The count of live pups was begun on the test rookeries. Kitovi was counted by Messrs. Clark and Macoun on August 2. This was followed by a count of dead pups on the "death traps" of Zapadni and Tolstoi.

August 5.—Prof. D'Arcy W. Thompson arrived at St. Paul on H. M. S. *Rainbow* from the Commander Islands.

August 8.—Mr. Macoun left St. Paul on H. M. S. *Pheasant*.

August 11.—Dr. Jordan and Mr. Clark left St. Paul Island on the revenue cutter *Rush*, arriving at Seattle in the evening of the 21st.

August 16.—Professor Thompson sailed from the islands on the *Amphion*.

August 18.—Mr. Lucas left St. Paul on the *Del Norte*, arriving in San Francisco August 31.

ROOKERY DEVELOPMENT.

It was possible this season to begin our observations with the earliest arrival of cows on the rookeries, thus securing a continuous history of the breeding season.

ARRIVAL OF BULLS.

When the rookeries were first visited on the 7th of June the bulls of the older class were found on the breeding grounds wherever harems were located last year. Of their incoming we have no personal knowledge, but the record in the logs of the two islands shows that the bulls began to arrive about the 1st of May, the number gradually increasing from one or two on each rookery to the number found on June 7. At that time one cow was present with a pup on East rookery of St. George. She had been present since June 3. No other cows arrived on St. George until the 9th, and on the 10th the first cows landed on St. Paul.

From this time on the population of bulls increased by the addition of that class known as idle bulls. At the time of the first visits to the rookeries these animals were not present, though some of them were doubtless swimming about in front of the rookeries. Twenty such bulls in the water were counted on North rookery. On St. Paul a count of bulls on Kitovi rookery was made on June 13, before any cows had appeared, 156 being found. On the 13th of July there were 179 bulls controlling harems and about 25 more of the idle class on this rookery. The observations of the season therefore show that the idle bulls as a class do not take up their places on the rookeries much before the arrival of the cows. It was also found as the season advanced that some did not occupy their places permanently, but shifted about and occasionally went to the water, and possibly they fed also, for when they came to enter the rookeries late in July, on the departure of the regular bulls, they were in good condition.

ARRIVAL OF COWS.

We were greatly surprised at the gradual arrival of the cows. The general impression was that they came in practically in a body. On the contrary, their arrival was so gradual that it was impossible to tell from day to day whether any additions had been made except by an actual count. The earliest arrivals for St. Paul dated with June 10 on Tolstoi rookery. But no cows appeared on the rookeries near the village until the 12th, when a single cow landed on Lukanin. By the 17th of June the total population of this rookery was only 11 and on the 22d it numbered no more than 74. By June 30 the number had increased to 635. On July 15 there were 1,841.

In order to get definite data regarding the development of the rookeries daily counts were kept up from the very beginning of the season on Lukanin rookery

and on a part of Kitovi known as the "Amphitheater." These counts are as follows, and show clearly the changing character of the rookeries from day to day:

Record of arrival of cows.

Date.	Cows present.	Date.	Cows present.
<i>Amphitheater of Kitovi.</i>		<i>Record of harems—Continued.</i>	
June 12	0	July 13	46
13	0	25	53
14	2	<i>Lukanin rookery.</i>	
15	3	June 12	1
16	3	13	1
17	4	14	3
18	6	15	5
19	7	16	6
20	8	17	11
21	9	18	19
22	23	19	25
23	37	20	37
24	45	21	52
25	56	22	74
26	76	23	103
27	105	24	131
28	137	25	176
29	168	26	207
30	210	27	257
July 1	246	28	
2	290	29	
3	362	30	635
4	411	July 1	
5	499	2	800
6	518	3	938
7	550	4	1,088
8	585	5	1,197
9	b 587	6	1,264
10	660	7	1,371
11	703	8	1,531
12		9	b 1,541
13	654	10	1,680
14	556	11	1,755
15	703	12	
16	678	13	1,736
17	698	14	1,841
18	556	15	306
19	556	16 ^c	327
20	429	17	325
21	528	18	338
22	416	19	238
23	469	20	290
24	465	21	214
25	426	22	215
26	463	23	219
27	406	24	212
28	304	25	196
29	414	26	186
30	427	27	148
31	375	28	157
<i>Record of harems.</i>		29	177
June 14	1	30	149
20	3	31	127
30	10		124
July 8	35		

^a Weather clear; no storms or surf, except one day when rain fell, causing a larger number of cows to take to water and making it difficult to distinguish those present from the rocks.

^b Rain.

^c After July 14 it became impossible, on account of the scattering of the cows, to continue the count for the entire rookery without too great loss of time, and so a section of 18 harems was singled out and the count continued on it.

CHANGES FROM DAY TO DAY.

From these figures it will be seen that on no two days of the breeding season are the rookery conditions the same. It is true that a time comes when the maximum attendance of cows is reached, but there is no "height of the season" in the sense that the number of cows present is uniform from day to day. Changes occur from day to day. Thus on the 14th of July there are 15 per cent less cows present on the Amphitheater than on the 13th, and on the 15th there were 20 per

cent more than on the 14th. But it required always an actual count to demonstrate this. To the eye of the observer these changes would not appear.

From the beginning of the season there is a gradual and more or less even increase in the population of the rookeries until a maximum is reached about the middle of July. There is no reason, however, to believe that the date of this maximum may not vary somewhat from year to year, depending on the season. Nor does the maximum here described represent a fixed condition in rookery population. As a matter of fact, at this time the greatest changes of the season are taking place. More cows are arriving and more departing than at any other time. But for a few days the arrivals and departures appear in a general way to balance each other. The increase in the number of arrivals which has been going steadily on since the beginning of the season reaches a climax and a decrease begins. About ten days after the first arrivals the cows begin to depart, the number increasing as the season advances, until at a certain point they equal the number of arrivals, and this is the "height of the season." From this point the arrivals and departures diverge, the latter continuing to increase as the season advances, the former decreasing until the breeding season closes.

MAXIMUM POPULATION.

The maximum population on Lukanin and Kitovi rookeries was reached on the 15th of July. From the 18th onward the arrivals decreased rapidly, practically ceasing by the end of July. In the meantime the departures increased in number as the pups became older, and by the end of July the population on any particular day was but little more than one-half what it represented at the height of the season, or about one-fourth of the total number of females actually belonging to any particular rookery.

APPEARANCE OF THE BREEDING GROUNDS.

This peculiarity in the development of the rookeries should be noted; while they show a gradual increase in numbers to a maximum and then a decline, the appearance of the breeding grounds apparently shows a different condition of things. Up to about the 10th of July the harems are held in rigid control, and in the present thin and scattered condition of the rookeries each harem is distinctly marked. During this time the cows are occupied with bringing forth their pups, nursing them and resting. They lie as closely as may be together and are rather indifferent to what is going on about them.

When, however, the greater part of the cows have borne their pups and begin to come in heat in large numbers, which occurs from the 5th to the 10th of July, they become restless, biting at one another and moving about. The harems are kept constantly stirred up. The bulls grow excited, and the idle bulls adjoining the harems become aggressive. When the harem masters are otherwise engaged, the idle bulls steal cows one by one and establish small harems behind the original families. The cows themselves wander beyond the close harem confines when the bulls are busy, and are captured or else voluntarily join the new harems formed by capture. The harems so formed frequently outnumber in size the original ones. At this time, also, the pups begin to move out and gather in pods by themselves. The cows follow them. The interspaces between the harems are filled in, so that only in a general way can individual families be distinguished.

Viewed before the 10th of July and very soon after, when this change has taken place, it might easily be supposed that there had been a great expansion of the rookery population. But the actual count shows this not to be the case. It further shows that this apparent expansion goes on and increases through the season notwithstanding the fact that the population is largely diminished. Thus when the Amphitheater of Kitovi showed only a population of 375 cows on the last day of July, this limited number occupied more territory than did 703 on July 15, or 585 on July 8.

As the number of cows diminishes, the pups become more conspicuous, and deceive the observer, for their number is far in excess of the largest number of cows ever present. For this reason the rookeries when covered with pups seem more populous than in the height of the season. It was necessary to actually count the cows on July 25 to make sure that they had not increased instead of diminished. Under such circumstances no correct impression of the condition of the rookeries can be obtained by mere observation, a fact which can not be too strongly emphasized. The relative numbers of cows present can never be ascertained by the eye. Only actual counts can be trusted.

Not only can no true idea of the condition of the rookeries be obtained from

counting the cows, but a count of the families themselves which have been regarded as more or less permanent can give no better results. The following record of harems on the Amphitheater will suffice to show this clearly:

Count of harems—Amphitheater of Kitovi.

Date.	Harems.	Date.	Harems.
June 14.....	1	July 8.....	35
21.....	3	13.....	46
30.....	19	25.....	53

Thus with 277 less cows on the 25th of July, the Amphitheater had seven more harems than on July 13. In further illustration of this may be cited the results of two counts made at an interval of seven days in 1896 on Tolstoi cliffs. On July 14 Mr. Lucas found 108 harems with 1,498 cows; on July 21, 115 harems with 1,033 cows. While the number of cows had decreased by 30 per cent, the number of harems had increased by 7 per cent.

After the 25th of July, of course, the breeding season was practically over so far as the adult cows were concerned. The original harem masters began to leave; the idle and younger bulls came in in large numbers to take their places and to serve the two-year-old cows when they should appear in the last week of July and the first week of August.

With a view to illustrating the phenomenon of scattering above noted on the rookeries, the Amphitheater of Kitovi was photographed every other day throughout the month of July. Through these photographs can be traced from day to day the changes on this breeding ground. On all the other rookeries the changes were equally marked.

PHOTOGRAPHS NOT TO BE RELIED ON.

These observations also show that too great reliance must not be placed on photographs or maps to indicate actual rookery conditions. Photographs taken at a week's interval show radical changes. To trace in the rookery outlines on a chart is merely to fix in a general way the impression of the rookery for the particular day in question. In other words, the breeding grounds are in a constant state of change both as to population and extent of ground occupied from the beginning to the end of the season. This affects also all observations of the rookeries and all counts of cows and harems. Hence these methods of arriving at a knowledge of the true state of the rookeries are indefinite. There is only one absolute gauge of the numerical condition of the herd, and this is the number of pups. These pups for the first six weeks of their lives are constantly on the rookeries. They can be counted with reasonable accuracy about the first of August on a number of typical breeding grounds, and a comparison of such counts from year to year will give a reliable index of the condition of the herd.

THE CENSUS OF 1896.

In the beginning of our work last season we were influenced by the notion long currently accepted that there was a time in the breeding season when the rookeries were at their height and practically all the cows present. With this idea in mind we set about making a census of the rookeries.

On certain rookeries and portions of rookeries the individual cows were counted by harems, and on all the rookeries harems were counted or closely estimated. Of the rookeries counted, Kitovi was taken as most typical of the conditions on the larger breeding grounds, and its average size of harem was used in determining the population of those rookeries on which only the count of harems could be made. By this means a provisional enumeration of the breeding cows was made before the 1st of August.

During August it became evident that the number of pups to be seen on the rookeries counted was manifestly in excess of the number of cows. Accordingly a count of live pups was made on all rookeries where cows had been counted, and they were found in every case to be greatly in excess. It was therefore found necessary to make a large correction in the preliminary estimate for absent cows. It was assumed that this correction should be about 75 per cent. This correction was accordingly applied to the provisional census of cows and the following completed census for 1896 obtained:

Summary of breeding seals (counts and estimates).a

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
Gorbatch.....	302	5,224	9,142
Ardiguen.....	27	550	652
Reef.....	504	8,719	15,258
Sivutch 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	2,335	4,086
Zapadni.....	182	3,148	5,509
Staraya Artil.....	75	1,297	2,269
Total.....	661	11,432	20,023
Grand total.....	5,009	81,793	143,071

a Published in the Preliminary Report for 1896.

Bobrovi (Otter Island) had 1 harem, containing 5 cows and 5 pups.

THE REVISION OF THE CENSUS OF 1896.

ERRONEOUS ESTIMATES.

As a result of our experience in making the census for 1897, it becomes necessary to make certain corrections in the foregoing figures. The closer inspection of the breeding grounds in 1897 showed that on St. Paul Island, Zapadni and Tolstoi rookeries were probably overestimated in 1896 to the extent of 40 harems and 30 harems, respectively. Polovina seems to have been underestimated by about 15 harems. Sivutch Rock was not visited last year in the breeding season, and the estimate for it was based upon a count of harems made from the reef with the aid of a glass, verified by a later count on the rookery in August. A careful inspection in the breeding season this year showed 103 harems, and proved the rookery to be much larger than was supposed in 1896. On North and Zapadni rookeries of St. George the estimate of harems for last year was based upon a count made at the close of the month of July. Our experiences this year show that counts made after July 20 can not be relied upon. We have, therefore, in the revision taken for Zapadni an earlier count made on July 11. North rookery was in 1896 counted in part and in part estimated, the total number of harems being 189. From closer inspection of the estimated part in 1897 it has seemed best to raise this figure to 200. These corrections are not given as absolute, but represent the best possible judgment after carefully considering all the conditions.

UNDER AND OVER ESTIMATES BALANCE.

These under and over estimates, however, nearly balance each other, and are unimportant. The serious error in the census of 1896 lies in the low percentage of correction made for absent cows. In the original enumeration of cows present in the height of the season the conditions of Kitovi rookery were applied to the others as being most typical. When the enumeration of live pups changed this original enumeration, in making the correction the average ratio of pups to cows on all the rookeries counted instead of the ratio of Kitovi was used. The experiences of this year show that the conditions of Kitovi rookery were more nearly correct.

The ratio of pups to cows on this rookery in 1896 was 1.91 to 1. The average ratio was 1.75 to 1, but this abnormally low average is known to have contained certain elements of error.

In revising the census of 1896 we have therefore simply gone back to the conditions of Kitovi and applied them to the other rookeries, making such other minor changes as, in the light of our experience, seem necessary. It may be noted that we have no occasion to alter the original actual counts upon which the census is based.

Revised census, 1896.

ST. PAUL.

Rookery.	Harems.	Pups (cows).
Kitovi	182	6,049
Lagoon	120	2,484
Polovina Cliffs	86	2,496
Zapadni Reef	176	3,862
Lukanin	147	4,880
Tolstoi <i>a</i>	467	15,504
Zapadni <i>b</i>	543	18,027
Little Zapadni	210	4,584
Gorbatch	302	10,026
Ardiguen	27	c896
Reef	504	16,732
Sivutch <i>d</i>	105	3,486
Polovina <i>e</i>	153	5,079
Little Polovina	45	1,494
Vostochni	975	32,370
Morjovi	293	9,727
Total	4,335	137,696

ST. GEORGE.

North	200	6,640
Little East	44	1,359
East	135	4,482
Zopadni	143	4,747
Staraya Artel	75	2,490
Total	597	19,709

RECAPITULATION.

St. Paul	4,335	137,696
St. George	597	19,709
Grand total	4,932	157,405

a A reduction of 30 harems from the original estimate.

b A reduction of 40 harems.

c The original count of 650 pups used in the census of 1896 was made from the cliffs above the rookery under circumstances which make it certain that it is an underestimate. It is therefore discarded.

d An increase of 42 harems.

e An increase of 15 harems.

This elaborated census is not given as the basis for a comparison between the two seasons, but as a matter of information as to the true condition of the herd. It is impossible that the enumeration should be made absolute, but it is near enough the actual conditions for all practical purposes. The total of 157,405 breeding seals means between 150,000 and 160,000. No closer accuracy is claimed for the figures, but none is needed, and the margin of error can not be great.

