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SPECIAL INVESTIGATION
of the
Alaska Fur-seal Rookeries,
1910.



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DEPARTMENT OF COMMERCE AND LABOR

BUREAU OF FISHERIES

GEORGE M. BOWERS, Commissioner

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ALASKA FUR-SEAL ROOKERIES, 1910.

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By HAROLD HEATH

Professor of Invertebrate Zoology, Stanford University

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SPECIAL INVESTIGATION OF THE ALASKA FUR-SEAL ROOKERIES, 1910.

By HAROLD HEATH,
Professor of Invertebrate Zoology, Stanford University.

Under the act of Congress of April 21, 1910, involving various changes in the administration of the Pribilof Islands and the seal fisheries and providing for the appointment of additional officers and employees, it was decided that a naturalist should be designated to study and report upon the condition of the seal herd. Pending the selection of a permanent occupant of this position, to take effect July 1 under the law, the writer was sent to the islands as a special investigator to perform the naturalist's duties for the season which was already beginning. Observations were made on St. Paul Island, beginning June 29, the date of arrival on the island, and continuing until July 15, then for a week on St. George Island, and again on St. Paul until August 29. A report of these observations is contained in the following pages.

I am indebted to the Government agents on the islands and to the officers of the revenue fleet for valuable data and many courtesies in connection with my work.

BRIEF SKETCH OF NATURAL HISTORY OF THE SEAL.

As popularly applied the term "seal" includes a fairly large group of aquatic mammals, such as the sea lion and the fur and hair seals, all of which bear a superficial resemblance to each other. Strictly speaking, the last named are the only ones deserving of the name. Unlike the hair seal, the fur seal, or sea bear, is able to progress readily on land, is able to hold its head erect, and its fore limbs, finlike in form, are used in swimming. Concerning its life at sea, we know that the seals of the Pribilof Islands spend their winter months along the western coast of North America, the adult females extending their migrations as far as southern California. Early in May the adult males or bulls begin to appear on the rookeries, where each is subsequently joined by 30 females on the average, the height of the

breeding season occurring about the 15th of July. Shortly after her arrival each cow gives birth to a pup, and after a sojourn of perhaps two weeks, during which time she is served by the bull, she puts out to sea on the first of several journeys in search of food.

During this time the young males or bachelors are arriving, and are usually found in groups on the outskirts of the rookeries. It is from these young males that the land catch of skins is made.

Early in August disorganization of the harems commences. The greater number of cows have been served, the active bulls accordingly relax their vigilance, the idle bulls and those less mature wander about without serious molestation, the pups congregate at various points on shore or in the shallows, where they learn to swim, and as autumn advances the roving instinct becomes more and more apparent in all classes, finally leading to the abandonment of the shore early in November.

THE ROOKERIES.

In position and extent the rookeries have undergone but few changes since last year. The number of active bulls and the attendant harems have decreased slightly, but whether this indicates an actual decrease in the number of cows is doubtful, since the count of pups, as noted in a succeeding section, was made on one rookery only and the data derived therefrom are not perfectly trustworthy. The decline in the number of harems on St. Paul is most apparent on Gorbatch, the Zapadnis, and Tolstoi, where there are 55 less than in 1909. On the other hand, there are 47 more on the Reef, Kitovi, Polovina, and Vostochni. On St. George the very slight increase noted on Staraya Artel and Zapadni is almost exactly counterbalanced by a decline on North and East rookeries.

This year the fleet operated chiefly about Northeast Point and to the south and east between St. Paul and St. George, but the results of their operations do not appear to be so distinctly reflected in a corresponding decline of adjacent rookeries as in 1909. Such a definite effect requires that the seals put out to sea along radii centering in either one of the islands, but on numerous occasions I have watched cows, and especially bachelors, leaving the rookeries, and their course is far from being either direct or uniform. The problem, however, is of interest chiefly to the naturalist as matters rest at present, and is without any very practical bearing on the conservation of the herd.

ROOKERY DEVELOPMENT.

At present there appear to be no very definite problems associated with the development of the rookery, but following the custom observed for several years past counts of harems and cows were made whenever and wherever it was possible. Kitovi especially received

attention and as far as practicable was examined at intervals of about three days with the following results:

DEVELOPMENT OF KITOVI ROOKERY, SEASON OF 1910, AS SHOWN BY COUNTS OF SEALS ON DIFFERENT DATES.

Date.	Harems.	Cows.	Reserve bulls.	Half bulls.
June 30.....	16	27	37	6
July 2.....	32	107	24	14
July 6.....	43	326	19	7
July 9.....	47	500	14	10
July 13.....	62	929	9	10

The past winter was unusually severe and long continued, delaying the breaking up of the drift ice, the melting of the snow, and the appearance of flowering plants for upward of three weeks. It is interesting to note, however, that this delay did not affect the summer resident birds, which put in an appearance at the customary time, though compelled in numerous instances to deposit their eggs on the snow. Nor did it hinder the migration of the seals, though several cows likewise took up positions on snow drifts, where they and the pups appeared to be unmindful of their unusual habitat.

HAREM COUNTS.

In accordance with the custom pursued in past years, the counts of harems were made as nearly as possible at the "height of the season," occurring July 12-16. Owing to stress of weather Sivutch, or Sea Lion Rock, rookery was not counted, but was estimated as containing 61 harems, the number found last season.

