

**Article II. — NOTES ON THE SEA ELEPHANT, *MIROUNGA LEONINA* (LINNÉ).**

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PLATES I–VII.

The following notes on the sea elephant (*Mirounga leonina*) are based mainly upon field studies made at the island of South Georgia during the Antarctic summer of 1912–1913. The term of 15 weeks during which the writer had these seals under observation, did not, unfortunately, include the period of the birth of the young, but some new facts were gathered concerning the sea elephant's feeding habits and activities during the æstivation following the breeding season.

### HISTORY.

No attempt will be made in the present paper to summarize the results of earlier observations in the scattered literature of this interesting seal. The older records, relating to its presence and habits at Juan Fernandez, the Falklands, and Tristan d'Acunha where it has become extinct, are filled with speculation and seamen's lore; and later publications concerning the animal at Kerguelen Land, Heard Island, South Georgia, and other places where it still persists, do not give us by any means a complete knowledge of its range and life history.<sup>2</sup> *Mirounga leonina* has been styled in the vernacular the *Antarctic* sea elephant to distinguish it from the *Northern* or California species (*M. angustirostris*). It is doubtful, however, whether there is any record of the occurrence of a member of the genus within several hundred miles of the Antarctic Circle. The southern species, which may be of northern origin, is typically a resident of the lower South Temperate or sub-Antarctic belt.

At South Georgia the life history of the sea elephant seems to be somewhat as follows: The single "pups" are born on shore early in the spring and the adult seals pair immediately afterwards while the young are sucking. The adults then lie ashore for a time, moving little and of course feeding not

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<sup>2</sup> At the present time Major C. E. H. Barrett-Hamilton is at South Georgia conducting an investigation into the status of the sea elephant for the British Colonial Office. We may hope, therefore, that our knowledge of the species will soon be further extended, especially with regard to breeding habits and migrations.

at all, while they become gradually thin as their metabolism consumes the blubber layer. The young are more active, frequently entering the water and playing with one another, particularly at night. After eight or ten weeks most of the adults go into the sea where they feed and make journeys of unknown extent. A few continue ashore through the summer for I have seen greatly emaciated males lying in back-beach wallows, either alone or with several females, as late as March first. Most of the pups leave the beaches during January. The return to the land of rejuvenated, fat sea elephants begins, according to my observations, in January, and continues for two or three months. March, which corresponds to the northern September, is the month in which seal hunters consider that the most profitable animals are to be found on shore. After having "hauled up" the sea elephants congregate in herds, usually behind the open beaches, and lie in sleepy ease throughout the remainder of summer and the autumn. During the winter (May–September) they are said to divide their time between the land and the adjacent waters, and are in exceedingly well nourished condition when they come ashore to remain for the breeding season in the spring.

#### SEASONAL MOVEMENTS.

The area of field work at South Georgia included the shores of four large fiords on the northeastern seaboard — Cumberland Bay, Antarctic Bay, Possession Bay, and the extensive Bay of Isles. Six weeks were spent at the last named place, which in its isolated position, accessible beaches, and grassy islands offers an excellent summer habitat for sea elephants.

During the latter part of November and all of December the groups of sea elephants encountered comprised animals in every stage of growth. On December 3, for instance, we found on a beach near Nordenskjöld Glacier, Cumberland Bay, a large herd which included a nursery of fat pups about a meter and a half in length, a few yearlings and half grown animals, and many adults wallowing in a muddy stream, the females close beside a few of the larger males. None of the adults were extremely fat, and the males, in particular, appeared to have scanty blubber and loose skins. On December 15 at the Bay of Isles we found similar conditions, except that there were then fewer fully adult animals in proportion to the pups. Thereafter a rapid decrease in the numbers of old males and females on the beaches took place until January.

Sea elephants just out of the ocean are distinguishable at a glance from those which have lain long ashore, for the former are sleek, round, and obviously well fed, a deduction borne out by an examination of their stom-

achs. On January 4, at the Bay of Isles, I saw the first of these "newly hauled up" seals nearly all of which were females. Throughout the month they arrived almost daily, and a table of the population on various beaches during January may be of interest.

*Number of Sea Elephants seen on the Beaches at Bay of Isles in January, 1913.*

Locality in Bay of Isles.	Date January	Numbers of Seals	Sex, age, etc.
Shingle Beach	5	66	Mostly ♀ ♀ just from sea.
Sea Leopard Fiord	10	59	Mostly ♀ ♀ just from sea, 1 adult ♂ just from sea.
Beckman Fiord	11	84	42 ♀ ♀ just from sea, several thin, beach-lying ♂ ♂, the remainder pups.
Near Lucas Glacier	16	15	13 ♀ ♀ and 1 adult ♂ just from sea, 1 adult beach-lying ♂.
Sea Leopard Fiord	19	56	55 ♀ ♀ just from sea, 1 adult beach-lying ♂.
Beckman Fiord	20, 23 24	123	Mostly adult ♀ ♀ just from sea.
East of Grace Glacier	26	24	Mostly ♀ ♀ just from sea, 1 pup came out on this beach today.
West of Grace Glacier	27	44	43 ♀ ♀ and 1 large ♂ just from sea.
South of Brunonia Glacier	29	70	67 adult ♀ ♀, 1 large ♂ and 2 half-grown ♂ ♂ just from sea.
Sunset Fiord	31	44	42 adult ♀ ♀, 2 very large and fat adult ♂ ♂ just from sea.

It will be observed from the foregoing table that by far the greater number of the earlier arrivals are females, a fact which perhaps may be explained in part as the result of human interference. The patriarchal bull sea elephants have been sporadically killed off by sealers at South Georgia for more than a century, and since 1908 they have been annually wiped out in all the fiords of the island by a sealing steamer of the *Compania Argentina de Pesca*. Of the hundreds of carcasses we saw on various beaches all but very few were those of fully grown males, and the disproportionate number of females at the end of the summer season is certainly due to this slaughter.<sup>1</sup>

<sup>1</sup> Six thousand males are said to have been killed during a single season. The result of this slaughter is showing itself in a way which points to the speedy extinction of the sea elephant at South Georgia, viz., very many illegally killed females, which I dissected during the summer, had not been impregnated. The present supply of males is therefore insufficient for the perpetuation of the species.