THE CENSUS OF 1897.

NATURE OF THE PROBLEM.

In undertaking the census of 1897 we had a clear idea from the beginning of the nature of the problem. The first important thing was to make a full enumeration of the harems on all the rookeries in the height of the season. The next important

thing was to make a count of pups on some typical rookery or rookeries, thus obtaining an average size of harem which could be applied to the larger breeding areas, on which the pups could not be counted.

The cows on the rookeries counted in 1896 were similarly counted in 1897 for purposes of comparison, and it was from these that we discovered the inadequacy of the correction of 75 per cent made for absent cows last year. These counts are as follows:

Comparison of counts of cows and pups, 1897.

Rookery.	Cows present.	Pups.
Kitovi.....	2,436	5,289
Lagoon.....	1,319	2,598
Zapadni Reef.....	1,499	3,041
Polovina (cliffs).....	747	2,200
Ardiquen.....	470	735
Little East.....	497	1,190
Total.....	6,518	15,056

On the basis of all these rookeries the pups are 2.3 times as numerous as were the cows in the height of the season. For Kitovi rookery itself the pups are 2.2 times as numerous. As the most careful and accurate counting was done on this rookery, we feel justified in using its conditions as a basis for an estimate of the others.

The following is the enumeration of breeding seals on the islands for the season of 1897. The intermediate step of obtaining the number of cows present in the height of the season is dropped out and the average size of harem for Kitovi rookery, ascertained by a count of the pups on August 3, is applied to the rookeries on which only harems are counted. For Kitovi rookery, and all others on which pups were counted, the actual counts are used unchanged:

Census, 1897.

ST. PAUL.

Rookery.	Harems.	Pups (cows).
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
Gorbatch.....	308	9,086
Ardiquen.....	33	735
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
Starie 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

THE WORK OF COUNTING.

The work of counting the seals is most difficult and demands skill and experience to make it of value. Inexperienced counts are usually below or above the facts according to the personal equation of the person doing the work. The live pups must be counted while in motion, as they are run off in pods, and unless the work is done surely and quickly confusion results. Many of the dead pups are hidden among the rocks and it requires keenness of vision to pick them out. The cows themselves are with difficulty distinguished from the rocks among which they lie.

With a view to securing the most satisfactory results, the work of counting during the season of 1897 has been left almost wholly to Mr. Clark, whose experience in counting dead and living pups in 1896 was greater than that of all other members of the commission combined. For the British commission the work has in like manner been done almost entirely by Mr. Macoun, the two men working together, making separate counts and verifying results whenever differences arose.

As director of the investigations, I think it proper to say emphatically that the keen eyesight and conscientious accuracy of these two observers are very unusual, even among skilled naturalists, and I believe the results of their work in this regard to be above criticism. I should not accept a count of my own if differing from theirs, nor should I accept a count of any other member of either commission as opposed to any numerical conclusion they might reach.

EVIDENCE OF DECLINE—COUNTS.

Wherever counts were made during both seasons they show a marked decline in the breeding herd. Fewer harems were found on the typical rookeries in 1897, fewer cows in the height of the season, smaller apparent harems, and a lesser number of pups. The following is a summary of the actual counts for the two years:

Actual counts, 1896-97.

Rookery.	Harems.		Cows.		Pups.	
	1896.	1897.	1896.	1897.	1896.	1897.
Kitovi	180	179	3,152	2,436	6,049	5,289
Lagoon	120	115	1,474	1,319	2,484	2,598
Tolstoi (cliffs)	108	98	1,498	1,286	2,664	(a)
Zapadni Reef	176	114	2,256	1,049	3,862	3,041
Polovina (cliffs)	86	61	1,266	747	2,496	2,200
Little East <i>b</i>	(<i>b</i>)	33	(<i>b</i>)	497	1,350	1,190
Ardiguen	27	33	550	470	(<i>b</i>)	736

a Not counted.

b Count of 1896 rejected as obviously incorrect.

Taking as a basis the whole number of live pups actually counted, we find the decrease to be about 12 per cent. By reference, however, to the count on Lagoon Rookery, which has been here included, we find that instead of a decrease there has been an apparent increase of 3 per cent. This increase is really due to defects in the count of 1896. That no real increase took place is evident from the fact that not only has the number of harems decreased from 1896 to 1897, but the number of cows found present in the height of the season as well. The count of live pups on the 18th of August, 1896, was made under very much greater difficulties than the one this year on July 30, and is manifestly less accurate. This year the pups had not begun to spread across the point of the reef at the time of the count. Last year the pups occupied the entire width of the rookery and took to the water on both sides.

But whatever this individual count may show, it can not of course be considered an indication of increase on the rookeries as a whole. Leaving out Lagoon Rookery from the record, we find that the remaining rookeries on which the pups were counted show a reduction of 14.4 per cent.

COUNT OF PUPS THE ONLY SURE BASIS.

The count of pups is the only sure basis for an estimate of the relative condition of the rookeries, but at the same time the count of harems and cows, made on practically the same dates in succeeding years, must be admitted as corroborative evidence. The count of harems is more satisfactory than that of the cows, as the families themselves are more permanent than the individuals which occupy them.

Both show a marked decrease. By reference to the individual counts, however, it will be seen that on Zapadni Reef and Polovina Cliffs the cows this year were scarcely half as numerous as at the same date last year. The comparison of the count of pups on these rookeries shows only the normal decrease found elsewhere. Every indication, therefore, is that these counts represent abnormal conditions, more cows perhaps being in the water in 1897 on account of the warmer weather. But whatever these seeming irregularities may mean, the counts of cows for the two seasons point unmistakably in the direction of decline.

From the foregoing counts we may draw the following summary of results:

Summary of counts, 1896, 1897.

Count.	1896.	1897.	De-crease.
Harems (total).....	4,932	4,418	<i>Per cent.</i> 10.41
Cows (on certain rookeries).....	10,198	7,307	28.34
Pups (on certain rookeries).....	16,241	14,318	11.8

ABANDONMENT OF BREEDING GROUNDS.

SHRINKAGE NOT EVERYWHERE EQUALLY VISIBLE.

From the nature of the breeding grounds shrinkage in the rookeries is not everywhere equally visible. Where the rookery occupies the narrow beach at the foot of cliffs, as on parts of Lukanin, Tolstoi, and Polovina, the ground of last year was in a general way occupied this year. The reduction consisted simply in a general thinning out over the whole surface, and did not appear as an abandonment of breeding territory. Where the harems occupied a slope of indefinite extent, the shrinkage could be seen but not defined. Here, in addition to thinning out over the whole area, there was a reduction of the space occupied. But this could not be stated in definite terms except where an actual count of live pups was made or where some landmark familiar to the eye during both seasons indicated the abandonment of ground formerly occupied.

ABANDONED TERRITORY.

At various points on all the rookeries, portions of ground occupied last year by harems were not entered by the breeding seals this year. This was particularly noticeable at the head of the slide on Ardiguen. This rookery was closely watched during the entire season of 1896, a record of its conditions being taken from day to day. On the 14th of July, when it was first visited, there were three harems, aggregating 78 cows and about 125 pups on the flat above the slide. In the slide itself there were four other harems with over 100 cows. During the past season no cows or pups appeared above the slide and the three bulls which marked the place of the harems last year remained idle throughout the whole season. The four harems in the slide itself were reduced to three very small ones of a few cows each, the greatest number actually seen being from 10 to 12. The harems recorded in our preliminary report as A, B, C, and E were wholly gone, not a cow appearing in any of them.

In 1892, Mr. Macoun, of the British commission, tells us there were more than 300 cows on the now deserted flat at the head of Ardiguen. This example of abandonment of breeding territory was in 1897 particularly striking because of the frequency of the observations made upon it.

Another example almost equally striking was seen on Gorbach rookery, in the vicinity of Old John's Rock. This rock could not be reached last year in the height of the season, because of the idle bulls about it, and the presence of a large harem at its foot. This year it could be used as an observation point at all times, and at no time did the cows reach within 100 feet of the rock.

The cliff of Lukanin rookery, a place of observation much visited in 1896, furnishes another illustration. The cliff is broken into several sections by slides and runways. In each of the three runways last year large harems were located which overflowed on the surface above later in the season. This year no harems whatever were found in these runways in the breeding season. On all rookeries visited frequently both seasons, similar instances of abandonment were noticed.

SHRUNKEN APPEARANCE OF MASSES OF ROOKERIES.

More noticeable, though less definite, was the shrunken appearance of all the massed portions of the rookeries. On the sand flat of Tolstoi, for example, the seals were much less dense in 1897, and occupied only about one-half of the territory covered in 1896. The breeding seals were crowded at the eastern end of the sand flat in a wedge-shaped mass, reaching to the foot of the rocky slope by the nearest route, and extending up it in a narrow band. For the greater part of its surface the slope was unoccupied.

FALLING OFF IN NUMBER OF DEAD PUPS.

No better evidence of the shrunken condition of the herd on Tolstoi rookery can be desired than the count of dead pups. Where 1,495 were found last year, there were only 593 in 1897. The conditions which produce the mortality in this particular locality have to do directly with the crowding of seals; the fewer there are, the less will be found dead. The same decrease in dead pups was noted on all other crowded rookery spaces, as on Zapadni, Gorbach, and the Reef, and it was due to the same cause, namely, the thinning out of the breeding seals, which avoid, whenever possible, the flat and sandy areas.

OTHER EVIDENCES OF DECLINE.

The decline in the breeding herd manifested itself in still another way during the present season. Last year, on such rookeries as Reef, Zapadni, and Vostochni, were large breeding masses which could not be approached or accurately counted even by harems. It was this fact that led to the overestimate of certain parts of these rookeries. This year, however, the fact that no difficulty was experienced in counting these breeding masses plainly shows their scattered and shrunken condition.

During the present season the crosses painted by Mr. Townsend in 1895 were again an evidence of decrease. Where in 1896 the shrinkage from these crosses was given in so many feet, it could be similarly expressed for 1897 in yards.

STRUGGLES AMONG BULLS—MORTALITY AMONG COWS.

A very striking though indirect evidence of decrease in the breeding females is shown by the mortality among the cows. On Reef rookery last year 25 dead cows were counted; this year there were 42. The diminished number of cows had increased the competition among the bulls, and in their struggles more cows were killed. Some of these cows were literally torn to pieces. Two cows were washed ashore from Lagoon rookery which had died from being bitten by bulls. On Lukanin rookery a cow was actually seen being torn to pieces by the bulls. Everywhere the stealing of cows was more extensive than last year, and the number of cows showing cuts and gashes was very large. These conditions were plainly the result of the presence of bulls, this year idle, which had harems last year and were rendered furious by their failure to get them this year. Their actions were in marked contrast to those of the ordinary idle bulls which have yet to form harems.

THE QUOTA OF KILLABLE SEALS.

FURTHER EVIDENCE OF SHRINKAGE.

Further evidence of shrinkage in the breeding herd is found in the quota of killable seals. The breeding rookeries are affected by causes which act upon the yearly accession of three-year-old cows; and since whatever affects the three-year-olds as a class affects also the males of the same age, the condition of the quota becomes an index of the state of the herd. The quota of the year is made up practically of three-year-old bachelors. Some two-year-olds are killed, and some four-year-olds, but the majority of those taken each year are three-year-olds.

Last year the hauling grounds of the Pribilof Islands yielded 30,000 killable seals. During the present season a quota of 20,890 only could be taken. To get these it was necessary to drive more frequently and cull the animals more closely than has been done since 1889. The killing season was closed on July 27, in 1896. This year it was extended on St. Paul to the 7th of August, and on St. George to August 11. The quota to be taken was left to our discretion, and every opportunity was given the lessees to take the full product of the hauling grounds. Notwithstanding all their efforts, the quota of 1897 shows a decrease of 30 per cent in the class of killable seals, and when we take into account the increased number of drives and the extension of the times of driving, the difference between the two seasons is even greater.

The following table of statistics relating to the quota of 1897 indicates clearly the conditions under which it was taken:

Statistics of killings.

ST. PAUL.

Date.	Rookery.	Animals killed.	Rejected. ^a		Percent- age killed.	Weight of skins. ^b
			Large.	Small.		
1897.	Food skins (fall of 1896 and spring of 1897).	1,701				Pounds.
June 15	Reef	492	144	119	65	
18	Zapadni	316	130	26	67	9
23	Zolotoi, Reef, and Lukanin	708	556	184	48	7.7
26	Tolstoi, Middle Hill, and English Bay	1,098	402	214	64	7.4
30	Northeast Point	790	376	214	57	7
July 1	do	703	288	224	58	
2	Lukanin	208	107	90	53	7.7
5	Reef and Zolotoi	703	229	175	63	7.8
6	Tolstoi, Middle Hill, and English Bay	1,230	301	306	67	7.6
8	Northeast Point	1,713	355	551	65	
9	Polovina	456	97	115	68	7.5
12	Reef and Lukanin	804	140	638	50	
14	Northeast Point	1,249	216	661	58	
16	Zapadni	886	391	586	53	7.8
17	Middle Hill and English Bay	297	180	412	66	8
19	Lukanin, Zolotoi, and Reef	988	377	1,174	39	7
22	Northeast Point	1,322	500	2,047	34	
23	Polovina	274	161	698	24	8.5
24	Lukanin and Reef	526	352	1,380	23	7.4
26	Zapadni	514	491	540	27	8.3
27	Tolstoi and Middle Hill	199	221	595	20	
29	Northeast Point	268	298	1,114	16	
30	do	276	383	708	20	
31	Polovina	108	118	456	16	7.9
Aug. 2	Reef and Lukanin	418	350	1,440	19	8
5	Middle Hill, and English Bay	101	159	376	15	7.7
7	Reef	172	200	486	20	7
	Total	18,520				

ST. GEORGE.

1897.	Food skins (fall of 1896 and spring of 1897).	228				
June 16	East	150	93	159	36	
19-24	Food skins	10				
25	Zapadni	140	74	192	34	
July	Food skins	2				
3	Staraya Artel	70	21	330	16	
3	Food skins	4				
7	East	227	41	741	22	
8-10	Food skins	6				
13	North and Staraya Artel	253	54	645	26	7.5
16	East	209	34	690	22	7
17	Food skins	4				
19	Zapadni	104	71	563	13	
22	East, North, and Staraya Artel	391	82	1,620	18	7.3
24-31	Food skins	10				
Aug. 2	East	179	47	902	16	
4	North and Staraya Artel	153	23	725	16	
5-9	Food skins	6				
10	East, North, and Staraya Artel	207	87	1,343	12	
11	Food skins	17				
	Total	2,370				

RECAPITULATION.

St. Paul Island	18,520
St. George Island	2,370
Total	c 20,890

^a The total number of animals rejected during the season can not be taken as indicating the number of bachelors not of killable age left, as many of these were driven several times and many of the younger seals doubtless do not come to the islands at all in the killing season.

^b The weight here given is that of 100 skins weighed in lots of 10 each.

^c This includes all animals killed. The skins of 131 animals were rejected by the lessees.

In contrast with these figures for 1897 may be cited those of 1896 in so far as they were kept. As the killing season was far advanced when we arrived last year at the islands, the data for that season are incomplete except for the actual number killed. The following are the figures:

ST. PAUL ISLAND.

