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Illustrations

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The Beresovka mammoth ice-mummy in process of being salvaged, after the debris had been cleared away and two-thirds of the frozen body exposed to view. The skull, in the upper left corner, has been cleaned of all meat.

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FROZEN SIBERIAN MAMMOTHS. (*ELEPHAS PRIMIGENIUS*)[1]

Some Facts Concerning Their Discovery, Expeditions to Their Primeval Burial Grounds, Zoological Status and the Romance and Commerce in Their Ivory

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Part I.—Expeditions.

CENTURIES ago rumors of the discovery in northeastern Asia of great curved tusks of ivory persistently drifted into Western Europe. Could it be true that animals apparently surpassing an elephant in size lived on the bleak tundra of northeastern Siberia? Did it not sound like a fairy story that such gigantic beasts burrowed and lived underground somewhat like our tiny moles?

Ides, the famous Dutch traveler and ambassador to China, seems to have been the earliest to gather first-hand information. On traversing northern Siberia between the years 1692 and 1695 he learned that many of the Yakuts, Tunguses, and Ostyaks, steadfastly believed that these huge monsters spent their lives deep underground, moving about easily in spacious tunnels even though the earth was thoroughly frozen. Should they become particularly active the whole ground might rise above them, caving in later as they passed on. But let the "mamonts" or "ground-dwellers" come to the surface and breathe the warm air, they instantly died.[2]

This is not so strange a story when we consider that actual circumstances helped strengthen native belief. At certain places in Siberia, after the melting of the snow, plenty of bones of what later came to be called the mammoth were lying about the surface or sticking up from the ground. Here and there after the thawing and slipping of portions of steep river banks the more or less complete remains of these proboscideans had been exposed to view in the very sites where inadvertently they might have reached the fateful daylight. At other times one of these frozen giants was discovered at a point the natives imagined to be the end of the mammoth's diggings.

It is with amusement that we turn to the many heated, rather sprightly controversies that centered about the early finds in Europe of certain fossil bones of enormous proportions. Did they belong to giants? Certainly the few pieces available showed a more striking resemblance to those of man than to any other quadruped they could then be compared with. In Switzerland, after unearthing in 1577 some of these huge bones, the city elders of Lucerne desired to express pride in what they were pleased to consider their giant ancestor. After many enthusiastic comments they decided to figure him as bearer of the town escutcheon. More remunerative proved the resurrection of the supposedly nineteen foot tall Cimbrian king, Teutobochus, in 1613, near Montrigaud (Drôme), in southeastern France. The astute surgeon Mazurier arranged a traveling show, making the curious crowds pay for the pleasure of viewing the relics.

After parts of skulls, molars, and tusks had finally been obtained there was of course no

[1] The photographs and some of the data in this article have been kindly contributed by Dr. E. W. Pfizenmayer, Curator, Natural History Museum, Stuttgart. Formerly: Assistant, Petrograd Zoological Museum; Member of the Beresovka Mammoth Expedition; Leader of the Sangajurach Mammoth Expedition.

[2] Ides, Isbrand, 1704, *Dreyjarige Reize naar China*, Amsterdam, p. 31.

question as to their belonging to some kind of elephant. Cuvier, who was the founder of the Department of Paleontology in the Paris Museum, was the first to recognize that these gigantic bones exhumed in Western and Central Europe and the frozen remains in northeastern Siberia belonged to the same kind of animal, the extinct mammoth *Elephas primigenius*.

There was naturally a keen desire on the part of the more enlightened to recover for scientific purposes at least one of the ice-mummies, soft parts and all. As early as 1722 Peter the Great of Russia gave orders to that effect to the governor of Siberia. From time to time quantities of bones collected apparently at random were sent in. Small portions of the coveted quarry occasionally reached interested centers and kept alive the yearnings for real success. But in the hope of securing more complete remains the Petrograd Academy of Science before the close of the century sent several expeditions into Siberia to have exceptionally promising finds followed up, exhumed if possible, and transported to their zoological museum.