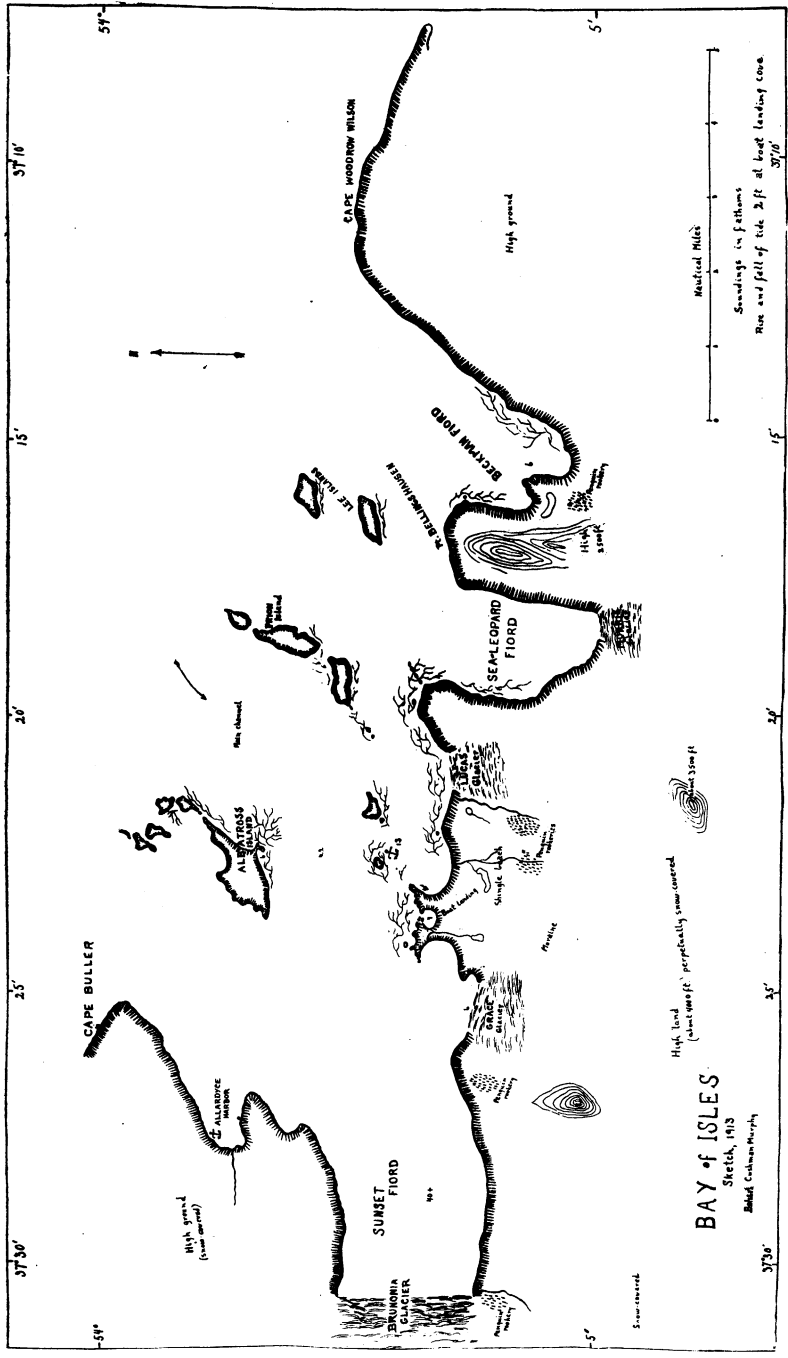


Fig. 1. Sketch map of the Bay of Isles, South Georgia, showing localities referred to on p. 65.



Few pup sea elephants were observed after the middle of January. By the end of the month large old males began to "haul up," and from that time they came out of the sea in increasing numbers until March. The largest number seen in one place was 25, observed on the eastern shore of Possession Bay on February 28.

### HABITS.

Although mixed herds of sea elephants were under observation throughout December, which corresponds to our June, I never saw a female suckling her young or giving any other indication of motherly ownership. Females dissected late in the month showed only slight traces of milk in the lacteal glands, so that it seems probable that the pups are weaned early in the season. The pups are tremendously fat during the spring, but they lose much of their plumpness before midsummer. They spend most of their time sleeping, lying in groups over the beaches, piled one upon another or resting close together on their sides or backs. Often while I walked among them and stepped over them they slumbered as though anesthetized, rarely stirring except to yawn or to scratch themselves with the nails of their flippers. A vigorous prod would arouse them, but after momentarily attempting to look ferocious by showing their ridiculous little peg-like teeth, and glaring fixedly with large, moist, brown eyes, they would fall back again with closed lids and a sigh of resignation. They did not object very seriously even to having their chins scratched. Sometimes they were seen to play with one another in a kittenish manner, and they appeared to move about considerably at night.

Adult sea elephants are instinctively ill-tempered, especially toward the end of the breeding season when they are thin and presumably hungry. They snarl even at such a familiar creature as a penguin if it chances to walk near them along the beach. When approached too closely the bulls rear up on their fore flippers, thrash about with their hinder parts, contract their trunks into tight, bulging folds, open their pink mouths to an angle equalled among all mammals only by the Pleistocene saber-toothed tiger, and finally utter their vocal expression of displeasure, which cannot be described by any single English word. This sound has usually been termed a "roar," but it has been compared more accurately with the noise made by a man gargling. The whole process appears extraordinarily painful. After the mouth has been opened to its greatest extent a rather long period of nearly noiseless choking ensues; then the volume of breath seems to squeeze past the epiglottis, the soft palate vibrates violently, and a spasmodic sound suggestive of both strangulation and nausea is produced. It is not a loud

sound yet it can be heard for a surprisingly long distance on calm nights. The voice of immature bulls is louder and more startling than that of the adults, being a cavernous, grating bellow with somewhat of a groan in it. The cows have rather soft "gargles," and also utter high pitched barks. The pups, too, bark, and sometimes wail almost like young children.