Date.	Rookery.	Animals killed.	Rejected.		Percentage killed.
			Large.	Small.	
1896.					
	Food skins (fall of 1895)	929			
	Food skins (spring of 1896)	384			
June 19	Zolotoi	283			
20	Watchmen	2			
23	Northeast Point	1,414			
24	do	1,408			
27	Reef	2,076			
29	English Bay, Middle Hill, Tolstoi	1,398			
July 2	Northeast Point	1,396			
3	do	1,109			
6	Zolotoi, Lukanin	1,535			
7	Zapadni	784			
8	Polovina	961			
10	Reef, Zolotoi	1,271			
13	Northeast Point	1,045			
14	do	1,169			
15	Reef, Zolotoi	849	548	522	44
16	Tolstoi, Middle Hill, English Bay	1,138	279	1,038	46
21	Northeast Point	803	811	637	35
22	do	1,047			
23	Polovina	585	313	344	47
25	Lukanin, Kitovi, Zolotoi, Reef	1,630	1,008	1,177	42
27	Middle Hill, Tolstoi, Lukanin	621	457	137	53
	Total	23,842			

ST. GEORGE ISLAND.

1896.					
	Food skins (fall of 1895)	166			
	Food skins (spring of 1896)	161			
June 19	East	576			32
24	Zapadni	568			76
26	North and Staraya Artil	999			72
29	East	804			62
July 2	Zapadni	333			68
6	North and Staraya Artil	700			56
7	East and Little East	614			57
9	Zapadni	221	64	265	40
13	North and Staraya Artil	487			46
21	East	221			27
24	North and Staraya Artil	308			17
	Total	6,163			

RECAPITULATION.

St. Paul Island	23,842
St. George Island	6,163
Total	30,005

It will be seen from a study of these figures that the lowest percentage of seals killed in any drive on St. Paul Island in 1896 was 35; during the present season it reached as low as 15 per cent. The gradual fall in the percentage of animals killed does not represent a decrease in the number of animals driven. It means simply that the seals of killable age in the latter part of the season began to be outnumbered by the younger seals which arrive at the islands in the latter part of July. In the earlier drives of the season the older bachelors are in the majority and consequently the greater proportion of the animals driven are killed. Later in the season the drives are larger and more seals are killed, but because of the excess of yearlings and 2-year-olds the percentage is very much smaller.

^a Five of these skins were rejected.

REDUCTION IN KILLABLE SEALS NOT AN ACTUAL MEASURE OF DECREASE.

The reduction in killable seals for 1897, while proving a large decrease in the herd as a whole, can not be taken as an actual measure of such decrease. The normal quota is made up of 3-year-old seals, but some large 2-year-olds and small 4-year-olds are regularly included. In 1896 the number of 2-year-olds taken was unusually large. This anticipated to some extent the quota of 1897. At the same time, however, it was evident that in 1896 a certain number of killable seals were still left over after the quota was filled. In the comparison of the quotas of the two years these two elements must be taken into account. It is impossible to say how nearly they balance each other, but in our judgment they practically do so.

The difference of 30 per cent in killable seals for 1897 may be slightly abnormal, but that the decrease in this class from 1896 should be greater than that in the breeding herd for the same period is reasonable when we take into account the fact that the *modus vivendi* protected in some measure the pups of 1893, whereas the pups of 1894, from which the killable seals of this year were taken as a class, felt the full effects of the resumption of pelagic sealing in Bering Sea in that year.

LAND KILLING AND THE DECLINE.

NO CONNECTION WITH THE DECLINE OF THE HERD.

The investigations of the present season have only served to confirm the conclusion reached last year, that killing, as practiced on land, has no connection whatever with the decline of the herd. Such killing is and has been for half a century confined to superfluous males, whose removal is a benefit rather than an injury. It would have been better for the herd if land killing had not been limited by the *modus vivendi*. The rookeries to-day are overstocked with adult bulls, which in their struggles to gain possession of the females tear them to pieces and trample their offspring.

The only way in which land killing could injuriously affect the herd is through a reduction of the male life to a point below that required for propagation. The records of the islands show that there was never anything approaching a dearth of breeding bulls on the rookeries. The mere fact that for fourteen years after the islands came into the possession of the United States approximately 100,000 seals were taken each year without difficulty shows that the usual birthrate was maintained. That land killing was not connected with the decline of the herd at its beginning, about the years 1882-1885, may reasonably be inferred from the fact that in the years 1876-77 only 175,000 males were killed, whereas the total for 1875 and 1878 was 215,000, and for the five years preceding and succeeding a like proportionate number was taken.¹ The 40,000 males thus saved out in 1876-77 were of breeding age in 1882 and were still in their prime in 1885 and the subsequent years of decline.

NUMBERS OF MALES SPARED.

Again, it is impossible to connect land killing with the greatest intensity of the decline in the years 1888-89 and subsequent years. In the years 1882-83 25,000 less males were killed than in 1881 and 1884, or for five years before and after. These males, three years old in 1883, were ready to enter the rookeries in 1887 and were still in their prime in 1890. These were voluntary contractions of the quota for commercial reasons, and would have abundantly stocked the rookeries had no males been reserved from year to year, as was the case. It is, indeed, to be doubted whether at any time the killing on the islands could by any possibility be made close enough to endanger the supply of bulls. There are certain inaccessible hauling grounds, as Sivutch Rock, Otter Island, Zapadni Head, and Lagoon, from which bachelors are never driven, and which are in themselves probably sufficient to supply the necessary increment of bulls from year to year. There are, moreover, beyond doubt, many bachelors whose arrival is so late or whose stay is so short that they would escape from any danger of a drive. It is, in fact, by no means certain that all the bachelors actually visit the islands each year.

CONTRAST BETWEEN BERING ISLAND AND THE PRIBILOFS.

It is furthermore only necessary to contrast the conditions on Bering Island as described by Dr. Stejneger in Appendix II of this report with the history of the

¹ This includes pups taken for food in the fall.

rookeries of the Pribilof Islands to see the absurdity of any claim that land killing could have affected the latter herd. The islands are at present grossly overstocked with bulls, and yet the average size of the harem is about 30 cows. There is no reason to believe that a bull can not take care of 200 cows, and the actual condition of South rookery of Bering Island shows that such is the case.

With reference to the relation of land killing to the fur-seal herd, the accompanying table of statistics regarding land and sea killing from the Pribilof Island herd is pertinent. It gives the date at which the quota was each year filled, the number of hauling grounds from which seals were driven, the number of drives, and the total number of males killed for all purposes on both islands. These data are taken from the official records of the islands. Joined with the statistics for land killing is a table showing the yearly pelagic catch. A study of the record of the two catches will not only show that land killing is free from responsibility for the decline of the herd, but also that killing at sea is directly responsible for the decline.

Statistics regarding land and sea killing, 1871-1897.

Year.	Date quota filled. <i>a</i>	Hauling grounds driven. <i>a</i>	Number of drives. <i>a</i>	Killed on land. <i>b</i>	Killed at sea.
1871	July 28	46	43	102,960	16,911
1872	July 25	43	30	108,819	5,336
1873	July 24	51	37	109,177	5,229
1874	July 17	61	41	110,585	5,873
1875	July 16	55	37	106,460	5,033
1876	Aug. 1 ^c	36	30	94,657	5,515
1877	July 14	44	32	84,310	5,210
1878	July 18	54	35	109,323	5,544
1879	July 16	71	36	110,411	8,557
1880	July 17	78	38	105,718	8,418
1881	July 20	99	34	105,063	10,382
1882	do	86	36	99,812	15,551
1883	July 19	81	39	79,509	16,557
1884	July 21	101	42	105,434	16,971
1885	July 27	106	63	105,024	23,040
1886	July 26	117	74	104,521	28,494
1887	July 24	101	66	105,760	30,628
1888	July 27	102	73	103,304	28,189
1889	July 31	110	74	102,617	29,858
1890	July 20 ^d	87	55	28,059	40,814
1891	(e)	(e)	(e)	12,040	59,568
1892	(e)	(e)	(e)	7,511	46,642
1893	(e)	(e)	(e)	7,396	30,812
1894	Aug. 4	-----	-----	16,270	61,838
1895	July 27	-----	-----	14,846	56,291
1896	do	31	21	28,964	43,917
1897	Aug. 7	42	27	20,890	f25,079

a These figures refer to the hauling grounds of St. Paul.

b These totals include all males killed for any purpose on the islands.

c In 1876 the killing was begun at an unusual date, said to be on account of an exceptionally late season.

d Closed by order of the agent in charge.

e Years of the *modus vivendi*.

f As reported to date.

From this table we find that the herd was in a state of comparative equilibrium from 1871 to about 1884. From 1874 to the latter date the normal quota was filled before the 20th of July with a more or less even average number of drives. From 1885 on the date at which the quota could be filled was steadily retarded, an increased number of hauling grounds were driven, and an increased number of drives made, until the collapse of the bachelor herds came in 1890.

If we examine the column giving the record of pelagic sealing, we find that up to 1881 the pelagic catch was very small, ranging about 5,000, rising slightly in the last two years. The period of apparent equilibrium, as shown by the history of the land catch, was balanced by a corresponding equilibrium in the catch at sea. From 1881, when the sea catch rose steadily, there began to be felt difficulty in filling the quota. It was maintained at its full measure of 100,000 until 1889, at first by closer killing and finally by killing younger animals. In 1890 the fall to 20,000 came, showing the true condition of the herd.

From this table it will be plain that with the trebling of the pelagic catch in 1882 and its subsequent steady increase we have the cause of the equally steady decline in the fur-seal herd. The figures relating to land killing show with equal clearness that land killing can not be connected with the decline. In fact, it can

not be too strongly emphasized that no action which has been taken on the Pribilof Islands since 1870 has been in any appreciable degree a factor in the reduction of the herd. For this reduction neither the United States Government nor the lessees of the islands have been in any degree directly or indirectly responsible.

THE CAUSE OF THE DECLINE.

PELAGIC SEALING THE SOLE CAUSE.

The sole cause of the decline of the fur-seal herd is found in pelagic sealing. This conclusion was reached last year, and a reconsideration of all of the questions involved gives no occasion to alter or modify it. The investigations of the season of 1897 only strengthens it. Pelagic sealing involves the indiscriminate killing of males and females, the latter forming at all times the greater part of the pelagic catch. When we take into account the loss of the herd through old age and the small percentage of young which survive to breeding age, we find the margin of increase in the herd to be very small. The killing of females to any degree in excess of the annual increment of three-year-old breeders must cause decline. Under pelagic sealing this increment has at all times since 1885 been vastly exceeded.

EFFECTS OF PELAGIC SEALING ON THE HERD.

Pelagic sealing in its effect on the herd acts in two ways. Directly, it reduces the number of breeding females by killing them at sea; indirectly, it reduces the number of three-year-old breeders to return each year to the rookeries by starving them as pups or destroying them unborn with their mothers.

The decline on the rookeries and hauling grounds between 1896 and 1897 has been intensified by the large pelagic catch made in Bering Sea during the summer of 1894 on the resumption, under the Paris award, of pelagic sealing after the *modus vivendi* of 1892-93. In 1893 seals were of course taken off the northwest coast, as usual, but none were taken in Bering Sea. No pups, therefore, starved to death in the summer of 1893. The pups so spared appeared as three-year-olds on the breeding and hauling grounds in 1896, swelling to some extent the number of killable seals as well as of young breeders.

During the summer of 1894, however, the largest pelagic catch on record was made. A smaller number of pups was born, and many of these starved to death. These were wanting upon the hauling grounds and breeding grounds in 1897. The result has been the marked reduction in killable seals and in the three-year-old cows. The latter were notably fewer in numbers than in 1896.

HIGH PROPORTION OF FEMALES IN PELAGIC CATCH.

Knowing the pelagic catch and the proportion of females which it contains, it is possible for us to put the results of pelagic sealing into definite form. During August and September, 1896, there were taken in Bering Sea 29,500 seals of both sexes. The reports of the expert examination of skins brought to American ports show 75 per cent to be females. Mr. Andrew Halkett, who spent the summer in Bering Sea on board the *Dora Siewerd*, making investigations for the Canadian Government, found a percentage of 84.2. This high proportion of females in the pelagic catch is further corroborated¹ by the expert examination of pelagic skins in the London market.

Taking the average of the available estimates, we find that under present conditions about 80 per cent of the pelagic catch in Bering Sea are females. This percentage, applied to the actual catch of 29,500, gives a total of 23,600 female fur seals actually killed and secured in Bering Sea. When, as in 1894 and 1895, the land killing was abnormally reduced, the percentage of males in the catch at sea becomes, of course, greater. To all computations based on the recorded pelagic catch must be added a considerable, though undetermined, number of animals killed but not recovered. In addition to the number of seals killed in Bering Sea, 8,422 were taken off the northwest coast in the spring of 1897, of which about 93 per cent,² or 7,834, were females. A certain number of the females killed in each case were composed of yearlings and two-year-olds which have not yet bred, and of adults which had lost their pups. We may balance these two classes off against the undetermined loss through animals killed or wounded and not recovered. We have therefore a total of 31,434 breeding females lost to the herd since the date of our census of 1896.

¹ See affidavits of London furriers, Appendix V.

² As shown by the custom-house inspection of the catch of American vessels.

LOSS THROUGH PUPS STARVED IN 1894.

Of the indirect loss which the herd has this year felt through the absence of pups starved in 1894, exact figures can not be given, but they can be approximated. We know from a study of the quota that the percentage of animals reaching the age of three years has been of late, under ordinary conditions, about one-third of the number born. There were killed in Bering Sea in the season of 1894 31,000 seals of all classes. Assuming that 80 per cent of these were females, we have a total of 24,000 pups starved. Of these, 8,260 should have returned this year as three-year-olds, one-half to the breeding grounds and one-half to the hauling grounds. Adding 4,130 to the 31,434 already mentioned, we have a total loss of 35,574 breeding females to the rookeries between the seasons of 1896 and 1897.

By the most liberal estimate possible there appeared on the rookeries this year, to offset this loss, not more than 25,000 three-year-old cows. This estimate is based on the quota of killable seals, and makes liberal allowance for two-year-olds killed in 1896. For the number of three-year-old bachelors a corresponding number of females of the same age must each year appear. This calculation therefore shows a net loss of about 10,000 breeding females, or at the very least about 7 per cent of the breeding herd of last year. This takes no note of the loss sustained through death by old age, which must be considerable, and certainly can not be less than ten per cent of the whole number.

These figures are, of course, only approximate, and can not be taken absolutely. They, however, furnish corroborative evidence of decline, and when taken in connection with our actual counts on the rookeries for the two seasons, they fully justify our claim that from 1896 and 1897 there has been a reduction of from 12 to 15 per cent in the fur-seal herd.

PELAGIC SEALING AND THE CONDITION OF THE HERD.

As has already been stated, the decline in the herd from year to year is found in the relation of the losses sustained by the adult females to the gains of this class through the accession of three-year-old females as breeders. The losses through natural causes can only be roughly estimated, but they may be assumed as constant. If females are to be killed at sea or elsewhere, the herd must decline so long as the number killed exceeds the additions to the herd.

The number of animals to return as three-year-olds year by year is, under natural conditions, at present about $33\frac{1}{2}$ per cent of the pups born. One-half of these are females. Thus, of 150,000 pups born in a given year, 75,000 are males and 75,000 females. Of the males about 25,000 return as killable three-year-olds, and of the females 25,000 return as three-year-olds to bear their first pups. In other words, one-sixth of the total number of pups born survive to become breeders.