SUMMARY OF HAREM COUNTS, 1910, AND COMPARISON WITH 1897 AND 1909.^a

Rookery.	1897	1909 ^a	1910	Rookery.	1897	1909	1910
St. Paul Island:				St. George Island:			
Gorbach.....	308	120	112	Little East.....	46	4	4
Ardiguen.....	33	11	11	East.....	128	65	59
Reef.....	454	184	206	Zapadni.....	133	43	47
Sea Lion Rock.....	102	61	61 ^b	Staraya Artel.....	57	42	48
Kitovi.....	179	55	62	North.....	196	106	103
Lukanin.....	139	39	41	Total.....	560	260	261
Polovina.....	143	42	50	Grand total.....	4,418	1,357	1,351
Polovina Cliffs.....	61	23	20				
Little Polovina.....	40	19	12				
Morjovi.....	233	45	47				
Vostochni.....	910	184	204				
Zapadni.....	458	147	118				
Little Zapadni.....	176	62	54				
Zapadni Reef.....	114	11	7				
Tolstoi.....	295	87	77				
Tolstoi Cliffs.....	98	25	29				
Lagoon.....	115	12	9				
Total.....	3,858	1,127	1,120				

^a Figures for 1909 are those of Mr. George A. Clark.

^b Estimated.

Assuming that Sea Lion Rock is occupied by the same number of harems as in 1909 or neglecting it for both seasons, there are 7 fewer harems on St. Paul this year than last.

Comparing the number of harems on St. George during the years 1909 and 1910 there is 1 more, and when both islands are considered 6 fewer. As there is one bull to a harem, this is another way only of stating that there are 6 fewer bulls this year than last; and obviously such an estimate affords no indication whatever of the actual number of breeding cows.

ACTIVE BULLS.

The number of active bulls, each in control of a harem, is as just noted, somewhat smaller this year than last (as 1,387 to 1,381); but it is the universal verdict that as a class they have lost none of those characteristics that make them successful masters. As usual there was considerable skirmishing among them as the harems were forming, but the wounds inflicted were comparatively insignificant and no deaths were recorded. Early in the season one dead female was found on Gorbateh whose wounds may have been caused by a bull, and later six cows were seen on various rookeries that had been severely though not fatally slashed.

In a few cases young bulls or "quitters" were found with harems on various rookeries, but usually they held sway on the outskirts of the community and joined the females in the mad rush to the sea whenever they were approached. It was the rare exception that they held a position in the more crowded portions of the rookery, where they would be called upon to defend their cows against the attempted inroads on the part of more seasoned harem masters.

By some authorities it has been urged that this infusion of young male life into the general herd is beneficial, but in all probability its value is overestimated. It is not disclaimed that some animals are born with more vigorous constitutions than others, and that in all probability their offspring will be more hardy in consequence. And furthermore, it is a truism that in the struggle for existence it is a gain that the feeble are weeded out; but this is an entirely different question from the one relating to the effects of age. In the case of the female a long existence may lessen the production of milk or alter its composition, and consequently inhibit the proper nourishment of the offspring, but with the male no such argument may be brought forward. In the case of the race horse, which has been studied as much as any other mammal, attempts have been made to show that it is desirable to breed young males, and again, with essentially the same data, such a position has been attacked. To-day we know far less about the seal, but it is a safe proposition to argue in favor of perpetuating, as far as possible, those fully developed males that are able to protect their harems.

IDLE BULLS.

These animals are victims of circumstances. Owing usually to an unfavorable location, they have failed to secure harems, though they are as physically able to control them as any of their class. Furthermore, the term "idle" is a misnomer, for no one who has watched them on the rookeries would ever accuse them of being sluggish. On the other hand, they are aggressive in the extreme, and especially during the height of the season engage in frequent quarrels with the harem masters, from whom they usually pilfer a small number of cows before the close of the season.

It can not well be doubted that an excess of this class of animals is more or less of a menace to the normal, or at all events what appears to be the most successful, type of seal existence. Claims have been made to the effect that for untold ages the seal has fought the battle of life successfully and that in the present time the hand of man is not required to control his destinies. The first part of this statement is undeniably correct, but the last is open to criticism, for it assumes that the seal is to-day leading a normal existence. Unfortunately this is not true, for we know that the number of breeding cows is becoming alarmingly reduced. In the open Pacific the number of captured males and females may be approximately equal, but the Bering Sea catch, as past records show, contains from 70 to 80 per cent of females. Since, on the average, there is 1 male to every 30 cows in the harem, there must inevitably result an excess of males, an unnatural state of affairs, and the belief that in cutting down this excess we are conferring a benefit appears to rest on a firm foundation.

This season the number of idle bulls was 221, not so great a number but that they were kept at bay until the disintegration of the harems had commenced, when they usually became the possessors of a small number of cows.

YOUNG BULLS.

Young bulls, otherwise known on the islands as "quitters", are usually 6 or 7 years old, and at the approach of man retire. They frequently haul out with the bachelors or form a shifting fringe about the group of breeding seals. In rare cases they controlled harems, usually on the margins of the rookeries, and in a few cases were seen in the act of copulation.