If a group of sea elephants is annoyed, for instance by being prodded and driven by sealers, they sometimes give way to an uncontrolled panic of passion, thrashing about blindly, biting the ground, running amuck and tearing the backs of all others within reach. Sealers have told me that they

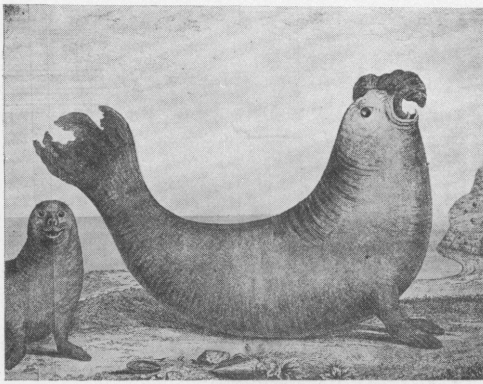


Fig. 2. "A Sea Lyon of Juan Fernandez." From Anson's Voyage. Compare with Fig. 24, Plate VI.

have seen bulls in such fits of fury actually lift a younger male or full grown female off the ground and toss it aside. When a man shouts and swings his arms in front of a bull sea elephant, vexing it until it has become thoroughly excited, its behaviour recalls a toy rocking-horse in motion, for the enraged seal commonly sways in a similar manner, first rising until its fore flippers are far above the ground, then rolling forward

until the hind flippers are curved up over its back, but as a rule only rocking, without moving from its position. All the while the beast's blood-shot eyes are blazing with rage, the trunk is drawn up into a "bonnet" above the gaping mouth, the tusks gnash the ground as the animal strikes forward and downward, the whole expression of its emotion being truly hideous. Sea elephants can spin themselves around very quickly to meet an attack from the rear, and their surprisingly extensible necks give them a long and dangerous reach.

Generally their tactics with regard to human beings are wholly defensive. Indeed, barring rare exceptions, they regard a man with absolute indifference unless he comes within a few paces of them, the few shy individuals that take to the water at sight probably having vaguely unpleasant memories of sealers' cruelty. Now and then, however, and particularly during the rutting season, according to sealers, one meets a pugnacious or jealous bull which seeks trouble at every opportunity. On February 17, at the Bay of Isles, I watched in hiding an unusually large sea elephant come out

of the cove below my tent about noon and work its way up among the tussock hummocks. I wanted its skeleton, but unfortunately had left my rifle aboard ship. However, as soon as the lazy animal had found a berth to please it and had fallen asleep, I descended all unsuspectingly with a camera and a seal lance, and after making ready for a head-on snapshot I whistled to awaken the brute. The effect was greater than I had bargained for. It opened its eyes casually enough, but instantly on seeing me it rolled over with a snort, and bounced toward me so quickly that I had barely time to avoid the charge. Of course after that it was easy enough to dodge it among the hummocks where it was at a disadvantage, but nevertheless it continued for some time to bump along steadily after me, with homicide in its eye. Setting down the camera I attacked my pursuer with the lance, and the brute snorted and bellowed as it reared two or three feet above my head and hurled forward its tons of weight in an effort to crush me. Finally it headed for the water, but I succeeded in killing it before it could escape.

The fighting by means of which bull sea elephants obtain possession of the cows has been often described;<sup>1</sup> but the animals fight from other motives as well, or apparently from no motive at all. From my camp I frequently saw half grown bulls wake from peaceful naps and immediately start quarrels with near neighbors; and the youngest pups were quite as apt as their elders to rear and bump against each other, or to assume heroic poses and glare with infantile ferocity into one another's eyes. In the ordinary contests of the bulls, which seem to be of a purely calisthenic nature, the two champions meet closely and rear up until only the hinder part of the belly rests on the ground, and then hurl themselves one against the other, clashing their breasts and raking one another's thick-skinned necks with their heavy

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<sup>1</sup> It would seem curious that the accounts of polygamy and selective fighting among these seals should have been discredited by several recent writers. The common experience of sea elephant hunters has been that during the breeding season the larger bulls accumulate groups of cows which they defend desperately from the encroachments of other bulls, a successful lord of such a seraglio being termed a "beachmaster." (In this connection see Pl. VII, fig. 27). Anson (1748), writing of the bulls at Juan Fernandez, says: "One of them was the master of the flock, and from his driving off the other males, and keeping a great number of females to himself, he was by the seamen ludicrously styled the Bashaw." Although my observations, at South Georgia were made after the height of the breeding season had passed, I repeatedly saw single bulls lying apart with four or five cows, and I observed that whenever a rival approached such a group a fight was apt to be precipitated.

The account of the American sealer, Captain Fuller, (*Forschungsreise S. M. S. "Gazelle,"* Theil III, Berlin, 1889) is worthy of consideration. Captain Fuller is said to have been born on a sealing vessel at Kerguelen Land, a distinction probably shared by no other human being, and in later life he voyaged frequently to that island in order to take sea elephant oil. He had unparalleled opportunities for learning the habits of these animals, and he has been generally credited with being "an unusually careful observer" (*Bull. U. S. Nat. Mus.*, No. 2, 1875, p. 41). Captain Fuller's direct testimony concerning the polygamy of the sea elephants will require indubitable refutation before it may be disregarded.

lower canines, at the same time flinging their posteriors into the air. Occasionally they come to a clinch by pressing the sides of their necks together, and so take a breathing spell. All the motions are clumsy and lumbering; a good deal of threatening and sputtering occurs between the clashes, and sometimes they merely rise up on the toes of their fore flippers and stand rigidly, with heads held back and mouths wide open, until each collapses from weariness, without a blow having been struck. Thoroughly angry bulls, however, clamp jaws on their rivals, badly lacerating each other's pelts. I saw one large animal which had lost a good portion of the wall of the snout, and others with cicatrices which extended clear through the blubber layer on the shoulders. All but the youngest animals have faint spots distributed over the back, breast, and sides, which seem to be due to irregularities of the hair on small scars made by the teeth of their fellows.