Let us assume for some year the presence of 180,000 cows. Of these, 150,000 would be old cows and 30,000 cows bearing their first pups, these latter being the remnant of some 90,000 female pups born three years before. We may estimate the herd to have lost about ten per cent from storms, old age, attacks of enemies, and other causes. This is equivalent to the assumption that the average age attained by a female who has once entered the herd will be 13 years, or ten years of breeding life.

There would then have been a gain of 30,000 cows in the year in question and a loss of 18,000, leaving a net gain of 12,000 cows. Under such conditions, with no artificial cause at work, the herd would increase. Or, it would be possible to take out of the herd of 180,000 breeding cows 12,000 without causing a reduction, provided they were taken under conditions which would not cause reduction in the number of pups through starvation. But for practically every cow killed in Bering Sea a pup starves to death. With every cow killed, also, an unborn pup dies. Thus a secondary loss is entailed by the killing of the 12,000 breeding females, which would still cause a decline in the herd. In other words, if we take this secondary loss into account, we find that under the conditions outlined above the number of females that can safely be taken from a herd of 180,000 can not much exceed 8,000. This is $4\frac{1}{2}$ per cent of the total breeding herd, and it represents the danger point, beyond which pelagic sealing or any killing of females cuts into the herd and destroys it by compound interest. If the herd is to grow at all, its loss of females must not exceed about 3 per cent, and the percentage must be progressively lowered, unless means is found for reducing the so called natural losses. These losses have been proportionately greater in the greater herd.

In the herd as estimated at its prime there were not less than 600,000 breeding females. Applying the limit of 3 per cent above found, this would permit of the killing of 18,000 females. It is probable that under the crowded conditions of the

rookeries in those days even this per cent was too great. By referring to the pelagic catch we find that in 1882 it numbered 15,500 animals actually taken, but as in the early days many more seals were killed than were secured, this number is too small. Without, however, attempting to estimate the actual loss, we see that it could easily have been more than the herd could bear. Under it and with its steady increase the equilibrium was broken and the decline began, increasing in rapidity until 1890, when the pelagic catch equalled 10 per cent of the original number of females, though we have every reason to believe that at that time the herd had diminished by at least one-half.

FUTURE DECLINE OF THE HERD.

For the year 1898 there will be a still further accentuation of the decline of the herd through the after effects of pelagic sealing, and the decrease in the breeding herd will continue whether pelagic sealing does or does not go on. The reduced catch made by the much smaller fleet of the present season will diminish the direct loss through the death of breeding females. But in addition to this there will be the loss of pups starved in 1895 and of unborn pups killed with pregnant females during the summer of 1894 and the spring of 1895, for every adult female killed at sea is pregnant, and those killed in Bering Sea, for the most part, leave dependent pups to starve.

Thus the effects of pelagic sealing must continue to be felt for three years after the industry itself had ceased to exist. If pelagic sealing were to be at once suspended, through the starvation of pups this fall and through the death of unborn pups last fall and this spring, the rookeries must continue to shrink until 1900 or 1901.

THE FATE OF PELAGIC SEALING.

The relation of pelagic sealing to the fate of the fur-seal herd has already been discussed. It is clear that through its operations the fur-seal herd has been commercially ruined. With its continuance the herd must soon approximate, though, of course, not actually reach, biological extermination.

It is worth while, also, in this connection to note the effect of the pelagic-sealing industry on itself. The following tabulation of the pelagic catches from the Pribilof herd since 1894 will clearly show the waning condition of pelagic sealing:

Pelagic catches, 1894-1897.

	North-west coast.	Bering Sea.
1894	24,101	31,585
1895	12,122	^a 44,169
1896	14,417	29,500
1897	8,422	16,657

^a In 1895 there were 59 vessels engaged in sealing, as against 37 in 1894.

The fact that scarcely one-half the pelagic fleet of 1896 entered the seas in 1897 shows on the face of it that the industry had already in 1896 ceased to be profitable. Such a result is a necessary outcome of the fact that as an industry it destroys its own capital. If pelagic sealing continues, more vessels will doubtless withdraw from the business, but a diminished fleet will work upon a diminished herd and the result will continue to be disastrous to the fur seals.

MORTALITY AMONG NURSING PUPS.

GREAT MORTALITY PRIOR TO AUGUST 1.

During the season of 1896 our investigations showed that there was a very great mortality among the nursing pups prior to the 1st of August. At the time when this discovery was made the cause of death had practically ceased to exist and the great mass of the dead were too far decomposed to make it possible to examine them. Such bodies as were still in condition were dissected, and the immediate cause of death in many cases was found to be trampling. The mortality being greatest on those level, sandy areas where the seals were most thickly massed and the greatest amount of fighting observed, the trampling of bulls was ascribed as a general cause for the death of pups prior to the 1st of August.

DEATHS DUE TO PARASITIC WORM.

Profiting by our experience of last year, however, this mortality was reinvestigated this year from its beginning, in the height of the season, and found to be due in large measure not to trampling, but to the ravages of a parasitic worm, especially infesting the sandy areas which were last year designated as "death-traps." The conditions favorable for the development of the worm are identical with those favorable for the trampling of pups. As a matter of fact, the pup which is weakened by the worm falls victim to the trampling feet of the bulls and cows where its more healthy and active companions escape. Thus the two causes of death interact and promote one another. The worm, however, is beyond question the chief source of death, and death from trampling is doubtless mainly confined to very young pups.

The subject of mortality among the fur-seal pups was specially investigated by Mr. Lucas, and in Appendix II of this report will be found a detailed account of his work. It is only necessary here to point out in this connection that the finding of this cause of death among the pups adds no new complication to the question. Like trampling and other natural causes of death, it has been at work throughout the history of the herd. It represents, together with the losses to which the young seals are subjected at sea, the check which prevented the indefinite increase of the fur-seal herd in the days of its prosperity. As a cause of loss it acted with greater force when the herd was larger. It has diminished year by year with the decline of the herd. This year the infected rookery grounds were so thinly populated that the deaths from this cause were reduced to less than one-half the number in 1896, as the following list of the rookeries counted will show:

Dead pups August 10.

Rookery.	1896.	1897.
Tolstoi Sand Flat and adjacent beach.....	1,495	503
Zapadni Gullies and adjacent beaches.....	1,314	689
Gorbatch.....	712	382
Reef.....	950	642

For this shrinkage of deaths on the massed rookeries there was no corresponding reduction on the rocky beaches. There conditions were normal and the percentage of loss remained practically the same. On the infected grounds the deaths were in proportion to the crowded condition of the rookeries. Under normal condition, such as rocky breeding grounds represent, the deaths are due to accidental causes, and naturally do not vary much from year to year.

RECOMMENDED TREATMENT OF INFECTED AREAS.

Last year, on the supposition that the mortality was caused chiefly by trampling, we recommended that the open and flat rookeries be covered with bowlders. This should still be done, but the sand should, wherever possible, be washed away and the covering of rocks should be complete enough to be a virtual floor over the infected areas. As will be seen from Colonel Murray's statement in Appendix III of this report, an important beginning has been made in this direction during the present season. By the breaking up of the rocks and by the use of dynamite more can be done.

Perhaps the most effective measure of all in the treatment of the "death-traps" would be to fence the seals away from them. The animals show a desire to avoid these places, but they have little choice in the matter. With the herd increased in size the occupation of the entire sand flat of Tolstoi is a matter of necessity. The ground above and behind this, however, is suitable for rookery purposes, and if in some way the sand flat can be broken up or shut off the seals will seek the better ground. During the past year but few seals occupied the sand flat. The bowlder beach was ample for the great mass of them. On the part of the sand flat occupied the death rate of pups was quite as great as last year, but the space occupied was but a fraction of the whole.

PERCENTAGE OF DEATHS FROM UNCINARIA.

It is probable that the number of pups dying of *Uncinaria* in 1896 was from 7 to 10 per cent of the whole number born. In 1897 it was about 5 to 7 per cent. This loss, taken in connection with other natural losses, only demonstrates the low margin of natural increase in the herd and emphasizes more clearly the disastrous effects of the added artificial source of loss which pelagic sealing entails.

THE STARVATION OF PUPS.

SPECIAL STUDY IN 1896.

During the season of 1896 the starvation of pups as a result of the death of their mothers at sea was made the subject of special study as late as the 20th of October. A count of the pups which starved to death in that season was made about October 1, and a total of 16,000 found. This count was made under unfavorable conditions in that it was necessary to recount in October the early dead pups and deduct them from the total then found. It was impossible to estimate accurately how many of the early dead had become unrecognizable. There was reason to believe that on St. George Island none remained, the foxes having eaten them all. At the same time the total estimate of 16,000 represented an actual minimum, and was sufficiently large to demonstrate the evil effects of pelagic sealing.

INVESTIGATIONS OF 1897.

During the season of 1897 an effort was made to get more satisfactory results in the counting of starved pups, and accordingly all the dead pups to be found on Kitovi and Lukanin rookeries were carefully gathered up on August 12 and removed. On the 15th of October these rookeries were again counted, and a total of 1,057 dead pups were found. A preliminary count made on August 25 shows that the deaths from starvation up to that time had not been great. The great majority died in September. This is as was to be expected. Pelagic sealing begins August 1, and it takes from two weeks to a month, according to its age, to starve a pup. Pelagic sealing ceases about the middle of September, and by the middle of October all pups whose mothers have been killed during the season have died.

There were, in round numbers, about 9,500 pups born on Kitovi and Lukanin rookeries. The number of starved pups (1,057) was therefore about 11 per cent of the number born. Applying this percentage to the total pups born on the two islands, the number starved to death the present season must have been about 14,000. In 1896 Mr. Andrew Halkett found a percentage of 84.2 females in the pelagic catch in Bering Sea. From the closer killing of males in 1897 we have good reason to believe that the percentage for this season was even greater. The percentage of females in the northwest catch this spring was itself 93. Placing the percentage of females taken in Bering Sea for 1897 at 90, we have 15,000 females killed. Allowing for the fact that some had already lost their pups from natural causes and that a few were too young to have borne pups, but also remembering that a certain proportion of the seals killed at sea are not secured, we find that the estimate of 14,000 starved pups for the season of 1897 fully satisfies the conditions of the problem, and is in turn accounted for by the known loss of mothers.

Having in mind these very definite figures for the season of 1897, we can at once determine the inadequacy of our estimate for 1896. There were taken in Bering Sea in August and September, 1896, 29,500 seals, of which, using Mr. Halkett's percentage, 24,700 were females; and this figure less the number of immature cows and those whose pups had died from natural causes, rather than the count of 16,000, should represent the actual number of pups which starved to death in 1896. Or, taking the double proportion of the total number killed at sea and the total number born in 1896, we find that the total number starved on Lukanin and Kitovi in 1896 should have been about 1,576, instead of 943, as counted and estimated. For the two islands this would give about 22,000 instead of 16,000. It is in any case perfectly clear that the assumption made by Clark and Macoun in 1896 that 20 per cent of the early dead had been lost or obliterated before the late counts at the 1st of October were made is far short of the truth. This is made clear also by a study of the fate of the dead bodies under the attacks of the gulls and foxes and of the elements themselves.

It is worthy of note in this connection that Dr. Stejneger (see Appendix II) found late in the season of 1897 a considerable mortality from starvation among the pups on Bering Island. In the portion of North rookery which he counted on September 27, he found 572 which had plainly died from this cause. He was prevented from making a full investigation of the subject, but the result of the partial count is sufficient to show there, as on the Pribilof Islands, the destructive effects of pelagic sealing.

EVERY MOTHERLESS PUP STARVES.

It is not necessary to dwell here upon the dependence of the unweaned pup upon its mother. The killing of more than a score of pups in 1896 at intervals during the months of September and October clearly demonstrated the fact that the pups

subsist solely upon their mothers' milk as late at least as the 20th of October, when the last observations by the Commission were made. The continued observations of Chief Agent Crowley in the month of November and until the final departure of the pups the first week of December showed that during all this time the cows nursed their pups regularly, and the stomachs of pups killed as late as the 5th of December contained nothing but milk. Under such circumstances it is impossible to conclude otherwise than that every pup whose mother dies before it is weaned must starve to death.

As the starvation of pups in 1894 manifested itself in the depleted numbers of killable seals and young breeders during the season of 1897, so the 14,000 pups starved to death in 1897 will inflict additional loss upon the hauling and breeding grounds in 1900.

THE REGULATIONS OF THE PARIS AWARD.

A reconsideration of the entire subject affords no reason for changing what was said last year concerning the utter inadequacy of the regulations of the Paris award to fulfill their avowed purpose, the "protection and preservation" of the fur-seal herd. This year discloses, through the dearth of killable seals and young breeders caused by their destruction as pups in 1894 and 1895, even more plainly than last year the disastrous effects of the resumption of pelagic sealing under the award. During the present season the pelagic fleet has been largely reduced because of the unprofitableness of the business in 1896. At the same time upwards of 14,000 breeding females and their dependent pups have been destroyed, and there is no possibility that under the regulations the destruction can be stayed until the herd is reduced to the equilibrium of utter insignificance. As the regulations are helpless to prevent the decline of the herd, so are they naturally helpless to bring about its restoration.

THE BRANDING OF PUPS.

The work of branding pups was left in charge of Col. Joseph Murray, chief agent on the islands, who last year, as an assistant to the commission, inaugurated the work. Colonel Murray began the work of branding early in September on St. Paul Island, and working parts of six days was able to brand 5,371 pups and 118 cows. During the same period Mr. James Judge, agent in charge of St. George Island, branded 1,880 pups on that island. In all, therefore, there were branded on the Pribilof Islands in the season of 1897, 7,251 pups and 118 adult cows.

A full account of the work of branding is given in Colonel Murray's report, which appears in Appendix III. The practical experience of Colonel Murray in the handling of cattle on the plains of Colorado gives added weight to his opinions on the branding and herding of the seals. In his judgment both plans are entirely feasible, and would, if carried to their logical conclusion, furnish the solution of the whole fur-seal question.

METHOD OF BRANDING.

The method of branding used this year, as last, was the red-hot iron, heated on a portable forge. It was desired this season to make experiments in the use of an electrical cautery, and a machine for this purpose was taken to the islands by Mr. Elmer E. Farmer, instructor in electrical engineering in Stanford University. A preliminary test of the apparatus proved that too little power was provided for, the density and oiliness of the fur of the seal making greater demands upon the current than did the fur of the cats and dogs upon which the experiments in constructing the apparatus had been made.

The defect in this regard was in great measure removed by the application of additional power, but the apparatus being not quite perfect, it was set aside by Colonel Murray, and the irons, which he had tested and with which he was thoroughly familiar, were used instead.

The tests of the electrical cautery were, however, sufficient to demonstrate the entire feasibility of the use of electricity in the work of branding. Should it become necessary to make the branding general, the electrical apparatus should be perfected. The advantage of the cautery over the iron is evident and great. By its means the extent of the burning can be more readily controlled, a greater variety of marks can be made, and the operation is practically painless.

EFFECTIVENESS OF BRANDING.

Of the effectiveness of branding to destroy the value of the skin without injury to the animals we had abundant proof before leaving the islands. Eleven adult

females were branded last season, and during the summer of 1897 five of them were seen on the rookeries in good condition and with pups. The brands were perfectly distinct. There was no replacement of the fur and the animals gave no evidence of having been adversely affected.

None of the branded yearlings were seen by us, as they had not before our departure begun to arrive in numbers at the islands. A branded skin, however, was taken by the Aleuts during the winter at Akun Island. It was obtained by us and tanned for preservation. Later in the season Colonel Murray reports seeing many of the branded yearlings "hale and hearty" on the rookeries.