An accurate count of these animals was not made, unfortunately, since a considerable number had hauled out with the bachelors and could not be numbered without interfering with subsequent drives. At the height of the season the number on the rookeries was 184, and at various times 386 in all were included in the drives. Some were doubtless driven more than once, but it seems certain that the

actual number was at least 200, giving a total of 384. As the average life of the male is 13 years, of which 5 are spent as harem master, the decrease annually of the present active list is 276. It is apparent therefore that killing in the past has not been too close, and that there is a sufficient reserve at the present time.

COUNTS OF IDLE AND YOUNG BULLS.

The following count of idle and young bulls was made at the time the census of harems was taken. It was not possible without causing undue disturbance to enumerate members of the latter class that had hauled out with the bachelors on four important rookeries—Northeast Point, Gorbateh, the Reef, and Tolstoi.

COUNTS OF IDLE AND YOUNG BULLS ON ST. PAUL AND ST. GEORGE ISLANDS, 1910.

Rookery.	Idle bulls.	Young bulls.	Rookery.	Idle bulls.	Young bulls.
St. Paul Island:			St. Paul Island—Continued.		
Gorbateh.....	12	17	Tolstoi Cliffs.....	5	1
Ardiguen.....	1	Lagoon.....	3
Reef.....	28	17	Total.....	144	136
Kitovi.....	9	9			
Lukanin.....	5	11	St. George Island:		
Polovina.....	5	12	East.....	20
Polovina Cliffs.....	5	5	Zapadni.....	19	17
Little Polovina.....	2	7	Staraya Artel.....	17	21
Morjovi.....	1	1	North.....	21	10
Vostochni.....	29	26	Total.....	77	48
Zapadni.....	22	13			
Little Zapadni.....	10	8	Grand total.....	221	184
Zapadni Reef.....	3			
Tolstoi.....	7	6			

BREEDING COWS.

While there is a steady increase in the number of cows hauling out on any rookery for a month after the middle of June, a seagoing stream soon makes its appearance, consisting of cows en route to the feeding grounds after their pups are born. Hence at the "height of the season," about the middle of July, the number of cows on the beach is no true indication of the total number, nor does it always bear a constant ratio to the whole. Under certain circumstances, possibly due to climatic conditions, nearly the full complement may be present at the height of the season, and again in other years not over 30 per cent of the community may be on the rookery. It thus becomes apparent that such counts, of varying character from season to season, must be used with extreme caution, if at all, in estimating the entire number of females on any rookery or the annual decline or increase. As has been pointed out by others, we may arrive at an approximate estimate only by a count of the pups, and under that heading an attempt has been made to show that even here we must use the results with the greatest care in making a census of the herd.

During the height of the season counts were made on the following rookeries:

COUNTS OF COWS ON SOME ST. PAUL ROOKERIES DURING HEIGHT OF SEASON,
1897, 1909, AND 1910.

Rookery.	1897	1909 ^a	1910
Lagoon.....	1,319	281	229
Toisloi Cliffs.....	1,286	698	646
Zapadni Reef.....	1,049	137	78
Ardiguen.....	470	207	218
Kitovi.....	2,436	892	837
Kitovi Amphitheater.....	654	127	92
Lukanin.....			820
Polovina Cliffs.....			426
Little Polovina.....			421
	7,214	2,342	3,767

^a Counts of Mr. George A. Clark.

COUNTS OF PUPS.

Owing to the fact that all the cows are never present on the rookeries at a given time, it is obvious that the only approach to an accurate census of the breeding females is to be made by counting all the pups on all the rookeries. Such a procedure is not only arduous but wasteful, since the cows in early August, when the counting is usually done, are readily driven into the sea and a portion must inevitably fall a prey to the pelagic sealer. Accordingly it was the custom, for several years prior to 1906, to count the pups on a number of rookeries, and with such data estimate the entire herd. In more recent times the number of such pup counts has become gradually lessened until this year Kitovi was the only rookery examined, with the following result: Total number of pups, 1,966; dead, 62.

The implication that Kitovi is a typical average rookery must rest upon the assumption that it stands between those in which the decline is great and those in which it is at a minimum. As a matter of fact, an examination of the counts of Kitovi during the past four years shows that in reality it has been remarkably constant so far as the cows are concerned. Commencing with 1907 the number of pups each year is 1,959, 1,960, 1,979, and this year there are 1,966.

Last year there were 55 active bulls on Kitovi and 1,979 pups; this year there are 62 bulls and 1,966 pups. The average harem last year was 36; this year, 31.7; a difference due almost wholly to the increased number of active bulls. And, furthermore, this slight difference is of far-reaching importance when we come to consider the application of these data to the estimate of the entire herd. With 1,381 harems, each numbering 36 cows, the estimate would be 49,716; if each comprised 31.7 cows there are then 43,777 in the breeding herd, a difference of 5,939, or 11,878 when the pups are included in the count, due solely to the presence of 7 active, extra bulls.

Then, again, on the other rookeries an increase or decrease in the number of active males produces a corresponding rise or fall in the estimated number of cows. For example, on Vostochni there may be 6,500 cows and 200 active bulls. If 20 idle bulls, before the height of the season, secure 1 cow apiece, they enter the active list, and there are then 220 harems. As the average harem is 31.7, this increase affects the estimate to the extent of a gain of 634 cows, though in reality the number of cows has remained constant. At present this gain or loss in the active bull list outside of Kitovi is of relative unimportance, but it is conceivable that under certain circumstances it may assume a more prominent rôle.