Fondness for company is one of the sea elephant's marked traits. An animal coming out of the sea is obviously not contented on a lonesome shore. It wanders about nervously between brief resting periods and soon returns to the water, perhaps feeling that it *must* find someone to quarrel with. A sea elephant when landing crawls slowly up the strand, stopping to let the waves break over it and taking advantage of every swell to aid its progress. When it has reached the upper beach it rises to its full height and reconnoiters; then, proceeding a little further it repeats the action, or if it spies none of its kind it may take a siesta before continuing the search. A certain wind-swept beach plain, bounded by two glaciers and extending back more than a mile from the Bay of Isles, was a favorite place for sea elephants of all sizes to "haul up." The western end of this beach, below the site of my camp, was covered with hummocks of tussock grass and a dense growth of "Kerguelen tea" (*Acæna*), the other three-quarters being a stretch of fine shingle, nearly bare of vegetation, and enclosing four ponds or chains of ponds which were fed by some of the innumerable glacial streams that cross it. During December about 250 sea elephants were summering on various parts of this beach, and even after the sealers had sent these the sad way of their forefathers, whose bones lay scattered far and wide, others came up from time to time. When we first arrived, groups of the animals were occupying three different types of lairs, namely: 1, the depressions or troughs between the tussock hummocks; 2, grassy places on the banks of the streams and fresh-water ponds; 3, pockets of stagnant, fluid mud around the edges of a terminal moraine behind the shingle. Each cluster of sea elephants lay as closely together as possible during the daytime, and all the lairs had a strong swinish smell. The younger animals of the groups near the ponds entered the water more or less and indulged in many of their fights there; the animals in the mud-holes lay engulfed to the eyes and

seemed to wallow thus for days at a time. At night all were noisiest and most active, some roving about, for in the morning I often found their broad tracks winding across the pebbly plain and sometimes leading a mile away from the bay. On a level surface sea elephants can bob along faster than a man can walk, but pauses for rest are made at short intervals. Their mode of progression has been well likened to that of an inch-worm, yet when in a hurry they arch the spine and jerk forward the pectoral flippers with such rapidity that their resulting gait might almost be called a gallop. It is laughable to see a fat adult bounce along at full speed, with head jerking up and down and ponderous blubbery sides shaking. The hind flippers are of course not employed for travel on land, but are merely trailed. Although going up hill is necessarily a slow and painful process for sea elephants, they are nevertheless ambitious in that feat, especially on those parts of the coast where the best growths of tussock grass are on hillocks near the shore. East of Possession Bay is a lake which can be reached from the seaside only by a very steep climb, yet many young sea elephants were swimming in it. Not infrequently we found herds of the animals on the summits of promontories 70 or 80 feet above the sea, and in one instance much higher, atop a perpendicular cliff which the seals had surmounted from the rear by clambering up an adjacent valley. Later the seal hunters visited this place, and I was told that a stampeded cow had dashed over the brink of the cliff and had fallen more than a hundred feet to the beach below, yet she scurried right into the sea and swam away vigorously!

When in the water sea elephants remain submerged most of the time. Sometimes when offshore I have seen a bull thrust its great head out of the still bay, slowly revolve two or three times while replenishing its store of oxygen, and then quietly sink to be seen no more. When swimming they progress by means of wide sculling sweeps of the hind flippers, the lobes or blades of either limb working simultaneously and in parallel planes. Young pups make strong backward strokes with their fore flippers also, but the adults seem to do so only when sharply turning. It is astonishing to see with what ease their huge bodies glide through the dense thickets of the giant kelp, that longest of sea plants, whose submarine branches harbor a fauna more abundant than any inhabiting the forests of the upper world. I suspect that the sea elephants procure a part of their food among the tangles of the kelp, for I sometimes found small rubbery pieces of the seaweed in their alimentary tracts.

Notwithstanding the various activities I have described, sleeping, after all, seems to be the main business of sea elephants during the summer months. They sometimes take naps in the coves and ponds, either at the surface, with round backs just awash, or else down near the bottom, where they

maintain a perfect hydrostatic balance. Ashore they sleep most of the time, usually lying belly up, and they often refrain from breathing for considerable periods by keeping the nostrils tightly closed just as if they were under water. Still more often they make use of one nostril only, spreading and closing it with each breath, while the other remains shut all the time. A sea elephant's sleep is suggestive of nightmares or a guilty conscience. The inspirations of the breath are irregular gasps, the expirations tremulous wheezes. The body shakes violently from time to time, and the fore flippers are ever nervously moving about, now scratching the sides, now the head, which is inclined downward until within their reach; next they may be crossed over the breast in order that one flipper may be scratched by the other. The fingers of the flippers are very flexible, bending when employed in scratching quite like human fingers. The hind flippers are now and then spread fan-like, and brandished in the air, or are rubbed and clasped together like a pair of clumsy hands. Awake or asleep they are fond of flinging sand or mud over themselves by scooping the earth backwards with the palmar surface of the pectoral flippers. All these motions often go on while the brutes are in such total oblivion that it is difficult to awaken them. I have tossed a handful of sand into the wide open nostril of a restless, sleeping bull, throwing it into a fit of coughing, yet it did not even open its eyes. In December a group of nine half grown bulls, which I was careful not to alarm, lay sleeping beside a stream near my tent, and I believe none of them moved so much as its own length during ten days, although they roused up once in a while for pugilistic encounters, and made considerable noise.

#### Food.

Regarding the food supply of the sea elephant I made some interesting discoveries. The stomachs of animals which had lain on the land a long time were almost invariably filled with sand and gravel, and the sealers considered this an indication that these seals had been on the point of going to sea. In such cases all trace of food had disappeared excepting the hard, chitinous beaks of squid of which there were sometimes a hundred in a single stomach. Within the stomachs of animals killed as soon as they had come ashore, I found the remains of both squid and small fish. From one female I took fifteen fishes about 25 centimeters long, but which were so far trituated that I could not identify them. No other swallowed substances were found excepting salt water and bits of kelp which probably had been introduced accidentally. In many of the two hundred or more stomachs which I opened there was a quantity of mucilaginous secretion colored yellow or

green with bile pigments, and the stomachs of all but the young pups contained at least a few squid beaks. Every stomach without exception swarmed with parasitic nematode worms. Occasionally I found platyhelminths in the colon.

#### PELAGE, GROWTH, SIZE, ETC.

The sea elephant's hairy coat is close, short, and stiff. The pelage of the pups during the first season is blackish brown on the upper surface, and of a light creamy buff color below. When wet the ventral surface looks white, especially from a distance. After the first year the animals show a wide range in coloration, seemingly with slight regard to age, for gray, brown, and tawny adults are often seen in one group. Adult females are perhaps prevaillingly grayish brown, and "brown cow" is a common term in the sealer's parlance. I noted a good many large bulls which were of a tan hue. However, the very oldest males seem to be invariably dark, and this is doubtless the stage quoted by Sir William Henry Flower (1881) as being "dirty blue-black," and by Professor Einar Lönnberg (1906) as "oily greenish gray." The shedding of the hair during the summer gives the animals a very ragged appearance. The season of this process is subject to individual variation, for I saw both males and females in every stage of the change from the end of November until March.