The yearling females come late to the islands, after the breeding season is over, and play about among the pups of the year. There is no evidence that in their case any more than in that of the cows has any adverse results followed the branding. As pups they were certainly too young to remember such matters. That the adults returned is abundant proof that branding will not drive the animals away, if, indeed, proof was needed, for no one at all familiar with the habits of the animal has ever supposed that any incident of this kind could affect their natural instincts.

The grade of intelligence of the fur seal is too low to cause it to take note of anything which happens to it. The driving and redriving of the bachelors from the hauling grounds, their culling on the killing field and return to the sea, furnish a conclusive test of the effect of any operation on the seals. If any class of the animals would be disturbed by the treatment accorded them by man, it would be the bachelors.

BRANDED SEALS NOT TAKEN ON ASIATIC SIDE.

It has been claimed during the past season that branded seals were taken on the Asiatic side and that they were animals which had crossed over from the Pribilof Islands. Such a claim is absurd on the face of it, as the herds on the two sides of the ocean do not intermingle, and they belong, in fact, to distinct species or subspecies. See Appendix. But an examination of the catch of the schooner *St. Lawrence*, said to have taken the skins, failed to find them, and the master of the vessel made affidavit that not only had he not taken any branded skins, but he had not even heard of any being taken on the Asiatic side.

If there is any foundation for these rumors it lies in the fact that a certain number of seals have defective spots in their fur. At every killing animals are turned away solely on this account. In some cases the defect is due to a bite which has left a scar in healing, or to some disease which destroys the hair or causes the animals to wear it off by scratching, leaving the brown fur underneath exposed. Several skins of this sort were taken this season, with a view, if possible, to determining the cause of the defect, but no cause for the phenomenon has been yet ascertained.

THE HERDING OF THE BACHELORS.

INCLOSURE OF THE SALT LAGOON.

During the present season the Salt Lagoon, on St. Paul Island, was inclosed with a wire fence,¹ and about the 1st of September the bachelors found on the hauling grounds within reach of the inclosure were driven up and confined within it. The details of this experiment, as well as that of branding, will be found in Colonel Murray's report (Appendix III). It was evidently entirely successful.

The delay in getting the wire fencing landed made it impossible to put the inclosure to much practical use for the present season. During the month of September the bachelors are absent from the islands more constantly than during any other part of the season. The proper time to utilize the lagoon is in the month of August. In the latter half of July the younger males arrive in large numbers. In the closing days of the month they should be driven up daily and confined in the lagoon during the month of August, or as long as they can be retained. Other bodies of water in other parts of St. Paul, as Webster Lake and Lake Anton, may also be fenced. The herding up of these young males to the number of 50,000 to 75,000 during the best month of the sealing season can not fail to affect in an appreciable degree the pelagic catch.

It is also desirable to use this inclosure in the killing season to confine the fur seals rejected from the drives, and to prevent the redriving of those too old or too young to be killed.

¹The wire fence used was that made by the De Kalb Company and was designed for fencing hogs.

What may or may not be done in the future with these two practical experiments in the handling of the fur seals will depend upon the disposition made of the fur-seal question. It is sufficient here to remark that both are entirely feasible, and their combined effect would destroy pelagic sealing.

THE FOOD OF THE FUR SEAL.

FOOD IN BERING SEA.

As the question has been raised as to the probable effect of the fur seals upon the salmon and other fisheries of the west coast, it may be said that the examination of several hundred stomachs shows that the food of the fur seal in Bering Sea consists mainly of squid, Alaskan pollock, and a small, smelt-like fish unknown save through bones obtained from the seals. The squid is of no direct value to man, the pollock has never been taken for economic purposes, and the "seal-fish" never been taken at all by man.

FOOD OFF THE NORTHWEST COAST.

The food of the fur seal off the northwest coast is less perfectly known, but, so far as is known, consists mainly of squid, though salmon, herring, and rockfish are eaten. The feeding grounds of the seals lie for the most part outside the hundred-fathom line, so that it is not likely that they disturb the salmon of the Columbia or other rivers to any appreciable degree. The fact that the most important salmon stream of the Commander Islands is only 7 miles from the largest rookery, and that it has never been affected in the least by the presence of the seals should be proof conclusive that they have no preference for this fish as an article of food.

It may further be added that twenty years ago, when the seals were most abundant, the salmon fisheries were also at their best.

UNWARRANTABLE ASSUMPTIONS.

The charge of destruction to the salmon made against the fur seal is based largely upon the supposed feeding of the sea lions from the Farallones upon this fish in the Bay of San Francisco. The sea lions and hair seals on the seal rocks just south of False Tillamook are in like manner charged with injuring the salmon fishing in the Columbia. It remains to be proven that even the sea lions and hair seal do any very great damage in this way, but if they did this does not prove the case against the fur seals, which do not frequent any shores but the Pribilof Islands.

THE PROPOSED SLAUGHTER OF THE FUR SEALS.

WOULD NOT ACCOMPLISH THE DESIRED END.

Within the past two years it has several times been proposed that we should settle the fur-seal question once for all by the slaughter of the entire herd on its breeding grounds. It is scarcely necessary to point out that this course of action would not accomplish the desired end. As the animals are never all present at one time on the islands, a remnant must be left which would in time revive the herd and with it the whole question. In the meantime every objection which has been urged against pelagic sealing would be justly chargeable against such a slaughter. It would be necessary to lie in wait for the gravid females and kill them as they came on land to give birth to their young or to provide them with nourishment. The young must be slaughtered wantonly or else left to starve. The whole proposition is an abominable one, without a single redeeming feature.

The fur seal is the noblest of all the mammals of the sea. From the naturalist's point of view it is one of the most interesting forms of life on the earth; from a commercial point of view it is one of the most valuable. Unlike the buffalo, the elk, the stag, and like animals, it occupies territory that can not be used for any other purpose. Where the former animals once roamed great cities have since grown up, but the haunts of the fur seal would be deserted for all time if their inhabitants were destroyed.

POSSIBLE RESTORATION OF THE HERD.

Though sadly reduced in numbers, a nucleus of the fur-seal herd is still left. Under favorable conditions it can be restored. The Pribilof herd once yielded 100,000 skins annually, worth \$2,000,000 or more, and without injury to itself. This would represent a cash value of \$25,000,000. If properly protected it will again reach this value. These figures represent a sum too great to be thrown away in childish spite. To slaughter the fur-seal herd ourselves because its

preservation is beset with diplomatic difficulties, in which the fault has not been all on one side, would be a confession of impotence unworthy of a civilized nation. It would transfer to the United States alone and for all time the odium for the destruction of the fur-seal herds.

CONCLUSIONS.

In closing this report we may submit here as a result of the work of the commission during the seasons of 1896 and 1897 the following answers to the propositions suggested as the object of the investigation:

1. The American fur-seal herd is at present about one-fifth its maximum size and is rapidly declining in numbers. It is already commercially ruined; but a nucleus of breeding animals remains which under proper conditions will insure the rehabilitation of the herd.

2. The threatened extermination of the fur-seal herd is solely due to pelagic sealing, which involves the slaughter of gravid and nursing females, with the consequent destruction of their offspring. The imminence of the danger threatening the herd may be judged by the total loss which it has sustained to the present time, and by the fact that its present rate of decline is not less than 12 per cent yearly of its breeding females.

3. The regulations framed under the award of the Paris Tribunal of Arbitration, while affording in the protected zone and the close season some slight advantage to the herd, are wholly ineffective for its protection and preservation. Under their operation the herd has steadily and rapidly declined, and is still declining.

4. To insure the preservation of the fur-seal herd and its ultimate restoration the regulations must be so amended as to prohibit absolutely the killing of females and the traffic in their skins. In other words, they must be made to prohibit pelagic sealing.

APPENDIX I.

REPORT ON DEATH OF PUPS FROM UNCINARIA.¹

By FREDERIC A. LUCAS.

Among the parasites collected in 1896 were a few small nematode worms which were identified by Dr. C. W. Stiles, of the Bureau of Animal Industry, as belonging to the genus *Uncinaria*, a dangerous parasite of the dog and man. Dr. Stiles reported that if this parasite were found to be abundant, it would probably prove dangerous to the seals on densely occupied spots that were favorable to its development.

AUTOPSY OF FIRST PUP SECURED.

In our investigations for 1897 the first pup secured for dissection was obtained from Lukanin rookery on July 24, although it was noted as dead on the 22d. No part of this rookery was crowded, and the dead pup lay on a sandy spot strewn with bowlders. On examination it proved to be fat, and the stomach contained a quantity of milk. There were no bruises and no sign of disease save a slight discoloration of the median part of the small intestine, which might have been due to decomposition. The intestine was, however, slightly nodular or swollen in spots in this discolored area, and on cutting open the nodes the mucous membrane was found to be broken down and the swollen spots filled with mucus and blood. Moreover, in each of these swellings there were a number of *Uncinaria*, the total number in the three feet of intestine affected being large. The flesh was pale, and but little blood, and this thin and watery, present in the heart and large vessels, the indications being clear that death had resulted from loss of blood and general anæmia produced by the attacks of *Uncinaria*.

NUMBER OF PUPS EXAMINED.

From this date until the 4th of September some 345 pups were dissected, revealing the existence of *Uncinaria* in all localities favorable to the disease, and showing that it was by far the most important factor in the natural death rate among pups from known causes whose effects may be determined. I left the islands on the 20th of August, but the dissection of pups was continued most actively by Messrs. Robert E. Snodgrass and Arthur W. Greeley, of Stanford University, up to the date of their departure, September 11.

DURATION OF THE DISEASE.

From our combined observations it would seem that the disease is at its height from July 15 or 20 to August 20, and that it ceases by the 1st of September. In 1896 no pup that had not obviously starved to death was noted after August 22, and in 1897 but two cases of *Uncinaria* were seen after September 1. Up to the 10th of August, at which date the effects of pelagic sealing in the starvation of pups are little felt, the number of deaths from *Uncinaria* exceeds that from all other causes combined; and while many young seals undoubtedly recover, it would seem that in the majority of cases the attack is sufficiently severe to cause death.

While many apparently strong and healthy pups suffer from *Uncinaria*, those dangerously attacked may usually be recognized by their sleepy appearance—the eyes being dull and partly closed—by the unkempt appearance of the coat, and by their lack of vigor. Two of the three blind pups killed for examination were seriously infected with *Uncinaria*, one, which was remarkably strong and active, having reached the stage in which the intestine is thick and white.

* ¹ An abridgment of the fuller discussion prepared for the final report.

SYMPTOMS.

When it is possible to get at the sick pups they are found to lack the spirit and bad temper of healthy animals, allowing themselves to be handled, and apparently enjoying being rubbed. One of the effects of the disease seems to be to make the pups restless and to cause them to wander away from the rookery limits, sometimes to very considerable distances, and it is probable that young seals observed in 1896 and recorded as stragglers were afflicted with a fatal attack of *Uncinaria*.

The blood of animals suffering from *Uncinaria* is small in quantity, deficient in red corpuscles, thin and watery, and in extreme cases will not coagulate. The flesh is anæmic, so much so in typical examples that the cause of death is revealed at the first stroke of the knife. The lungs are pale, and particularly the kidneys. At the same time, while the animals are somewhat flabby, they have every appearance of being well nourished, and unless death has resulted from a combination of *Uncinaria* and starvation, the bodies are enveloped in a thick coat of blubber, death coming before there is time to get thin. Thus the pups which have died from *Uncinaria* can always be told from those which have died from starvation, and the intermediate cases where death has resulted from starvation following an attack of the parasite are also readily recognizable.

RELATIONS BETWEEN THE DISEASE AND CHARACTER OF GROUND.

The sandy areas are not only favorable for the retention and development of the embryos of *Uncinaria*, but favorable to their transmission to the pups, for the reason that the females in lying on or moving over the sand get more or less of it in their coats, and a part of this is swallowed by the nursing pups. So much is sometimes swallowed as to give the milk a slightly grayish cast, the milk being so thick that sand does not settle in it.

On rocky ground the embryos are readily blown or washed off, while on boulder beaches, such as the Lagoon and Zapadni Reef, the embryos are still more readily washed away, and many fall among the crevices of the rocks at the outset and are lost. There is thus much less chance on rocky ground of the embryos being present to adhere to the coats of the female seals, and the animals are also unable to pack as closely together as they do on flat places.

As the damage done by *Uncinaria* bears a direct relation to the character of the ground and the number of seals present, the losses from this cause in past times must have been enormous, although in most places there is little apparent evidence of past destruction. Still, when one stands on the slope above the eastern end of Tolstoi and looks at the sands below, they seem grey with the whitening bones of thousands of pups, covering territory occupied when the rookeries were in their prime, but which has been vacant for at least eight years. The dead pups seen by the British commissioners, in 1891 and 1892, and also by Colonel Murray in the latter year, were the victims of *Uncinaria*.

WHY THE MORTALITY HAS BEEN UNNOTICED.

That this great mortality has gone on year after year practically unnoticed is not so remarkable as it might seem. At the time the deaths are most numerous it is quite out of the question to enter the rookeries, and most of the dead are hidden from view by the dense masses of breeding seals; naturally, also, the more abundant the seals, as in years gone by, the more difficult would it be to examine the breeding grounds. During the height of the season it is impossible to avoid disturbing the seals if the necessary examinations are made, and until 1896 no such examinations were permitted. After the breeding season was over no attention has ever been paid to the rookery grounds. Hence year after year thousands of pups have died and no one has been any the wiser. It is not possible, unless one has actually gone over a rookery foot by foot and counted every dead seal, to realize the actual number of the dead present. Thus, on the sands of Tolstoi, where, during the breeding season of 1896, there appeared to be not over 120 bodies, a complete count showed 1,495; while on the flat portion of Polovina, where 584 dead pups were found. Professor Thompson and myself, on July 23, could see only 8.

Then, too, on many places the bodies of the dead rapidly disintegrate and disappear. Gulls begin the scavenger work, flies and foxes continue it, and rain and wind sweep up what remains; or in the denser portion of the rookery grounds the grinding of hundreds of flippers and the drifting of the sand soon remove all traces of the dead, and in a few months a scattered bone or two, which will serve as playthings for next year's pups, is all that remains to tell the tale.

Now and then, however, some traces of the former destruction of pups comes to light, as in 1896, when a dry October gale swept over St. Paul, removing the sand in places to a considerable depth, laying bare the bones of numberless pups

long buried in the sand flat of Tolstoi. Here, where a short time before only a bone or two was visible, fragments of 336 skulls were counted in a space of 39 by 42 feet.

CESSATION OF PLAGUE.

As previously noted, the plague of *Uncinaria* ceases about the end of August, and its cessation appears to bear a direct relation to the habits of the pups, who by that time pass more or less of their time in the water, where the feces are for the most part voided. The embryos of *Uncinaria*, therefore, pass into the water and perish, instead of falling on the ground, where they may readily be taken up by the seals.

Summary of dissections on St. Paul in 1897, divided into periods of five days.

Date.	Cause of death.						Total.
	Starvation.	Uncinaria.	Uncinaria plus starvation.	Violence.	Sundry.	Unknown.	
July 25.....	2	1		2		1	6
30.....	5	12		3	2		22
Aug. 5.....	15	18	4	2	1		40
10.....	24	33	4	2	1	4	68
15.....	9	7	2				18
20.....	6	13	1			1	21
25.....	25	23	3		1	2	54
30.....	5	3	1				9
Sept. 5.....	86	12	7		1	1	107
Total.....	177	122	22	9	6	9	345

Summary of dissections on Tolstoi between July 28 and September 4.