I have in mind the fact that in treating this phase of the problem we are, after all, dealing in generalities, but the results may become so general that they have little actual value. In my opinion it is highly desirable that a pup count on all of the rookeries be made during August, or even early in September, in stress of weather, or possibly after the sealing fleet has left Bering Sea; and again a similar survey should be made five years later, when the typical rookery could be determined and questions relating to the increase or decrease of the herd be settled beyond a reasonable doubt.

ESTIMATES OF COWS AND PUPS.

Assuming that the average harem comprises 31.7 cows, the total number in the entire seal herd is computed in the following table:

COMPUTATION OF COWS AND PUPS ON ST. PAUL AND ST. GEORGE ISLANDS, 1897, 1909, AND 1910.

Rookery.	1897	1909 <i>a</i>	1910	Rookery.	1897	1909 <i>a</i>	1910
St. Paul Island:				St. Paul Island—Contd.			
Gorbatch.....	9,086	4,320	3,551	Tolstoi Cliffs.....	2,891	1,452	888
Ardiguen.....	736	355	349	Lagoon.....	2,598	693	285
Reef.....	13,393	6,624	6,530	Total.....	112,023	41,266	35,502
Sea Lion Rock.....	3,009	2,196	<i>b</i> 1,934	St. George Island:			
Kitovi.....	5,289	1,979	1,966	Little East.....	1,190	144	127
Lukanin.....	4,100	1,404	1,299	East.....	3,776	2,340	1,870
Polovina.....	4,218	1,512	1,585	Zapadni.....	3,923	1,548	1,490
Polovina Cliffs.....	2,200	828	634	Staraya Artel.....	1,681	1,512	1,522
Little Polovina.....	1,180	684	380	North.....	5,782	3,816	3,266
Morjovi.....	6,873	1,620	1,490	Total.....	16,342	9,360	8,275
Zapadni.....	13,511	5,292	3,740	Grand total.....	128,365	50,626	43,777
Vostochni.....	26,845	6,624	6,467				
Little Zapadni.....	5,192	2,232	1,711				
Zapadni Reef.....	3,041	319	222				
Tolstoi.....	8,702	3,132	2,471				

a Estimates of Mr. George A. Clark.*b* Estimated.

In the above census it is to be remembered that the totals apply to cows and pups and that both together number 87,554 in 1910.

YEARLINGS AND 2-YEAR-OLDS.

Of the various computations necessary to arrive at an estimate of the entire seal herd those concerned with the 2-year-olds and yearlings are the least satisfactory. And yet by restricting the quota of skins taken to 3-year-olds we could in a relatively short period arrive at a fairly close approximation, and at the same time settle other vexed questions that are in need of solution. At the present time we are compelled to base our estimates largely on the quota and those males dismissed from the killing grounds.

In the quota this year 10,210 skins weighed less than 7 pounds each, and 2,603 males were dismissed from the drives because they were undersized. Some of the latter were doubtless driven more than once, but even so it is probable that the number was not less than 1,800. Besides these, 337 2-year-olds were branded early in the season. This accounts for 12,347. That there are yet others is evidenced by the fact that fully 700 bachelors of killable size appeared on the hauling grounds of both islands in early August after the killing season, in addition to which there were probably other young animals in considerable numbers, though how many is uncertain. And it is probable, also, that some were at sea, but here again we have no exact information. A conservative estimate of 2-year-old males is therefore 13,000, which is also the number of virgin 2-year-old females that during the late summer arrived at the rookeries.

It appears to be the general belief that in 1909 there were 12,000 yearlings of each sex, and judging from estimates based on pup counts and the quota, the herd appears to have been stationary for the past three or four years. Hence we might suppose that the number of yearlings for this year is approximately the same as last. However, it is possible that the estimates based largely on Kitovi are misleading and that the quota was maintained by closer and closer killing. Future observations alone will settle this question. In order to be on the safe side we may assume that a shrinkage of 10 per cent has taken place and that accordingly the number of yearlings of each sex for the year 1910 is 10,800.

THE RESERVE.

For six years prior to 1910 two thousand 2 and 3 year old males were reserved annually, but as the brand, made by clipping the hair on the head, was not permanent, we have no means of knowing how many of these were subsequently killed. If 1,000 were actually exempted each year and there is an annual mortality of 10 per cent there should be between 500 and 600 this year remaining of the reserve of 1905. And if the decline of the present number of active bulls is approximately 300 there should this year be an increase of

over 200. As a matter of fact there is a slight decline, so that it appears that males exempted one year were killed the next. In reality, if we may judge from the records of past years, there is no necessity of reserving annually a number greater than one-half of the total number of active bulls, but these should be chosen from the class that will be wiggged next year, or branded with a permanent mark.

This year 1,271 males were set aside as a reserve. Very nearly 1,000 4-year-olds and older were dismissed from the drives. Some of these were doubtless driven more than once, but it is assuredly safe to conclude that 600 were actually present. In addition there were others on the water front and in the water to the number of at least 100, and finally there were 605 idle and half bulls. This gives a total of 2,576, a number considerably in excess of the requirements.

ESTIMATE OF ALL CLASSES.

The following is an itemized estimated census of the seals forming the herd in 1910:

ESTIMATED CENSUS OF SEAL HERD IN 1910.