The growth of the pups is very rapid at first, those which I saw about the first of December averaging a meter and a half in length, or almost twice as much as a newly born animal which I found dead. The few pups seen toward the end of January were about two meters long, but others found in a fresh-water lake on February 26 were no larger.

Among the adults the disproportion in size between the sexes is much greater than with the California species of *Mirounga*, for out of more than a thousand females I saw none which exceeded three meters in length, whereas Townsend (1912) measured females of *M. angustirostris* at "eleven feet."<sup>1</sup> Most of the females I measured at South Georgia were less than 260 centimeters long.

Until the first of February I saw no living male more than four meters long, but thereafter five meter bulls were taken several times. On Febru-

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<sup>1</sup> Harris, 'Pacific Monthly,' April, 1909, records a female of *M. angustirostris* which was "eleven feet, five inches" long.

Wilkes, Nar. U. S. Expl. Exp., 1845, records a female of the southern species taken on sea ice in lat. 65° 08' S, long. 163° E, Jan. 14, 1840, as having been 10 feet 9 inches long, but this measurement may have been made along the curve of the back.

Lönnberg (1906) records a South Georgia female measuring 310 centimeters in length.

ary 28 the record sea elephant was killed in Possession Bay. I did not see this animal until it had been stripped of blubber, but in its flensed condition it measured 651 centimeters (21 feet 4 inches) in a straight line. Measurements of five smaller males and of one large female are tabulated below. Lengths given are straight distances, the body contour being eliminated.

*Measurements in Centimeters of six adult Sea Elephants.*

	1 ♂	2 ♂	3 ♂	4 ♂	5 ♂	6 ♀	Measurements of adult males nos. 1-5 averaged and re- duced to per centum
Tip of snout to end of tail	370	362	419	408	455	265	100
Tip of snout to end of hind flippers	427	418	480	467	520	307	114.8
Tip of snout to anterior border of axilla	120	117	151	139	172	83	34.7
Tip of snout to inner can- thus of eye	26.4		38	30.4	36.5	14	8.1
Tip of snout to corner of mouth	25.5		30		31.4	15	7.2
Tip of lower jaw to cor- ner of mouth	14		18	15	22.5	11	4.3
Mouth, corner to corner	26		27.5	27	34	17.2	7.1
Length of eye opening			5.8	5.1	5.8	4.3	1.4
Breadth of head at exter- nal canthi of eyes			31.5	29.8	31.6	20.1	7.7
Pectoral flipper, anterior insertion to tip	57	63	65	55.5	69.5	44	15.4
Hind flipper from cruro- tarsal joint			81	75	76	55.5	19.2

In females the eye is relatively larger and both pairs of limbs average slightly longer in ratio to the body length. Other proportional differences are due chiefly to the absence of a long snout in the females.

When sea elephants are in best condition (from a sealer's point of view, at any rate) the girth nearly equals the extreme length. The fattest one that I saw was a bull 560 centimeters (18 feet 4 inches) long. It was so round and distended that it had the appearance of being pneumatic, and inflated under high pressure. Seven men could barely turn its body over with the aid of ropes and hand holes in its skin, even after half the blubber



had been removed and a trench had been scooped under one side of the carcass. Its blubber was 19 centimeters thick in the center of the breast and in the lumbar region.

#### CHARACTER OF THE SNOUT.

Concerning the character of the male sea elephant's snout or trunk, much wrong information exists in the literature. Dr. C. H. Townsend (1912) has disposed of the generally accepted tradition that the trunk is capable of inflation and that under excitement it is puffed up, like the hood of the bladder-nosed seal. A cursory dissection on the head of a large male which I brought from South Georgia shows that the upper and outer walls of the nostrils are composed of excessively developed dermal muscles the arrangement of which does not differ fundamentally from that of the nasal muscles in the harbor seal (*Phoca*). This heavy muscle layer is remarkably vascular, and is to all appearances true erectile tissue capable of being voluntarily charged with blood. Eliminating the inflation theory, such a great expansion of the snout as is shown in Fig. 19 can hardly be explained on any other hypothesis than that of erection by blood pressure. There are two or more blind vesicles leading upward from the nares at the middle of the lateral ethmoid cartilages, but they are far too small to permit appreciable inflation of the upper snout. Whether these culs-de-sac are homologous with the apparatus of the hooded seal (*Cystophora*) is a question which may be determined by further dissection and comparison of the material.

The snout of *Mirounga leonina* is entirely different from that of *M. angustirostris*, as may be seen by comparing the photographs of the latter species published by Rothschild (1908) and Townsend (1912) with the *leonina* pictures of Lönnberg (1906) and of the writer in the present paper. The whole nasal tube is narrower and shorter in the southern species, and is only slightly pendulous even in the case of the largest and oldest males. Nine out of ten of all those I saw at South Georgia had practically no "trunks" at all. The face in profile reminded me of that of a rat, except when the snout was drawn back and expanded into a series of tight ridges with the tip slightly overhanging the mouth. The most truly trunk-like snout that came under my notice was that of an animal only 480 centimeters long, the distance from the tip of the relaxed snout to the corner of the mouth in this instance being 30 centimeters (see table p. 74). During forcible expiration the rush of breath bulges out the nose and makes it vibrate. It then assumes its longest and straightest form as well as its greatest diameter (Fig. 8). The snout of the female sea elephant may be likened to that of a pug dog, the large, forwardly directed eyes adding to the resemblance.

## MORPHOLOGICAL NOTES.

*Bristles.*— The vibrissæ of *Mirounga* are somewhat flattened, and have curious constrictions 2 millimeters or more apart extending from the base almost to the filamentous tip. The bristles have therefore a nodulated appearance like the antennæ of certain insects. They rarely exceed 1 millimeter in diameter at the base.



Fig. 3. Maxillary bristle of *Mirounga leonina*.

In old animals many of the bristles are often broken or lost. The perfect complement is as follows:—

7 brow bristles above the inner canthus of each eye. These bristles increase in diameter and length from before backwards and are arranged in the same order in rows of 1, 3, 2, 1, respectively.

1 nasal bristle at each end of the main transverse sulcus of the snout.

39 maxillary bristles on each side. These increase in size from before backwards, and are distributed in horizontal rows as follows:—

1st row (lowest).....	6
2nd “.....	8
3rd “.....	8
4th “.....	7
5th “.....	6
6th “ (top).....	4

*Eye.*— The eye is exceedingly large. An eyeball taken from a fully grown male and preserved in alcohol is subspherical in form, measuring 74 millimeters transversely, and 67 millimeters in its antero-posterior diameter.