Date.	Cause of death.					Total.
	Starvation.	Uncinaria.	Starvation plus Uncinaria.	Sundry.	Unknown.	
July 28.....	1	2				3
29.....	2	6		1		9
Aug. 7.....	1	6	1			8
11.....		2	1			3
14.....		6				6
19.....	2	5			1	8
23.....	12	10			2	23
24.....	5	2				7
27.....	5	3	1			9
Sept. 1.....	16	2	3			21
4.....	6		2	2	1	10
Total.....	50	44	8	3	4	109

Summary of dissections by rookeries.

Rookery.	Dates.	Starvation.	Uncinaria.	Starvation plus Uncinaria.	Violence.	Sundry.	Unknown.	Total.
Vostochni	Aug. 6	3	5	2				10
Polovina	July 31	2	5	1		1		10
Lukanin	July 24, 25, 26; Aug. 1, 12	3	4	3	2			12
Kitovi	July 26; Aug. 3, 12, 14	10	6	1				17
Reef	July 19, 27; Aug. 2, 5, 9, 16; Sept. 1	42	10	2	3			53
Gorbatch	Aug. 4, 16; Sept. 1	16	14	1	1		1	33
Lagoon	Aug. 2	4						4
Tolstoi	July 23, 29; Aug. 7, 11, 14, 19, 23, 24, 27; Sept. 1, 4	50	44	8		3	4	109
Zapadni	July 30; Aug. 7, 24; Sept. 4	47	34	4	2	2	4	93
Total.....		177	122	22	9	6	9	345

Pups containing Uncinaria, but not in sufficient numbers to prove fatal.

Blind and killed for examination.....	3
Trampled.....	2
Starved and killed.....	1
Starved on St. Paul.....	6
Starved on St. George.....	4
====	
<i>Condition of Uncinariated pups.</i>	
Stomach full.....	14
Stomach partly full.....	9
Stomach empty.....	6
====	
Total.....	29

APPENDIX II.

THE ROOKERIES OF THE COMMANDER ISLANDS.¹

By LEONHARD STEJNEGER.

BERING ISLAND NORTH ROOKERY.

This rookery was visited by me twice during the height of the season of 1897, first on July 13 and second on July 16. It was at once evident that the number of females had greatly decreased since I inspected it in 1895. The characteristic outline of the breeding mass had not only disappeared, but there was a general thinness of the ranks and the "massed" patches had shrivelled up to an ominous degree. The best portion is still the western side of the sand, but even here the decrease was noticeable, while to the north of this the density showed the greatest falling off. The "sands" were fringed all around, though on the east side there were now actual breaks in the continuity of the line.

ESTIMATE OF NUMBER OF SEALS ON REEF.

Prof. Thompson, who accompanied me at my first visit, suggested that we make a rough estimate of the number of females actually on the ground, and we consequently counted, independently, a section at the eastern end of the "sands," finding it to contain 600 females and 10 bulls. Estimating that the ground so counted was one-fifteenth of the whole rookery, there were about 9,000 to 10,000 females and about 150 bulls, all told, on this breeding ground.

NUMBER OF SEALS ON KISHOTCHNAYA.

We next went to Kishotchnaya and found a similar state of affairs. There was not a seal above the steep bevel of the beach, and not one on the upper flat shingly portion which I have called the "parade." In 1895 the lateral sections of this rookery extended a considerable distance backward, leaving the middle section bare to the bevel, but all the harems situated there had disappeared in 1897, and the number of harems appeared one-half less. In 1895 I had to keep concealed behind a large stone, so as not to disturb the nearest harems, scarcely 10 yards away. At the time of our visit in 1897 Prof. Thompson stood upright on the top of this rock without the seals on the level even noticing his presence.

A cursory and rather superficial count of the females gave about 600 for the northern and 700 for the southern section of this rookery. Allowing 900 for the middle section, the total was about 2,200 females, certainly a maximum estimate. A subsequent count, on the 16th of July, increased this estimate to about 3,000, including such seals as were seen in the water. The day was an ideal one, and doubtless the maximum number of seals were on the shore.

SOUTH ROOKERY—NUMBER OF PUPS AND FEMALES.

I spent from July 24 to 30 on South rookery in company with Mr. Barrett-Hamilton of the British commission. We undertook a count of the live pups on this rookery, which is small and situated under a cliff affording good facilities for

¹ Condensed from a fuller discussion prepared for the final report.

observation. An average of 7 different counts of this rookery gave 526 pups, which may be accepted as nearly exact. Similar counts of females gave a total of 449, including all seals that were seen in the sea in the vicinity of the rookeries. The average number of females in harems on shore was 236, an average of 9 counts. These latter counts correspond to those made on the Pribilof rookeries, and show practically the same relation of pups to cows actually present.

SUFFICIENCY OF MALES FOR IMPREGNATION.

Only two full-grown bulls and one younger bull attended to the needs of this rookery. Of the grown bulls the larger and apparently the older bull had the greatest attraction in the eyes of the cows, as most of the 526 females belonged to his harem. I do not believe that more than a dozen cows were the legitimate property of the younger bull. Notwithstanding the demands of so great a harem upon the older bull, he was in fit condition to keep the younger bull at a respectful distance as late in the season as July 30. This rookery is said to have had 5 bulls in 1895. It had last year 6. For 526 pups to have been born on this rookery in 1897 the six bulls in 1896 must have been sufficient to impregnate at least 750 cows, as a number of the latter were undoubtedly killed during the pelagic sealing of the fall of 1896 and spring of 1897, besides those perishing from other causes during the winter migrations. This must set definitely at rest any fears that may have been entertained respecting the sufficiency of the male element now doing duty on the North rookery of Bering Island. It also shows how baseless must be the contention that a dearth of male life has been in any way responsible for the decrease of seal life on the Pribilof Islands.

COPPER ISLAND.

Glinka rookeries.—On account of the lack of means of transportation, I was unable to reach the Glinka rookeries until August 20. A detailed and conclusive comparison of these rookeries with their condition in 1895 and 1896 is out of the question, but from such observations as I was able to make I have no hesitation in saying that the year 1897 shows some decrease, though not nearly so great as that on Bering Island. The diminution was particularly observed on the south end of Zapadni rookery; at Palata, where the seals had almost abandoned the brow of the clayey bank; on the north gully at Zapalata, where I noted a falling off both at the western and middle portion of the eastern end, and at Urili Kamen, where the middle portion seems to have disappeared.

DEATH OF PUPS, SOUTH ROOKERY, BERING ISLAND.

Up to the end of our stay at South rookery (July 30) no startling mortality among the pups was visible. Such as had died must have been eaten by the blue foxes. During our stay only 3 dead pups were seen. These were exceedingly emaciated, and this with the characteristic tarry feces clearly showed starvation to be the cause of death. In addition to these, we noticed a few pups weak, as if starving.

GLINKA, COPPER ISLAND.

At Glinka on August 20 I saw a great number of decayed carcasses of young pups, probably a hundred or more, between Zapadni and Sabatcha Dira, which had apparently been dead a long time. Only a few bodies were fresh, and these appeared to have starved. Only a few were seen in a weak condition and one in an advanced state of starvation.

NORTH ROOKERY, BERING ISLAND.

On September 27 I was able to visit for a few hours North rookery, on Bering Island, to study further the mortality of pups. I counted the dead pups which lay in windrows about the "sands," and found 429 comparatively fresh carcasses, and 143 old ones, making in all 572. The fresh pups were rather large, black ones, with a large portion of gray ones. They showed every indication of having starved to death. A few dying gray pups, lean and helpless, crawling about on their bellies, were seen.

Having completed the count of the "sands," I proceeded to count the remaining portion of the rookery, but was stopped by the guard and ordered to leave the rookery, an order which I could not but obey. This is but a repetition of my former experience, twice before reported upon, and emphasizes the strange reluctance the authorities of the Commander Islands have shown at having their side of the seal question properly investigated and elucidated.

So much is certain, however, that there has been in 1897 a considerable mortality among the pups on North rookery of Bering Island, due to starvation.

THE LAND CATCH.

As might be expected, the land catch of the Commander Islands was considerably smaller this year than for the season of 1896, the totals being, respectively, 11,335 and 13,516. The falling off was greatest on the Bering Island rookeries and Karabelni. No decrease in the Glinka rookeries took place, owing to an unusual activity in killing seals from boats at places where no killing was formerly thought possible. The driving, as will be seen from the accompanying tables, was continued throughout August and a part of September. It will be noted that if the killing had been stopped on August 1, the total Commander Island catch would only have been 6,633 skins. Nothing could better illustrate the straits to which these rookeries have come.

Statistics relative to the fiscal catch on the Commander Islands, summer of 1897.

BERING ISLAND DRIVES, NORTH ROOKERY.

No. of drive.	Date (new style).	Locality.	Bachelors.	Cows.	Total.
	1897.				
1	July 12	Sivutchi Kamen.....	60	.....	60
		Reef	186	.....	186
2	July 27	Sivutchi Kamen.....	183	.....	183
		Reef	775	4	779
3	July 28	do	189	2	191
4	Aug. 6	do	722	3	725
5	Aug. 12	do	920	1	921
		Kishotchnaya	216	2	218
6	Aug. 21	Reef	519	.....	519
		Kishotchnaya	181	.....	181
7	Aug. 26	Sivutchi Kamen.....	118	.....	118
		Reef	352	1	353
8	Sept. 7	Sivutchi Kamen.....	a 96	.....	96
		Reef	b 223	1	224
		Kishotchnaya	c 119	.....	119
		Total			4,873

a Of these 10 were stagy.

b Twenty-three stagy.

c Seventeen stagy.

SOUTH ROOKERY.

Date (new style).	Bachelors.	Date (new style).	Bachelors.
July 14, 1897.....	14	September 7, 1897.....	5
July 20, 1897.....	32		
August 1, 1897.....	23	Total	151
August 9, 1897.....	30	Damaged skins.....	2
August 24, 1897.....	26		
August 28, 1897.....	16	Total	153

COPPER ISLAND DRIVES, GLINKA.

Number of drive.	Date (new style).	Locality.	Over 20 pounds	Under 7 pounds	Full weight.	Total.
	1897.					
1	July 3	South end of island and other places.....		6	333	339
2	July 4	Sikatchinskaya		3	631	634
3	July 5	Babi Podiom		1	257	258
4	July 12	Urili Kamen, Pagani, Sabatchi Dira, Palata.....		212	1,071	1,283
5	July 18	Palata		3	63	66
6	July 25	Sabatchi Dira		22	a 344	366
7	July 27	Zapadni, Sabatchi Dira.....		19	a 554	573
8	July 28	Zapalata		8	449	557
9	July 30	Zapalata, Babi Podiom.....			521	321
10	Aug. 3	Zapadni, Urili		42	243	285
11	Aug. 9	Zapalata, Palata, Zapadni, Urili.....		13	208	221
12	Aug. 19	Palata		10	47	57
13	Aug. 20	Zapadni	1	6	64	71
14	Aug. 23	Babi Podiom		3	23	26
15	Aug. 26	Palata			19	19
		Total	1	348	4,627	4,976

a Including 1 cow.

Statistics relative to the fiscal catch on the Commander Islands, etc.—Continued.

KARABELNI.

Number of drive.	Date (new style).	Locality.	Over 20 pounds	Under 7 pounds	Full weight.	Total.
	1897.					
	July 4	Stolp		4	280	284
	July 6	do		5	122	127
	July 13	do		14	285	299
	July 20	do		1	112	113
	July 26	do			58	58
	Aug. 2	do		1	73	74
	Aug. 4	do		2	73	a 76
	Aug. 6	Bolshaya Bukhta			79	79
	Aug. 10	Vodopad		12	187	199
	Aug. 23	Stolp		1	19	20
		Total		40	1,288	1,329

a Including 1 cow.

Summary of Commander Islands and Robben Island catch, summer 1897.

Bering Island:		
North rookery	4,873	
South rookery	153	
Total		5,026
Copper Island:		
Glinka rookeries	4,976	
Karabelni	1,329	
Caught in sea-otter nets	4	
Total		6,309
Commander Islands, total		11,335
Robben Island		214
Grand total		11,549

APPENDIX III.

PRACTICAL EXPERIMENTS.¹

By JOSEPH MURRAY.

HERDING IN THE LAGOON.

The fence about the lagoon was completed in due time by the young men assistants left for this purpose and to help in the branding. On September 1 the seals were driven from the hauling grounds of Reef, Kitovi, Lukanin, Tolstoi, and Middle Hill and kept within the enclosure under close watch until September 7, when the fence was opened and they were allowed to return to the sea and to their respective hauling grounds, which they did by degrees during the following week, many of the animals showing no particular haste in abandoning the enclosure.

At first the seals gave evidence of feeling the restraint put upon them. They patrolled the inside of the fence until they established a beaten path. A few climbed over and others found holes under the fence through which they crawled. After a day or two, however, the novelty wore off and no further attention was paid to the fence. The closest observation during the time of their captivity failed to discover anything in their actions or movements that indicated uneasiness or suffering of any sort.

The experiment of holding the seals in the lagoon by means of a fence may therefore be considered entirely successful. I never doubted its practicability, and the test has removed all possible doubt. I strongly favor the fencing of every important body of water on the islands, which can be conveniently used for the purpose, and the holding in them of the young seals for a month or six weeks in the sealing season.

¹A condensation of Colonel Murray's fuller report.

BRANDING.

The branding was begun on September 7, at Lukanin Rookery. About 350 pups were driven up, assorted, and branded during the forenoon, an effort being made to make the natives familiar with their work rather than to accomplish large results. The natives entered into the spirit of the work, and soon became skillful and effective in its various operations.

On the 8th, getting an earlier start and having two forges running, we branded 1,017 pups. During the forenoon of the 9th 600 pups were branded on Kitovi, and in the afternoon 900 on the Reef.

Heavy rains interfered with the work until the 14th, when 804 additional pups were branded on the Reef. On the 15th work was again interrupted by the rain, but on the 16th a third branding of 600 pups and 100 cows was made on the Reef.

On the 17th we crossed over to Zapadni in boats and branded 600 pups and 8 cows. The following day 500 pups and 10 cows were branded on Tolstoi Rookery.

In all we branded 118 cows and 5,371 pups. I used 2 forges, with 2 men to attend each, keeping 6 irons hot. One man carried the irons to and from the forges. With 9 active young men to handle the pups I found it possible to brand 300 an hour without special exertion.

With an assistant and a duplicate set of forges and men 5,000 pups a day could easily be branded, or in twenty working days 100,000 pups, which is nearly double the number of female pups at present on the islands. So far as the labor is concerned, the branding of all the female pups each year is entirely possible. It is simply a matter of time and men.

BRANDING DOES NOT INJURE THE ANIMALS.

It is evident that the branding does not injure the animals. The adult cows branded last year were seen in good condition and with their pups on the rookeries this year. The pups branded last year were also to be seen in numbers hale and hearty on the hauling grounds and rookeries. The salt water helps rather than hinders the healing of the wound. Neither pups nor adult cows are driven from the islands by the operation of branding.

The most difficult part of the work is the driving of the pups and the sorting of the sexes. This requires men and careful supervision, but this is all. The pups stand the handling well. Of the number handled this season, which must have exceeded 10,000, only one pup was killed.