Class.	1910
Active bulls.....	1,381
Breeding cows.....	43,777
Pups.....	43,777
Idle bulls.....	221
Young bulls.....	384
Bachelor reserve.....	1,971
2-year males.....	5,500
2-year females.....	13,000
Yearling males.....	10,800
Yearling females.....	10,800
Quota killed.....	13,584
Total.....	145,195

According to this estimate and Mr. Clark's estimate of 158,488 for 1909, the herd has diminished by 13,293 within the past year. Whether this is a just conclusion must be decided by computations to be made during the next few years. Accuracy is impossible so long as the present methods are employed. During late years it has been assumed that the error is not greater than 12 per cent, and this is probably a fair conclusion. Last year the herd numbered between 150,000 and 160,000; this year it seems to fall between 140,000 and 150,000.

THE QUOTA.

In 1897 it was estimated that the ratio of bachelors to the entire herd was 1:20; this year it is approximately 1:10. The conditions that have brought about this change are matters largely of conjecture, for our knowledge of the seal is too imperfect to warrant a satisfactory explanation. It is reasonably certain that the mortality among pups is less than formerly and, as Mr. Lembkey states in his report of 1909, this would insure a proportionately larger return of yearlings, males and females, and subsequently of breeding cows, both of which are factors tending to the increase of bachelors. Then again the death rate of the young, estimated to be 50 per cent during the first year, may have been excessive and the proportion of bachelors to the the entire herd may have been greater than was estimated in 1897. But even if these problems were solved to our complete satisfaction they do not bear directly on the question of the conservation of the herd. As noted in another paragraph, the essential point to be settled is regarding the reserve. If it is sufficient to supply the requisite number of males, as the active ones disappear, then it appears to be the best policy to kill those remaining. The herd is declining or at best stationary. The pelagic sealer is hovering about the islands and close killing diminishes his catch. That the quota should consist of the skins of 3-year-olds is obviously the most economical plan, but from a purely zoological standpoint this is a matter of detail and relatively unimportant.

This year 10,749 skins were taken on St. Paul and 2,834 on St. George, a total of 13,583, or 785 less than in 1909. The weights of these, together with data relating to the drives and numbers dismissed, are given in the report of the agent in charge.

CONSERVATION AND SOME INVOLVED PROBLEMS.

It has been seen from the foregoing paragraphs that the number of males for breeding purposes is sufficient, and this has been so for many years. On the other hand the number of females has been decreasing steadily, and there is no question but that the pelagic sealer is, and has been, an important factor in producing this decline. Furthermore, another fact is evident, that with the conservation of the females on land and the setting aside annually of a sufficient male reserve no additional care will add one jot or tittle to the number of cows. It is perfectly true that the elements involved in the problem of the male reserve are intricate and some are not clearly understood, but in the last analysis the important question to be answered is this: Is there a sufficient number of males to take the place of those active on the rookeries? and every year the answer has been in the affirmative. On land, killing may be close, and skins below the

maximum value may be taken, but if the females are protected and the male reserve be adequate other questions sink into a position of relative unimportance as the seal problem now presents itself.

The foregoing paragraph is written from a purely biological standpoint, having in mind only the conservation of the herd, but there are other questions of a more practical bearing that should be settled before the sealing business can be conducted on the most economical basis. In the first place it is highly desirable that the number of pups born annually be more accurately determined, reducing the possible error below 10,000, where it stands at present. In 1896 the error was estimated to be about 6 per cent, but last year and this it is probably twice as great. With the herd approaching the vanishing point accuracy is more than ever a desideratum and should be had even at the cost of an unusual amount of labor.

Again, we have no information, within narrow limits, of the number of males or females returning at the close of the first year, or if this be beyond computation, then of the number returning the second or even the third year. This, as the sexes are of approximately equal numbers, will give more nearly than any other practicable method the number of females taking their places on the rookeries. Beyond this time observations should be made to determine the number of reserved 3-year-olds that appear the next year, and finally the percentage that ultimately becomes active on the rookeries. From such observations the reserve of males may ultimately be made with an accurate knowledge of facts, and not with such hazy ideas as we have at present.

It is highly desirable that the quota be taken from the males in prime condition, and I heartily agree with Mr. Lembkey and Mr. G. A. Clark, who argue in their reports of 1909 for the killing of 3-year-olds. I am by no means convinced that even by the branding of every pup, and so destroying the fur to some extent, we can, by this means alone, reduce the value of the skin to such a degree that the pelagic sealer will be forced out of business. It may indeed be a fact, but the brands made in the past were in some cases fatal and are supposedly about all that the young seal is able to survive, and yet not over one-tenth or at most one-eighth of the fur is destroyed. The resulting depreciation of value will probably not amount to more than \$10, and two San Francisco furriers place it as low as \$5. The price of skins is gradually advancing and on the other hand we do not know what returns will pay the schooner owners to keep a ship in the sea. The crew, averaging 35, receives \$5 per man each month (Captain Quinan of the revenue cutter *Tahoma* says \$2.50) and 12½ cents goes to each man for every skin taken by his particular row-boat. Let us suppose each schooner is out six months, and, judging from past records, 8,000 skins will be taken this year, or 320 per

schooner. If the price per skin were only \$15 (\$30 was the price they received last year) \$4,800 would certainly be a paying investment.