The cornea has a conspicuous network of bloodvessels which gives the eye a bloodshot appearance in life, particularly in the case of old males. The nictitating membrane is prominent and is passed over the eye frequently. The lachrymal glands are well developed and the tears so profuse that the region about the eye is usually wet, and continuous streamlets trickle from the sides of the face.

*External Mammary and Reproductive Organs.*— The teats become inverted after the end of the nursing season, and within each of the pockets thus formed I usually found a small pebble tightly wedged. Sealers, knowing the likelihood of such a condition, invariably avoid cutting into the teat pits with their skinning knives.

The urinogenital canal of the male emerges through a long, slender papilla appended at the tip of the *glans penis*.

*Visceral Anatomy.*—The following notes are based upon field dissections.

The tracheal and bronchial rings,<sup>1</sup> which among the Phocidæ exhibit their extremes of structure, are rather more than four-fifths complete.

From the body of a male sea elephant 418 centimeters long the small intestine was carefully floated, in order to avoid stretching, and it was found to be 81 meters in length. Its diameter was 2 centimeters. The length of the large intestine in the same animal was 145 centimeters. Subsequent measurements on several other specimens showed that the length of the small intestine averages about 20 times that of the body. The cæcum is obsolete.

The liver is large. Of the three main ventral divisions the central or cystic lobe is deeply subdivided, and smaller than the lateral lobes. The right lateral is broad and long; the left small and cordate. A Spigelian lobe and a long caudate lobe are present. The gall bladder is free, retort-shaped, with a large cystic duct.

A heavy, elongate pancreas, which seems to communicate with the alimentary tract by several ducts, balances on the left side the right lateral lobe of the liver.

The axillary glands are large, and there is a ductless gland within the muscle tissue on either side of the back over the position of the kidneys, lying just beneath the blubber layer.

The multilobulate kidneys are frequently unequal in size as well as asymmetrical in position, the right in some instances being almost twice as large as the left.

*Arterial System.*—The origin of the great blood vessels from the aortic arch is ontogenetically of the type common to most Carnivores, the left brachial alone having a separate source. In mature animals, however, the appearance is deceptive owing to the crowding together of all four arteries, which appear to arise from a single, short innominate trunk, as described by Turner (1887). The condition in young animals is shown in Fig. 4, drawn from the arch of a male pup. The relatively great contraction of the descending aorta is noteworthy.

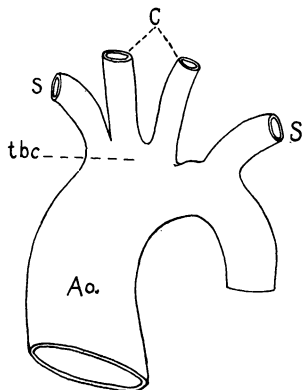


Fig. 4. Mode of origin of the great arteries from the aorta of *Mirounga leonina*, *tbc.*, brachiocephalic trunk; *s.*, subclavian; *c.*, carotid.

<sup>1</sup> Murphy, Bull. Amer. Mus. Nat. Hist., Vol. XXXII, p. 505.

The amount of blood in the body is astonishing. The following quotation from Anson's 'Voyage' (1748) is essentially true, even though the measure of a "hogshead" may here be indefinite: "...if they are deeply wounded in a dozen places, there will instantly gush out as many fountains of blood, spouting to a considerable distance; and to try what quantity of blood they contained, we shot one first, and then cut its throat, and measuring the blood that came from him, we found, that besides what remained in the vessels, . . . we got at least two hogsheads."

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## EXPLANATION OF PLATES.

## PLATE I.

Fig. 5. "Pup" sea elephant, Nov. 25, 1912, Cumberland Bay.

Fig. 6. Yearling ♂ asleep, showing navel, penis sheath, and vent, Nov. 30, 1912, Cumberland Bay.

Fig. 7. Head of adult ♀, Nov. 25, 1912, Cumberland Bay.

Fig. 8. Adult ♂, showing relaxed snout, and shedding hair, Dec. 22, 1912, Bay of Isles.

Fig. 9. Head of large ♂ (No. 5 of table p. 74). Feb. 17, 1913, Bay of Isles.

Fig. 10. Adult ♂, Jan. 9, 1913, Bay of Isles.

## PLATE II.

Figs. 11-13. Three views of the same adult ♂, shown in Fig. 10.

Figs. 14, 15. Two views of the same nearly full grown ♂, Dec. 13, 1912, Bay of Isles.

Fig. 16. Fore flipper of an adult ♂, Jan. 9, 1913, Bay of Isles.

## PLATE III.

Fig. 17. Hind flippers of an adult ♂, Jan. 9, 1913, Bay of Isles.

Fig. 18. Adult ♂ swimming, Jan. 10, 1913, Bay of Isles.

## PLATE IV.

Fig. 19. Very large ♂, Cumberland Bay. Photo by J. Innes Wilson. This shows the maximum expansion of the snout.

Fig. 20. Nearly full grown ♂ making for the water, and glancing backward as it runs, Dec. 23, 1912, Bay of Isles.

## PLATE V.

Fig. 21. Adult ♀, Dec. 3, 1912, Cumberland Bay.

Fig. 22. Adult ♂ asleep, throwing sand on its back, Jan. 9, 1913, Bay of Isles.

Fig. 23. Adult ♂ rearing, Feb. 20, 1913, Bay of Isles.

## PLATE VI.

Fig. 24. Enraged adult ♂, the same animal shown in Fig. 23. Feb. 20, 1913, Bay of Isles. Compare with Lord Anson's drawing, p. 68.

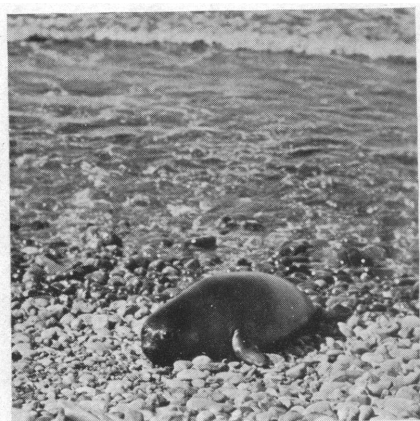
Fig. 25. Nearly full grown ♂ rearing to attack; the same animal shown in Figs. 14, 15, and 20. Dec. 23, 1913, Bay of Isles.