The appearance of the branded cows, as well as of the yearlings, shows clearly the effectiveness of the brand to depreciate the value of the skins. Each brand mark stands out bare and clean, not a trace of fur having come to replace that which was burned.

I am well satisfied that in the plan of herding the bachelors and branding the female seals has been struck the keynote of the whole situation. Carried to their logical conclusion, these methods will forever settle the vexed question of pelagic sealing.

THE DEATH TRAPS.

The afternoon of the 17th of October was spent in loosening and rolling stones into the gullies on Zapadni. The afternoon of the following day was similarly employed on the sand flat of Tolstoi rookery, which was covered with bowlders weighing from one hundred pounds to two tons each, as far out as the angle of the beach turning toward Middle Hill. The long gully in Zapadni, on which so many dead pups were found, was covered in a similar manner with bowlders of such proportions as to warrant their permanency. As occasion offers I shall continue to cover the death traps, drain the sinks, and otherwise improve the rookeries where possible.

DEAD PUPS.

On the 15th of October I made a count of the pups on Lukanin and Kitovi rookeries which had died since the middle of August, when, under Mr. Lucas's direction, all the earlier dead pups on these rookeries were carefully removed.

I found on Lukanin rookery 542 dead bodies, and on Kitovi 515, or a total of 1,057 pups for the two rookeries which had starved to death.

APPENDIX IV.

THE CONTROL AND PROTECTION OF THE SALMON STREAMS OF ALASKA.

By DAVID STARR JORDAN and C. L. HOOPER.

In going to the Pribilof Islands for the work of 1897 I was given, by the courtesy of the United States Fish Commission, transportation on the steamer *Albatross*, Capt. J. F. Moser. This vessel was engaged in the study of the salmon rivers, and by its means I was enabled to give some special attention to the problem of the preservation of the salmon, as well as to that of the sea otter. My views in regard to the sea otter are fully expressed in the recent excellent report of Capt. C. L. Hooper. I need only say that my own observations simply tend to show the thoroughness with which he has done his work.

In response to the request of Hon. W. B. Howell, Assistant Secretary of the Treasury, I have combined my own observations on the problem of salmon protection with those of Captain Hooper, in the form of the following joint letter from Captain Hooper and myself to Mr. Howell:

RECOMMENDATIONS.

WASHINGTON, D. C., November 4, 1897.

Hon. W. B. HOWELL,
Assistant Secretary, Treasury Department, Washington, D. C.

DEAR SIR: In response to your verbal request, permit us to give our views as to the proper management of the salmon rivers of Alaska. They are as follows:

1. We strongly indorse the recommendations of Governor Brady that provision should be made for a commission to codify the statutes of Alaska.
2. The statutes relating to the salmon and salmon fisheries should become part of this code.
3. The present statutes governing salmon fishing are good as far as they go.
4. In deference to the opinion of those who observe Sunday as a day of rest or worship, the period in each week in which the rivers are closed to fishing should include Sunday rather than a day recognized as secular.
5. The present exception of the tributaries of Bristol Bay from the requirement of a closed period is wise in view of the extreme shortness of the season there.
6. The chief inadequacy of the present statutes is that they secure no rights to the owners of the cannery properties and require no duties of them. These companies are virtually squatters on Government land. They have no exclusive rights in the salmon rivers near which they are built.
7. As a result of this they have no permanent interest in the preservation of the salmon rivers. They have no incentive to preserve or improve them. In case of valuable streams, the company in possession is forced to be constantly on its guard to maintain its advantages of possession. It is often necessary to work nets continuously day and night through the season to prevent others from taking possession of the beaches adjacent to its canneries. This action is wasteful, depleting the body of salmon, and it has been continued at times even though the canneries can make no use of the fish taken.
8. Such a condition of anarchy provokes dissensions among the owners and managers of canneries. It leads to constant complaints and recriminations, and in some cases even to bloodshed.¹

¹The present statutes prohibit the setting of a net within a certain distance of one already in the water. But there is nothing to prevent a small steamer from crossing the lines of a net and casting anchor, then steaming away dragging the anchor through the net with intent to tear it to pieces. Nor can the statutes prevent the owner of the net from hauling it up by means of a steam winch, drawing in the vessel by means of its anchor and throwing it up on the beach. Such contingencies, which are not imaginary, do not favor the orderly conduct of this most important industry.

The following article, from the San Francisco Chronicle of November 12, 1897, indicates a case in point. Without prejudice to either side, I may say that, being present at Karluk when the difficulty began, I do not suppose that the facts are impartially stated in this paragraph, which I introduce solely as an illustration of a condition which I believe to be unfortunate and menacing to good order:

"The superior court was called upon yesterday to settle a dispute over valuable

9. The inability to secure exclusive rights and privileges has led to the building of twice as many canneries as can be profitably worked.

10. The present overfishing of the salmon rivers is due chiefly to the absence of any legally recognized rights or duties on the part of the cannery companies.

11. In our judgment each packing company should have the exclusive right to take salmon in the streams adjacent to which it stands and along the beaches for a distance (say one-fourth mile) on each side of the mouth of the stream.

12. This privilege should be in the form of a lease, and it should hold good for a term of years (as 10, 12, or 15), unless in the judgment of the Secretary of the Treasury the provisions of the lease have been violated.

13. The lease should require (a) that the statutes forbidding obstructions, etc., in the rivers should not be violated; (b) that the native people should not be excluded from the fishing necessary to their sustenance.

14. To these may be added the maintenance of a hatchery of adequate capacity. It is better, however, that such hatcheries should be owned and managed by the United States Fish Commission.

15. In return for these privileges, each cannery or salting establishment should pay annually a certain sum as rental.

16. This sum may be a certain tax on each case of salmon packed or on each package of salmon salted or smoked. Or it might be a lump sum annually, proportioned to the output of the river or to the capacity of the cannery.

17. It would seem to be undesirable that the cannery or similar companies should acquire absolute title to land at the mouth of any salmon river.

18. It seems desirable that no additional canneries or salting establishments be built in Alaska except by permission of the Secretary of the Treasury.

19. Provision should be made for the proper protection of salmon breeders who may have established hatcheries on small streams for the purpose of selling the increased output to the canneries.

29. The propriety of the present custom of placing inferior or injured cans of

fishing rights in Alaska. The matter was presented through a suit commenced by the Pacific Steam Whaling Company to recover \$100,000 damages from the Alaska Packers' Association. Sensational charges are made in the complaint, and owing to the prominence of the two corporations and the magnitude of the interests involved the case promises to attract more than an ordinary amount of public attention.

"It appears from the complaint that the Pacific Steam Whaling Company has for a number of years maintained an extensive plant for the taking of salmon at the mouth of the Karluk River and along the Karluk beach on Tanglefoot or Karluk Bay. The corporation claims to have been seriously interfered with in this year's fishing by employees of the Alaska Packers' Association, the corporation defendant. It is on account of such interference that the whaling company now demands damages.

"The trouble between the two corporations is described as having commenced in July last, when the fishing season was at its height. A charge is made that, in order to prevent the taking of fish by the employees of the plaintiff, agents of the defendant corporation had resort to force and the use of firearms.

"It is the theory of the Pacific Steam Whaling Company that the fishing grounds at Karluk are public property. The company avers, therefore, that an exclusive fishing right or ownership cannot vest in any one corporation or individual. Such a right and ownership are asserted by the defendant corporation, and hence the dispute which has now given rise to litigation.

"The complaint tells of an occasion early in July when the employees of the plaintiff company were interrupted while drawing a seine. They were told to desist, and at the same time their attention was called to a formidable array of firearms in the hands of a number of Packers' Association employees, who had been posted on a bluff which overlooked and commanded the entire beach. On a subsequent date in the same month the drawing of another seine of the plaintiff company was prevented by agents of the defendant, who are said to have connected the seine by cable to a steam winch.

"Feeling between the two companies reached its highest point on July 28th. Several steam schooners of the whaling company on that day dropped anchor in the bay just off the beach. Employees of the packing company promptly ordered the vessels removed. The men in charge of the vessels refused to move, and then, according to the complaint, the packers' crew attempted to wreck the vessels by tripping their anchors on seines and dragging them ashore. This attempt failed, but the vessels sustained serious injury in consequence of the seines becoming entangled in the propellers."

salmon on the market (known as "duos") as the output of canneries or companies having no existence and to which imaginary names are given should be questioned. Such methods tend to injure the high reputation of the Alaska salmon pack.

21. The pack of each of the different species of salmon should be sold under its own recognized trade-mark—King Salmon (Tyee or Quinнат), Red Salmon (or Sugkegh), Silver Salmon (or Coho), Pink Salmon (or Humpback), Steelhead Trout. This distinction is at present in general honestly made, the output bearing the recognized names of existing companies and being for the most part what it pretends to be.

Concerning the work of the inspectors of salmon fishing, we have the following suggestions to make:

22. At present this work is virtually ineffective for the following reasons:

a. The appointees in general have been men who know little or nothing of the problems involved which demand expert knowledge of (1) salmon, their kinds and habits; (2) the methods of fishing, and (3) the conditions and peculiarities of Alaska. For effective work special knowledge is requisite, as well as general intelligence and integrity.

b. These men are largely dependent upon the courtesy of the packing companies (1) for their knowledge of the salmon, (2) for their knowledge of fishing methods, (3) for all transportation and sustenance (except in southeastern Alaska), and (4) for all assistance in enforcing the law.

c. The inspectors can not go from place to place at need and so spend so much of their time in enforced inaction.

(d) They have no authority to remove obstructions or to enforce the law in case of its violation. For this reason their recommendations largely pass unheeded.

22. To remedy these conditions provision should be made—

(a) For the appointment only of men of scientific or practical training, thoroughly familiar with fishes or fishery methods, or both, and capable of finding out the truth in any matter requiring investigation. For such purposes expert service is as necessary as it would be in bank inspection or in any similar specialized work.

(b) The Department should provide suitable transportation facilities for its inspectors. It should be possible for them to visit at will any of the canneries or salmon rivers under their charge. They should be provided with means to pay for expenses of travel and sustenance, and should receive no financial courtesies from the packing companies or be dependent upon them for assistance in carrying on their work.

(c) The inspectors should be instructed to remove and destroy all obstructions found in the rivers in violation of law. They should have large powers of action and discretion, and they should have at hand such means as is necessary to carry out their purposes.

Very respectfully, yours,

DAVID STARR JORDAN,
Commissioner in Charge Fur-Seal Investigations.
C. L. HOOPER,
Commanding Bering Sea Patrol Fleet.

APPENDIX V.

AFFIDAVITS OF DYERS AND DRESSERS OF FUR-SEAL SKINS.

The following affidavits of dyers and dressers of fur-seal skins, submitted to the conference of fur-seal experts, may here be placed on record:

QUEEN STREET, *London, E. C.*

I, Geo. Rice, of the city of London, England, make oath and say that I carry on the business of a dyer and dresser of furs and seal skins in this city; that I have been engaged in the seal-skin trade for over thirty years and have personal and practical experience in the various processes of dressing and dyeing skins; that I employ 500 men in my business; that of the seal skins that have been taken in the waters of North Pacific Ocean and Bering Sea by sealing vessels I have dressed or dyed skins of the pelagic catch of 1894, 85,000 skins; 1895, 70,000 skins; 1896, 50,000 skins.

That I personally and through my expert employees have had every opportunity of examining these skins; that a part of them, being those of pups or young seals, are not with certainty distinguishable as to sex, but the greater portion of the

skins can be readily determined; that of these latter, embracing the pelagic catches of 1894, 1895, 80 per cent, and of 1896, 70 to 80 per cent, were the skins of females; that of the skins of adult seals in these catches, the skins of males were rarely found. I further say that I make this declaration in the interest of truth and for the information of those who are concerned in making regulations for the preservation of the seal herd, and I make this solemn declaration conscientiously believing the same to be true.

GEO. RICE.

Sworn to at "The Elms," Edmonton, in the county of Middlesex, this 26th day of October, 1897, before me.

ALFRED HODGKINSON,
A Commissioner for Oaths.

I, Edmund Wischhusen, of 138 New North road, Islington, in the county of London, seal dresser and unhairer, solemnly and sincerely declare as follows:

1. I have been engaged in the seal-skin trade for over thirty-five years. I have actually worked on seals for the last forty years, and on the Bering Sea seal ever since they have been brought to market. I have had personal and practical experience in the various processes of dressing and unhairing seal skins during that period. I have been regularly employed as an expert by the largest fur merchants in London to examine the skins as they arrive from the pelagic sealers, at Messrs. C. M. Lampons & Sons', of 64 Queen street, in the city of London, at the Hudson Bay Company's premises in Lime street, and at Messrs. Culverwell & Brooks, at St. Mary Axe. These are the only firms to whom seal skins have been sent for sale during the last few years. I inspect them in order to determine the quality and condition of the skins, and it is my business to report to the merchants from time to time the quality of the skins, and the merchants act on my report. From my personal inspection in this way I am able to say that fully 80 per cent of the skins which have arrived from the pelagic sealers during the last three years are the skins of female seals. Of the 135,000, or thereabouts, of the pelagic northwest catch of 1894, fully 120,000 came under my notice and were examined by me; and of the 102,000, or thereabouts, of the like catch of 1895 about 100,000 came under my notice and were examined by me; and of the 70,000 forming the like pelagic catch of 1896, the whole parcel came under my notice and were examined by me.

2. There is absolutely no difficulty whatever in distinguishing the sex of the adult seals, as, apart from all other distinctions (and there are several, as, for instance, a difference in the size and shape of the head and also in the color), the distinction in the breasts is very marked, those of the females being very large and prominent and those of the males hardly distinguishable. It requires no expert to distinguish the sex. In most instances the hair round the nipples of the female seals has been worn off by the young pups.

The only reason there is a doubt as to the sex of the remaining 20 per cent of the skins is that about this proportion are the skins of very young animals in which, the breasts and heads not being fully developed, the sex is not so easily distinguishable, but this only applies to young pups and not in any way to adult seals.

There is no difficulty whatever in identifying the Bering Sea seals from those caught on the coast of Japan and round or in the vicinity of the Copper Islands.

And I make this solemn declaration, conscientiously believing the same to be true, and by virtue of the provisions of the statutory declarations act of 1835.

E. WISCHHUSEN.

Declared at No. 138 New North road, in the county of London, on this twenty-sixth day of October, 1897, before me.

JOHN VENN, *Notary Public.*

NOTE.—Attached thereto are the official certificates of John Venn, notary public, of the city of London, and Wm. M. Osborne, consul-general of the United States, with their official seals.

I, Walter Edward Martin, of 4 Lambeth Hill, in the city of London, member of the firm of C. W. Martin & Sons, of the same place, fur dyers and dressers, solemnly, sincerely, and truly declare as follows:

I am a British subject. I have been in the business of dyeing and dressing fur seals' skins in London about twenty-five years, and have personally handled many hundreds of thousands of such skins, and I have in consequence a special knowledge of seal skins.

I have at various times made a special examination of the skins of the northwest (pelagic) catch of seals (a very large number of which come through my

firm's hands) with a view to ascertaining whether they are the skins of male or female seals, and I say that of the seals caught in the Bering Sea and in the North Pacific Ocean by the pelagic sealers fully 80 per cent of them are female seals, and I believe a still larger proportion. The remaining 20 per cent are mostly skins of young pups in which the sex is not very distinguishable, and a few large bulls, not more than about 3 per cent of the entire parcel.