On the other hand there is another factor making toward the reduction of the sealing fleet which, together with the partial destruction of the skins through branding, may possibly put the pelagic sealer out of business or, more probably, so limit the number of vessels that an equilibrium of the seal herd may become a fixed feature. This element is competition. With 25 schooners in the sea, rivalry must this year have been very keen, and with a diminishing herd some competitors must sooner or later leave the field. Any depreciation in the value of skins must hasten the desirable result, provided—and here an unknown factor enters—that the price of skins does not advance. But with the decline of the number of skins it is probable that prices will advance, and it appears very questionable whether branding and competition will drive away all of the pelagic fleet for many years to come. It may, however, make it possible for the herd to remain practically stationary until some form of treaty insures more perfect conservation.

The branding process may be made to include the male pups, but as the pelagic sealer secures but few bachelors this would greatly destroy the value of the land catch without giving adequate returns. It is possible that the males dismissed from the drives might be penned up for a month or so, but unfortunately I can not speak with authority regarding this plan, that was once put into execution several years ago. Some advocates claim that it is entirely possible; that after a few days the captives show no signs of restlessness in their unnatural surroundings. Others are equally certain that the experiment was not a success, as several of the larger animals broke through the barriers and some less fortunate became restless in the extreme and finally died of exhaustion. Furthermore, it is reported the bachelors ordinarily put to sea from time to time in search of food, and it is difficult to see how food would be forthcoming even if they desisted from their attempts to escape. The fact that placing animals in captivity would prevent redriving does not appear in itself to be sufficient reason for carrying out the plan. If by these schemes we hope to drive the pelagic sealer from his elected calling then it seems to me they will not succeed, but that they may increase the value of the land catch is possible.

THE QUESTION OF AN EQUILIBRIUM OF THE HERD.

The question of an equilibrium of the herd is one of very high importance. In 1897 the Fur Seal Commission agreed that such a state of affairs would ultimately occur, and in 1909 Mr. G. A. Clark argues in favor of the possibility that there is now an equilibrium.

Unfortunately, in the present year a sufficiently large pup count was not made whereby to settle the question. The estimated decline may be approximately correct or it may be due to the methods of taking the census. If an equilibrium does exist it means that if the number of guards stationed on the islands is sufficient to prevent poaching the entire land catch may amount annually to something in the neighborhood of 10,000 skins and the herd would be in no danger of extinction. If instead of allowing matters to rest as they are the Government orders the branding of female pups, then some of the pelagic sealers may be compelled to abandon their calling, and the herd would probably increase, but there is nothing to prevent the return of the entire sealing fleet when the herd is larger and a profitable catch may be made even though each skin is much reduced in value.

As matters appear there is one way only whereby the pelagic sealer may be driven away entirely, and that is by the further reduction of the seal herd. This is at best a cold-blooded proposition and will probably not meet with general approval, but there seems to be no other way to destroy the activity of the fleet.

The question now stands, Shall the pelagic sealer be driven from the sea and the financial gain from the then highly diminished herd be reduced to a minimum, or is it better policy to place the business more nearly on a paying basis though the pelagic sealer share in the returns? Until pelagic sealing is discontinued by an agreement with the countries concerned the revenue fleet must be kept about the islands, under any circumstances the natives must be cared for, and in various ways a heavy financial outlay must be made annually. Personally I favor the latter plan, reaping as large a harvest as is compatible with the conservation of the herd and at the same time leaving as little as possible to those on the high seas.

THE PATROL AND PELAGIC SEALING.

The revenue fleet maintained throughout the season of 1910 a most thoroughgoing and careful patrol about the islands, where reefs, and shifty currents, and impenetrable fogs are of the most treacherous character. Three cutters, the *Tahoma*, Capt. Quinan, commanding; the *Manning*, Capt. Cardin; and the *Perry*, Capt. Haake, constituted the fleet, with Capt. Foley at Unalaska in command. Prior to July 26 each vessel remained 12 days in the vicinity of St. Paul, and after 5 days returned from coaling at Unalaska. On the date named the *Perry*, during a dense fog, went ashore at Rocky Point on St. Paul and was never floated. The duties of the remaining vessels became correspondingly increased, but so far as known no schooner pushed inside of the 3-mile zone after this accident, and

generally speaking the infractions of the law throughout the season were of minor importance.

Pelagic sealing, on the part of the Japanese, continued with unabated vigor. During this season 25 vessels were reported, 7 more than in 1909, and the reports in Capt. Foley's office in Unalaska show that each schooner carried approximately 25 to 40 men and from 5 to 10 boats. Furthermore, several of these ships cleared from Japan early in the year, and, arriving at various points from California to Sitka, followed the herd to the breeding grounds in Bering Sea. In the vicinity of St. Paul Island, none ventured, so far as known, within the 3-mile zone, but in one or two instances violations were reported by the natives on St. George, where the revenue-cutter patrol is far less vigilant. On June 28 the *Tokai Maru* was seized and fined for violation of the alien fishing law, and on July 25 the *Toro Maru* was seized and fined for violation of the custom laws (section 2773 of the Revised Statutes). On July 18 two row boats were sighted in the vicinity of Zapadni, on St. George, so close to shore that one was seen to contain at least one unskinned seal. And again during foggy weather on July 30 two boats' crews from the schooner *Hoko Maru* landed at Northeast Point and Lukanin, respectively, and the next day 4 sailors from the *Toro Maru* were captured en route to Zapadni. Though pleading stress of weather, all were taken into custody and were subsequently tried in Unalaska.