## PLATE VII.

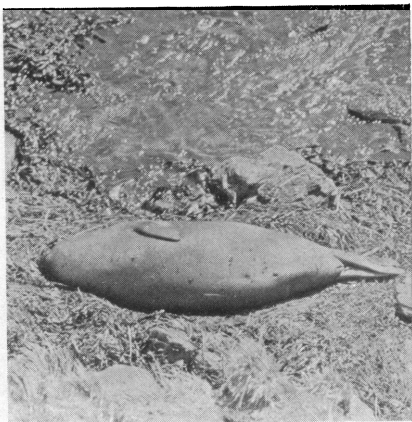
Fig. 26. Males fighting, Cumberland Bay. Photo by J. Innes Wilson.

Fig. 27. The "Beachmaster"; adult ♂ with herd of cows. Cumberland Bay. Photo by J. Innes Wilson.





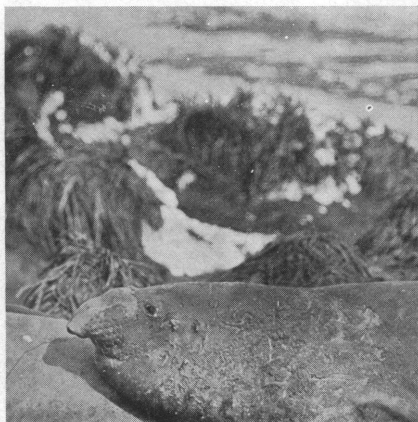
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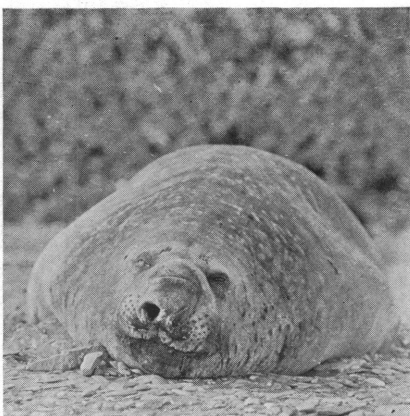
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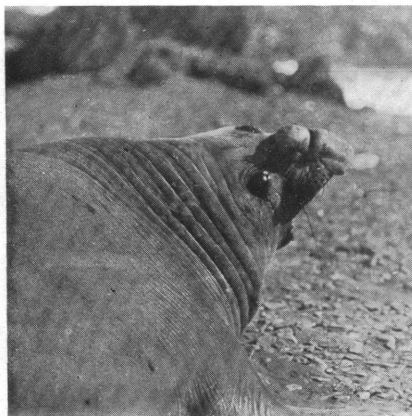




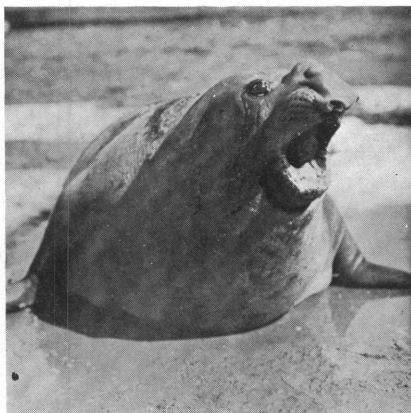
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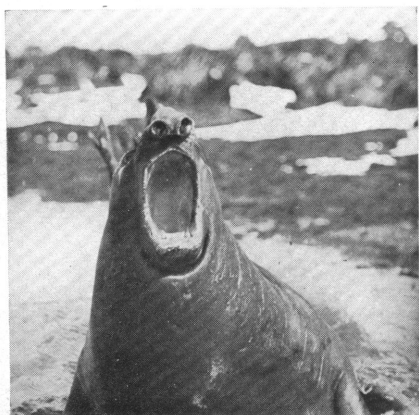
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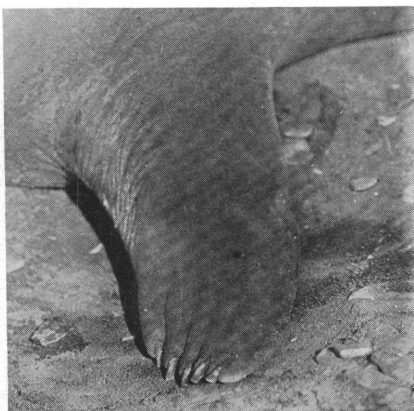
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MIROUNGA LEONINA.





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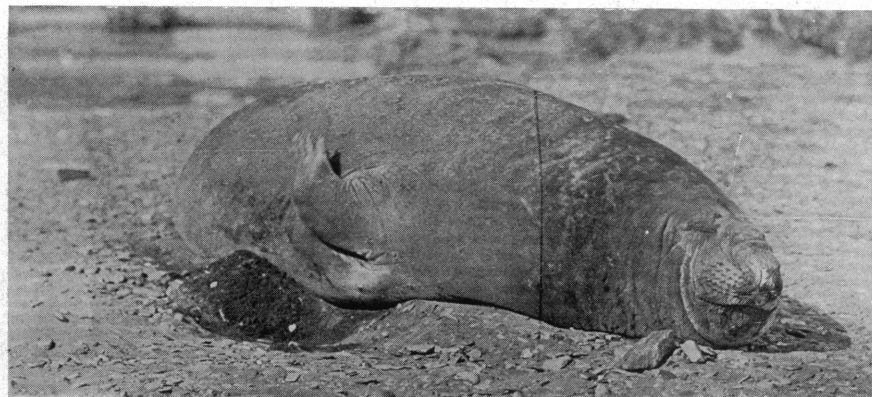
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MIROUNGA LEONINA.