With regard to adult seals, there is no difficulty whatever in detecting the skins of males and the skins of females. The breasts are very prominent in the female seals, and it requires no expert to detect which is the skin of a male seal and which the skin of a female seal, and very often round the breasts of the females the fur has been worn away. The regulations of the arbitrators, made in August, 1893, at Paris, with regard to pelagic sealing have not tended to in any way diminish the proportion of female seals to males killed by the pelagic sealers, and the large majority of the skins of the pelagic catch still bear traces of the seals having been killed by means of shot.

There can be no doubt whatever that a continuation of the present system of slaughtering such a large proportion of the female seals in the open ocean, with the consequential death of such a large proportion of pups, as is admitted by Prof. D'Arcy Thompson in his recent report to be due to pelagic sealing, and the death of the mothers, is fast tending to exterminate the seal from the ocean, and that unless some steps are promptly taken to stop pelagic sealing, which under the present conditions can not be profitable to the sealers, the herd will soon be entirely exterminated and destroyed, and I submit that the only means of preserving the seals from entire extinction is to absolutely put an end to pelagic sealing, which it ought not to be difficult to bring about by mutual agreement, due regard being had to the interests of all parties concerned.

And I make this solemn declaration, conscientiously believing the same to be true, and by virtue of the provisions of the statutory declarations act, 1835.

WALTER MARTIN.

Declared at No. 4 Lambeth Hill, in the city of London, this sixteenth day of September, 1897, before me,

JOHN D. VENN, *Notary Public*.

NOTE.—Attached thereto are the official certificates of John Venn, notary public, of the city of London, and Wm. M. Osborne, consul-general of the United States, with their official seals.

APPENDIX VI.

THE FUR-SEAL CONFERENCE.

Since the greater part of the foregoing report was prepared a meeting of the representatives of the United States, Great Britain, and Canada, engaged in the investigations of the past two seasons, was held in Washington and the following joint statement of conclusions agreed upon:

JOINT STATEMENT OF CONCLUSIONS RESPECTING THE FUR-SEAL HERD FREQUENTING THE PRIBILOF ISLANDS IN BERING SEA.

The undersigned, duly empowered delegates, engaged during recent years in the investigation of the condition and habits of the fur-seal herd frequenting the Pribilof Islands in Bering Sea, viz, on behalf of the United States, Charles Sumner Hamlin and David Starr Jordan; on behalf of Great Britain, D'Arcy Wentworth Thompson; on behalf of Canada, James Melville Macoun, have met in conference under instructions from our respective Governments. Under these instructions we were directed—

“To arrive, if possible, at correct conclusions respecting the numbers, conditions, and habits of the seals frequenting the Pribilof Islands at the present time as compared with the several seasons previous and subsequent to the Paris award.”

As a result of such conference, now completed, we, the above-named Charles

Sumner Hamlin, David Starr Jordan, D'Arcy Wentworth Thompson, and James Melville Macoun, find ourselves in accord on the propositions contained in the following joint statement of conclusions respecting the fur-seal herd frequenting the Pribilof Islands, and make this our report:

JOINT STATEMENT.

1. There is adequate evidence that since the year 1884, and down to the date of the inspection of the rookeries in 1897, the fur-seal herd of the Pribilof Islands, as measured on either the hauling grounds or breeding grounds, has declined in numbers at a rate varying from year to year.

2. In the absence for the earlier years of actual counts of the rookeries such as have been made in recent years, the best approximate measure of decline now available is found in these facts:

(a) About 100,000 male seals of recognized killable age were obtained from the hauling grounds each year from 1871 to 1889. The table of statistics given in Appendix I shows, on the whole, a progressive increase in the number of hauling grounds driven and in the number of drives made, as well as a retardation of the date at which the quota was attained during a number of years previous to 1889.

(b) In the year 1896, 28,964¹ killable seals were taken after continuing the driving till July 27, and in 1897, 19,189 after continuing the driving till August 11. We have no reason to believe that during the period 1896 and 1897 a very much larger number of males of recognized killable age could have been taken on the hauling grounds.

The reduction between the years 1896 and 1897 in the number of killable seals taken, while an indication of decrease in the breeding herd, can not be taken as an actual measure of such decrease. A number of other factors must be taken into consideration, and the real measure of decrease must be sought in more pertinent statistics drawn from the breeding rookeries themselves.

3. From these data it is plain that the former yield of the hauling grounds of the Pribilof Islands was from three to five times as great as in the years 1896 and 1897, and the same diminution to one-third or one-fifth of the former product may be assumed when we include also the results of hunting at sea.

4. The death rate among the young fur seals, especially among the pups, is very great. While the loss among the pups prior to their departure from the islands has been found in the last two years to approach 20 per cent of the whole number born, and though the rate of subsequent mortality is unknown, we may gather from the number which return each year that from one-half to two-thirds have perished before the age of three years—that is to say, the killable age for the males and the breeding age for the females.

5. The chief natural² causes of death among pups, so far as known at present, are as follows, the importance of each being variable and more or less uncertain:

(a) Ravages of the parasitic worm *Uncinaria*, most destructive on sandy breeding areas and during the period from July 15 to August 20.

(b) Trampling by fighting bulls or by moving bulls and cows, a source of loss greatest among young pups.³

(c) Starvation of pups strayed or separated from their mothers when very young or whose mothers have died from natural causes.

(d) The ravages of the great killer (*Orca*), known to be fatal to many of the young and perhaps also to older seals.

At a later period drowning in the storms of winter is believed, but not certainly known, to be a cause of death among the older pups.

6. Counts of certain rookeries, with partial counts and estimates of others, show that the number of breeding females bearing pups on St. Paul and St. George was,

¹ The nominal quota of 30,000 for 1896 and of 20,890 for 1897 included food skins taken in the fall of 1895 and 1896.

² That is to say, not including losses ensuing from the killing of mothers at sea. The number of dead pups counted on the rookeries between August 8 and 14, in 1896, was 11,045. It is recognized that this number is an underestimate, inasmuch as a greater number must have been overlooked than were counted twice. It is also recognized that the great majority of these pups died from the attacks of the worm *Uncinaria*.

³ The importance of this source of loss we now find to be much less than was supposed to be the case from the investigations made in 1896. (See Reports for 1896, Jordan, p. 45; Thompson, p. 20; Macoun, MSS.)

in 1896 and 1897, between 160,000 and 130,000, more nearly approaching the higher figure in 1896 and the lower in 1897.¹

7. On certain rookeries, where pups were counted in both seasons, 16,241 being found in 1896 and 14,318 in 1897, or applying a count adopted by Professor Thompson, 14,743 in the latter year, there is evident a decrease of 9 or 12 per cent within the twelvemonth in question. The count of pups is the most trustworthy measure of numerical variation in the herd. The counts of harems, and especially of cows present, are much inferior in value. The latter counts, however, point in the same direction. The harems on all the rookeries were counted in both seasons. In 1896 there were 4,932; in 1897 there were 4,418, a decrease of 10.41 per cent. The cows actually present on certain rookeries at the height of the season were counted in both seasons. Where 10,198 were found in 1896, 7,307 were found in 1897, a decrease of 28.34 per cent.²

8. It is not easy to apply the various counts in the form of a general average to all the rookeries of the islands. We recognize that a notable decrease has been suffered by the herd during the twelvemonth 1896 to 1897, without attempting, save by setting the above numbers on record, to ascribe to the decrease more precise figures.

9. The methods of driving and killing practised on the islands, as they have come under our observation during the past two years, call for no criticism or objection. An adequate supply of bulls is present on the rookeries; the number of older bachelors rejected in the drives during the period in question is such as to safeguard in the immediate future a similarly adequate supply; the breeding bulls, females, and pups on the breeding rookeries are not disturbed; there is no evidence or sign of impairment by driving of the virility of males; the operations of driving and killing are conducted skilfully and without inhumanity.

10. The pelagic industry is conducted in an orderly manner and in a spirit of acquiescence in the limitations imposed by the law.

11. Pelagic sealing involves the killing of males and females alike, without discrimination and in proportion as the two sexes coexist in the sea. The reduction of males effected on the islands causes an enhanced proportion of females to be found in the pelagic catch; hence this proportion, if it vary from no other cause, varies at least with the catch upon the islands. In 1895 Mr. A. B. Alexander, on behalf of the Government of the United States, found 62.3 per cent of females in the catch of the *Dora Siewerd* in Bering Sea, and in 1896 Mr. Andrew Halkett, on behalf of the Canadian Government, found 84.2 in the catch of the same schooner in the same sea. There are no doubt instances, especially in the season of migration and on the course of the migrating herds, of catches containing a very different proportion of the two sexes.

12. The large proportion of females in the pelagic catch includes not only adult females that are both nursing and pregnant, but also young seals that are not pregnant and others that have not yet brought forth young, with such also as have recently lost their young through the various causes of natural mortality.³

13. The polygamous habit of the animal, coupled with an equal birth rate of the two sexes, permits a large number of males to be removed with impunity from the herd, while, as with other animals, any similar abstraction of females checks or lessens the herd's increase, or, when carried further, brings about an actual dimi-

¹ For detailed account of the census of 1896, see Jordan, Preliminary Report for 1896, p. 15; Thompson, Report for 1896, p. 19; Macoun, Report, 1896, MSS. For a discussion of suggested corrections to the census of 1896, Jordan, Final Report, 1897. For details of the census of 1897, see Thompson, Report, 1897; Macoun, Report, 1897; Jordan, Report, 1897. A correction to be made in the census of 1896 arises from the agreed assumption that the total number of breeding females was 1.75 times the number seen in the height of the season. Later observations show that the actual total is at least twice the maximum number ever seen at once on a rookery.

² The extreme irregularity of the number of cows present on the rookeries from day to day and the consequent invalidity of any comparison of their number is shown by the counts made on Lukanin and Kitovi rookeries during the season of 1897. See Appendix II.

³ Statements on which to base an estimate of the relative numbers of these several classes are necessarily incomplete, but the following notes may serve as a partial guide:

Townsend, Report 1895, pp. 46, 47.

Alexander, Report 1895, pp. 142, 143.

Macoun, Report 1897, MSS.

Lucas, Report 1897, MSS.

nution of the herd. It is equally plain that a certain number of females may be killed without involving the actual diminution of the herd, if the number killed do not exceed the annual increment of the breeding herd, taking into consideration the annual losses by death through old age and through incidents at sea.

14. While, whether from a consideration of the birth rate or from an inspection of the visible effects, it is manifest that the take of females in recent years has been so far in excess of the natural increment as to lead to a reduction of the herd in the degree related above, yet the ratio of the pelagic catch of one year to that of the following has fallen off more rapidly than the ratio of the breeding herd of one year to the breeding herd of the next.¹

15. In this greater reduction of the pelagic catch, compared with the gradual decrease of the herd, there is a tendency toward equilibrium, or a stage at which the numbers of the breeding herd would neither increase nor decrease. In considering the probable size of the herd in the immediate future, there remains to be estimated the additional factor of decline resulting from reductions in the number of surviving pups caused by the larger pelagic catch of 1894 and 1895.

16. The diminution of the herd is yet far from a stage which involves or threatens the actual extermination of the species, so long as it is protected in its haunts on land. It is not possible during the continuance of the conservative methods at present in force upon the islands, with the further safeguard of the protected zone at sea, that any pelagic killing should accomplish this final end. There is evidence, however, that in its present condition the herd yields an inconsiderable return either to the lessees of the islands or to the owners of the pelagic fleet.

APPENDIX I.—*Statistics regarding land and sea killing, 1871-1897.*

Year.	Date quota filled. ^a	Hauling grounds driven. ^a	Number of drives. ^a	Killed on land. ^b	Killed at sea.
1871	July 23	46	43	102,960	16,911
1872	July 25	43	39	108,819	5,336
1873	July 24	51	37	109,177	5,229
1874	July 17	61	41	110,585	5,873
1875	July 16	55	37	106,460	5,033
1876	Aug. 1 ^c	36	30	94,657	5,515
1877	July 14	44	32	84,310	5,210
1878	July 18	54	35	109,323	5,544
1879	July 16	71	36	110,411	8,557
1880	July 17	78	38	105,718	8,418
1881	July 20	99	34	105,063	10,282
1882	do	86	36	99,812	15,551
1883	July 19	81	39	79,509	16,557
1884	July 21	101	42	105,434	16,971
1885	July 27	106	63	105,024	23,040
1886	July 26	117	74	104,521	28,494
1887	July 24	101	66	105,760	30,428
1888	July 27	102	73	103,304	26,189
1889	July 31	110	74	102,617	29,858
1890	July 20 ^d	87	55	28,059	40,814
1891		(e)	(e)	12,040	59,568
1892		(e)	(e)	7,511	46,642
1893		(e)	(e)	7,396	30,812
1894	Aug. 4			16,270	61,838
1895	July 27			14,846	56,291
1896	do	31	21	28,964	43,917
1897	Aug. 7	42	27	20,890	f25,079

^a These figures refer to the hauling grounds of St. Paul.

^b These totals include all males killed for any purpose on the islands.

^c In 1876 the killing was begun at an unusual date, said to be on account of an exceptionally late season.

^d Closed by order of the agent in charge.

^e Years of the *modus vivendi*.

^f As reported to date.

¹ The catch of the pelagic fleet, Canadian and American, in 1897 in Bering Sea was 16,657 seals. In the summer of 1896 it was 29,500. The aggregate catch which directly influenced the herd of 1897 was 38,922, a number made up by adding to the summer's catch of 1896 the northwest coast catch in the spring of 1897. Up to the present time, accordingly, the pelagic catch already taken (16,657) and operating directly against next year's supply is 57.22 per cent less than the pelagic catch which operated against the supply of 1897 (see, also, Appendix I): or, if we compare merely the summer catches, inasmuch as the possible spring catch of 1895 is an unknown factor, we have a reduction of 43.46 per cent.

APPENDIX II.—Record of arrival of cows.^a

Date.	Cows present.	Date.	Cows present.
<i>Amphitheater of Kitovi.</i>		<i>Record of harems—Continued.</i>	
June 12	0	July 13	46
13	0	25	53
14	2	<i>Lukanin rookery.</i>	
15	3	June 12	1
16	3	13	1
17	4	14	3
18	6	15	5
19	7	16	6
20	8	17	11
21	9	18	19
22	23	19	25
23	37	20	37
24	45	21	52
25	56	22	74
26	76	23	103
27	105	24	131
28	137	25	176
29	168	26	207
30	210	27	257
July 1	246	28	.....
2	290	29	.....
3	362	30	635
4	414	July 1	880
5	499	2	939
6	518	3	1,088
7	550	4	1,197
8	585	5	1,264
9	^b 587	6	1,371
10	660	7	1,531
11	703	8	^b 1,541
12	.....	9	1,680
13	654	10	1,755
14	556	11	.....
15	703	12	1,736
16	678	13	1,841
17	698	14	306
18	566	15	327
19	556	16	325
20	429	17	338
21	528	18	228
22	416	19	390
23	469	20	214
24	465	21	215
25	426	22	219
26	463	23	212
27	406	24	196
28	304	25	186
29	414	26	148
30	427	27	157
31	375	28	177
<i>Record of harems.</i>		29	149
June 14	1	30	127
20	3	31	124
30	10		
July 8	35		

^a Weather clear; no storms or surfs, except one day when rain fell, causing a larger number of cows to take to the water and making it difficult to distinguish those present from the rocks.

^b Rain.

^c After July 14 it became impossible, on account of the scattering of the cows, to continue the count for the entire rookery without too great loss of time, and so a section of 18 harems was singled out and the count continued on it.

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