Generally speaking, the fleet operated to the east and north of St. Paul, presumably in the path of the seals leaving the Reef, Kitovi, Lukanin, the Polovinas, and Northeast Point. On July 10 the steamer *Homer* reported at least a dozen schooners with their attendant boats, which had formed a great circle between St. Paul and St. George and were slaughtering the seals compelled to cross the line of fire at two points. Although the nearest of these vessels was at least 8 miles from the shores of St. Paul, the reports of the shotguns could be heard distinctly on land, and a count I made on that day from 11.20 to 11.50 a. m. showed that 228 shots were fired, an average of 7.6 per minute.

In this connection it may be mentioned that on certain days, owing to meteorological conditions, sounds travel amazing distances. According to Capt. Quinan, shots were heard one day in July seemingly well within the 3-mile zone, but with the lifting of the fog the nearest boat was fully 7 miles distant. Somewhat later in the month a fusilade was distinctly heard on St. Paul, but with the clearing away of the mists not a single boat could be detected even with powerful glasses used from the top of a 70-foot hill. It thus becomes apparent that alleged transgressions, based on this species of evidence alone, are far from being trustworthy.

To an outsider the practice of having Japanese stewards aboard the cutters is not above criticism. They must inevitably come into possession of valuable information that may be of service to Japanese prisoners, for whom they act as interpreters, if I am informed correctly. Furthermore, the Japanese detained for 10 days on St. Paul this year were in constant communication with the natives of the village, and it was no fault of theirs if they did not learn more of the island than is disclosed by the chart. One has a certain amount of sympathy for the pelagic sealer, who receives a mere pittance for his services and is the only sufferer when his boat is captured; but his imprisonment is not a serious hardship, especially if he be allowed to work on the coal pile at \$2 per day and is ultimately sent back to Japan.

These are, after all, matters of comparative unimportance. The arrest, and even the severe punishment, of such offenders do not seriously interfere with the activities of the schooners and their owners. Such devices as branding to partially destroy the value of the skins, and of penning up male seals released from the drives, are not complete preventives, so that until an agreement is consummated the international struggle between watcher and watched must forever go on with all of the attendant aggravating features. It is possible that the herd is not in a state of equilibrium, but is actually diminishing. If this continue the hunter on the high seas must ultimately vanish from the scene of his pernicious activity; but is the Government of the United States compelled to place the seal herd on the altar of sacrifice in order to bring about this desired result?

If this, indeed, be true then we must decide, and that right early, whether this be a lesser evil than the other, hypothetical to a certain degree, of branding the females, which form the greater portion of the pelagic catch, and by the depreciation of their skins, making it necessary for a greater number than at present to be taken with profit by the pelagic sealer. At the same time this would render it possible for an increased number of cows to escape and breed on the rookeries, and so add materially to the bachelor herd and consequently to the land catch.

THE PELAGIC CATCH.

Regarding the pelagic catch of this year, our evidence must rest upon a very slender reed—the reports of the Japanese themselves. According to these, 4,213 skins were taken prior to August 15, of which 2,098 came from Bering Sea. Last year the reported Japanese catch up to August 15 was 4,954 skins. As a matter of fact, it was then probably twice as large, for the entire season's catch, as reported from the London market, was 10,561 skins. This year it is safe to predict that there will be at least 8,000.

COWS IN DRIVES.

During the killing season proper, closing August 1, the discipline maintained by the active bulls on the rookeries was very strict, and accordingly a very insignificant number of cows made their way into the neighborhood of the bachelors and were driven to the sealing grounds. Such as did so, of course, were subsequently released. During a food drive on August 10, when the harems had commenced to disintegrate, several cows appeared in the drive, but I was unable to find a single one among the dead on the killing grounds. Doubtless females may occasionally be clubbed accidentally, but this year I can testify that the greatest care was exercised, and I know of no occurrences of the kind.

FEEDING OF PUPS.

For various reasons, up to the time of my departure from the islands, no attempt was made to raise pups. The pair handled successfully by Boatswain Thurber had shed the first coat and were fully 3 months old; he was unsuccessful with the young, black pups. These last named may possibly be reared if food of the proper character be fed, but at the present time we are ignorant of the composition of seal's milk. In any event one must have not only a large store of patience but an abundance of time, and whatever may be said regarding the first requisite the latter is not forthcoming during the summer, when one is concerned with numerous other matters pertaining to the herd in general and must leave the islands in August.

CAUSES OF DEATH.

Under normal circumstances the life of the seal of either sex is probably from 12 to 13 years. Since the bulls are active for not more than five seasons, one-fifth of the active list dies each year, and as the cows are believed to breed during ten seasons one-tenth of their number disappears annually.

Judging from the reports of former years the season of 1910 was one of comparative quiet. No fatalities due to fighting were noted among the bulls, and only one cow was discovered whose death may be attributed to rough handling on the part of a bull.

On the killing grounds between 20 and 30 bachelors were found with from one to three buckshot imbedded in various parts of the body. Some of the resulting wounds were severe, but no deaths were directly traced to this cause.