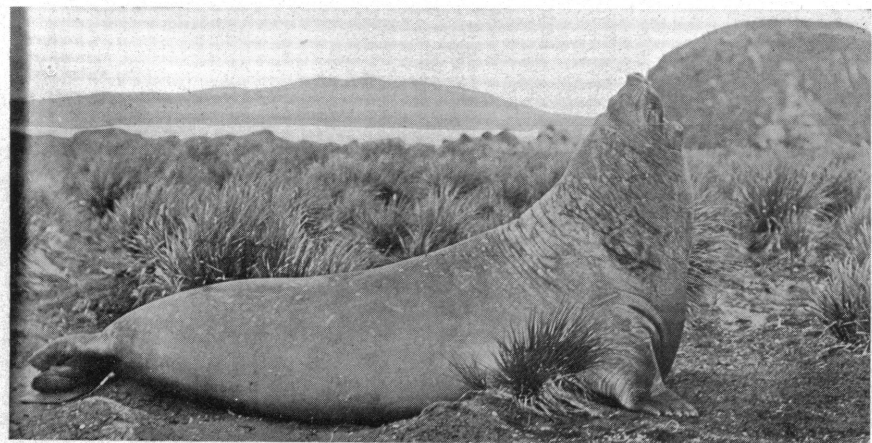




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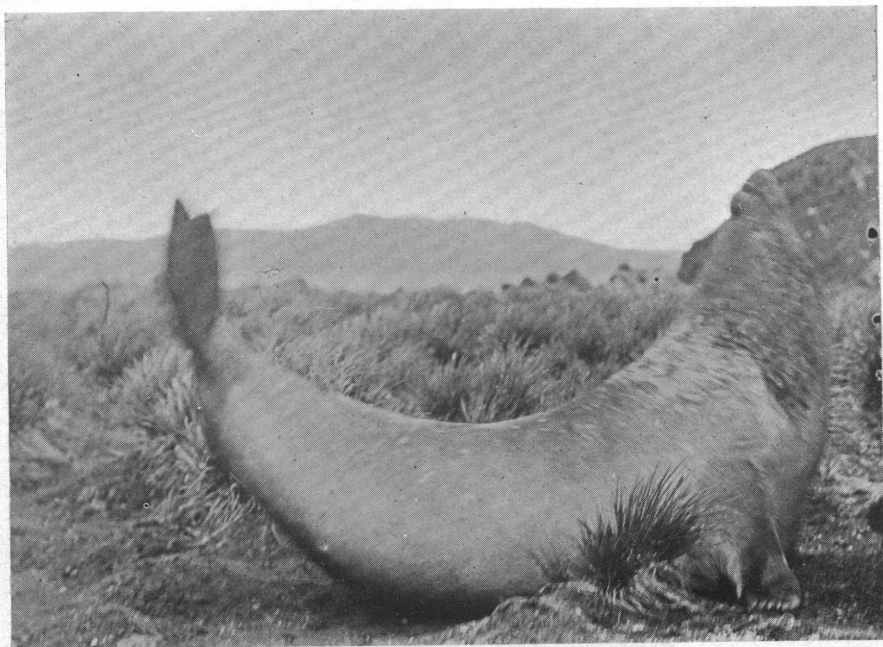


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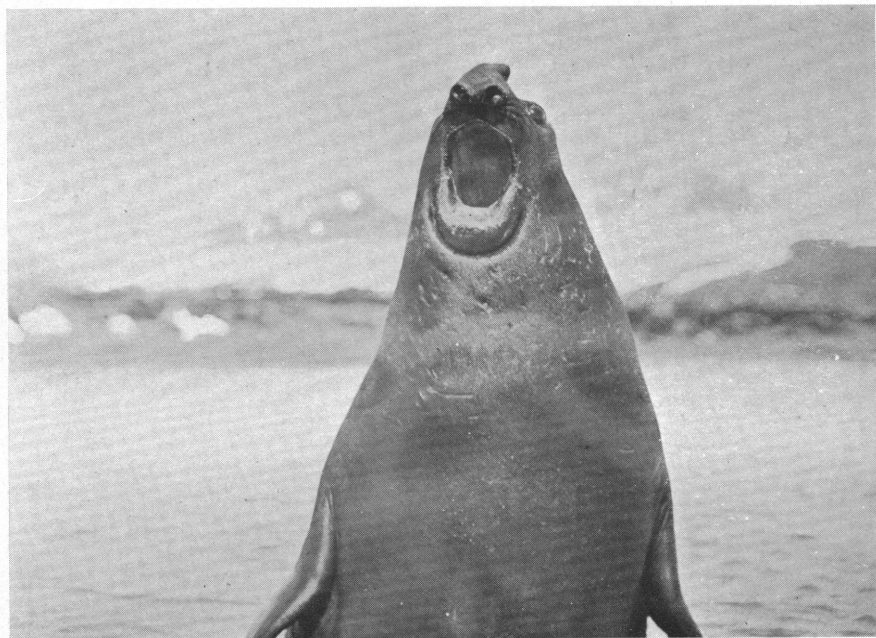
MIROUNGA LEONINA.







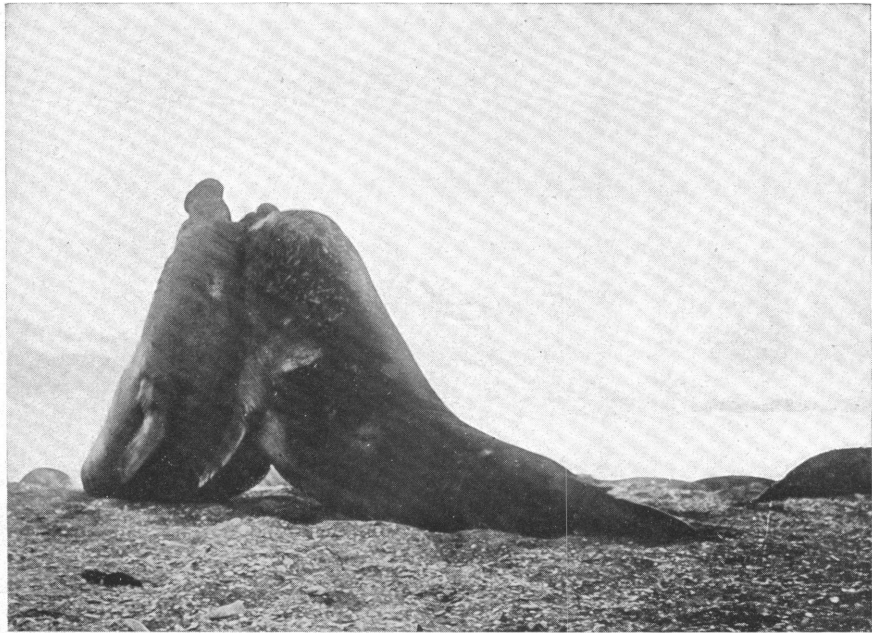
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MIROUNGA LEONINA.





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MIROUNGA LEONINA.