In earlier times the ravages of the parasitic worm, *Uncinaria*, were especially noticeable on the Tolstoi sand flat and portions of Zapadni, but in recent years, due to the shrinkage of the herd, these areas have been abandoned. Very few cases were noted by Dr. Chichester

in 1909, and not one was detected this year. The dead pups dissected showed no lesions whatever, their emaciated appearance and empty alimentary canal indicating death from starvation.

AGES OF SEALS.

Last year 34 branded cows that had been marked as pups not later than 1902 were observed on the rookeries. This year 11 were seen prior to August 1, but during this time there is little opportunity to examine the cows critically, and later in the season such an examination would produce an unwarrantable disturbance on the rookeries. However, the fact is established that there are branded cows in existence, and the time of their disappearance and their possible age may be decided at a later date. It is interesting to note that two cows on St. George bore the T brand of 1899.

Practically every active bull on both islands was examined critically, but not a single brand was seen and none was reported by the government agents or the natives. The branded bull on Kitovi, which last year completed his fifth season, has disappeared. Another bull, blind in one eye, occupied a site on Kitovi for the third season. In other years bulls with scars or other distinguishable marks have been seen at various stations, but these have rarely continued on the active list for more than three or four seasons. It is therefore an established fact that under ordinary circumstances the male becomes active at 8 years of age and lives three or four years thereafter. The age of the female is not known with the same degree of certainty, but it is commonly believed that she lives to the same age.

APPENDIX—EXTRACT FROM FIELD NOTES.

Beginning early in August, the harems begin to show signs of disorganization; the majority of the cows have been served and are free to come or go without serious let or hindrance; the idle and half bulls roam about at will and the breeding season thus passes into its last stage. From this time on observations producing no unwonted disturbance are to be made only from some place of concealment, such as are supplied by the cliffs of Ardiguen or Lukanin. To these two spots I repaired practically every day in August, and for varying lengths of time watched the life of the seal herd. It is unnecessary to detail observations that have already been recorded by several students of the subject, but I may voice again the general verdict that such a show of mammalian life is to be met with nowhere else on the face of the earth, and from several points of view it would indeed be a calamity if the seal meets the fate of the manatee, the sea otter, or the buffalo.

Concerning other life on the islands, much has been said and much remains to be investigated. For many years the bird life has received the attention of the ornithologist and the more important phases of the problems involved have probably been settled; yet there are other matters of minor detail relating to stray migrants, nest materials, and construction and feeding that well deserve attention.

The insects of the islands are numerous and of all the animals or plants doubtless afford some of the most important and interesting problems, if not the very greatest, of purely scientific character remaining to be solved. Owing to the brevity of the summer season, some of the stages in the life history are completed in a surprisingly short space of time, and a comparison of the life histories of related insects in adjoining regions would be interesting to say the least. Furthermore, the conditions under which they survive the winter will also be an interesting chapter in the life of the island organisms.

The flowering plants have been the subject of much study, and it is doubtful if many novelties will be recorded in the future. To a less extent this is true of the lichens, but there are unquestionably small species that have escaped detection; and again there are modifications due to habitat that make it altogether possible that superficially similar forms may in reality be distinct species. Among the fungi there are certainly new forms. On some of the upland slopes in the early season I have found species that do not correspond to any described in the reports of the region.

It is highly desirable that a museum be installed on the islands, containing, so far as is practicable, specimens of all the animals and plants. And equally desirable is a library, comprising all works that in any way are concerned with the biology of the country.

Finally, one word relating to the natives. Considering their antecedents, and especially their former mode of life and lack of advantages, these people have made truly remarkable strides, and yet there is obviously room for improvement. By nature conservative, they are somewhat nonplastic, but at heart they are anxious to better their condition, and they do respond with comparative readiness to all uplifting influences. In matters relating to personal hygiene there is much to be desired, and, improved, their span of life will doubtless be lengthened to a very noticeable degree. And, again, it is highly desirable that during the long and confining winter both the men and women have something to occupy their time—something profitable and yet agreeable, and if possible with a resulting value in some larger community. It is difficult to decide what is best. Numerous plans have suggested themselves, but none of them are free from certain inherent difficulties, and I earnestly hope that those more competent may give the subject their serious consideration, for certainly this species of missionary work carries a rich reward.

In addition to the questions here outlined are others of deep import. Years ago Darwin called attention to the remarkable similarity of the animals on the Galapagos Islands to those on the western slope of South America, and on the basis of this likeness formulated his theory of evolution. Doubtless on the Pribilof Islands the same conditions exist when compared with others of the mainland. Extensive breeding experiments are being carried on in several sections of our country, but it is by no means certain that new species are created in the period measured by a man's life or even in a hundred years. On the islands, however, in a normal habitat, evolutionary agencies have doubtless made their influence felt, even though the islands are geologically young. It seems therefore wise to make extensive collections of the island fauna and flora, to study these critically, and, finally, to compare them with related species on the mainland. These results might be very interesting when considered in connection with the newly formed island of Bogoslof. On this body of land, forced above the sea within the memory of man, we already find plants thriving, and there are doubtless animals on the land or along the shore. Even if there are no visible differences between organisms on this island and those of the Aleutian chain, we may gain some insight into the means whereby their transportation has been accomplished, and if collections and careful notes are kept in the near future the evolutionary side of the subjects may be studied sometime in the years to come.





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