During those early periods travel into such desolate, far-off regions was a slow and difficult process and rendered even the most hopeful of these enterprises uncertain. By the time adventurous men of science made their way over thousands of miles, the particular frozen mammoth whose quest called them into the howling wilderness had literally melted away. Exposed soft parts rapidly decayed or were destroyed by carnivores that often scattered the bones. Floods frequently carried whole portions away, or else the oncoming winter thwarted all further attempts at recovery.

Not until 1806, however, came the really epoch-making find which solved many questions about this extinct form. A Tungusian fisherman in 1799 had located a complete, frozen mammoth on the banks of the Lena River at the threshhold of the Polar Sea. Imbedded in ice, as it had been for thousands of years, its meat was still in such condition as to be eagerly devoured by polar bears, wolves, and other carnivores attracted from great distances. As time went on every warm season bared more of the body; only the natives contested the booty by securing some of the meat for their dogs through the following years of exposure. It was then that the intrepid explorer and botanist Adams happened to arrive in the neighborhood and, hearing of the famed monster, lost no time in reaching it. Most of the soft parts were gone, one limb had been carried away, and a native had sawed off both tusks and sold them for about fifty rubles. Through Adams' energy and foresight practically all remaining bones were collected. He also took to Petrograd a piece of the hide with the hair in place. It was from the still frozen side upon which the mammoth lay, and so heavy as to tax the strength of ten men to drag it along the shore. A large amount of loose, coarse hair, evidently trampled into the snow by feasting polar bears, was long enough to be considered as having formed a mane.

This mounted "Adams" mammoth, to which some of the dried parts were left adhering, served Tilesius[3] as a basis for the first figure of a complete skeleton, which by the way, measures nine feet eleven inches at the shoulder and remains even today the largest ever recovered from Siberia. An Indian elephant from Ceylon but three inches less in height weighed 8,700 pounds. G. Cuvier soon after copied the figure of the Adams' skeleton in his famous work on fossil bones.[4] Subsequently the same illustration found its way into nearly every scientific text book and is still used in the eleventh edition of the Encyclopedia Britannica. It also was taken as a model for the setting up of practically all fossil mammoths found in Western Europe. Unfortunately it was far from satisfactory. The missing tusks of the mammoth had been replaced by combining several other pieces of ivory. According to later authorities[5] these substitutes do not correspond in either size, length, direction, or curvature with those this huge bull originally seemed to have carried.

For nearly a hundred years after Adams' mammoth skeleton had reached Petrograd no important contributions were made in this line. Attempts to secure the entire frozen remains of some of the most promising of the twenty-one finds recorded during this period resulted practically in failure. They were too widely scattered over the bleakest of ice-bound solitudes, mostly in regions beyond the Arctic circle. Here nature seemed to be intent on holding on to one of its most fanciful creations—ice-mummies.

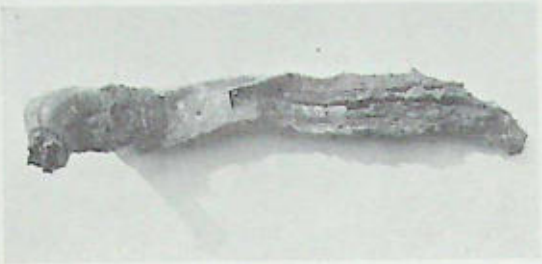
Several Alaskan mammoths in a very much poorer and more fragmentary state were

[3] 1815, *Mém. Acad. Imp. Sci.*, St. Petersbourg, V, *Pl.* X.

[4] 1821, *Recherches sur les Ossemens fossiles.* Nouv. Ed., I, *Pl.* XI, *opp. p.* 204.

[5] Pfizenmayer, E. W., 1907, *Ann. Dept. Smithsonian Inst. for* 1906, Washington, *p.* 332.

The steep slope where the Beresovka frozen mammoth was discovered. Masses of thawed ground slipped and uncovered the ice-mummy that reposed here perhaps anywhere from 12,000 to 25,000 years.



Portion of the trunk of the Sangajurach mammoth, showing essentially the same structure as those of living elephants. Near the lower part, to the left, a piece of the dense hair cover remains.

also investigated. The great credit for the rapid advance of our knowledge about frozen mammoths, is due chiefly, however, to the extraordinary success of the three following expeditions: Herz-Pfizenmayer, on the Beresovka, a right tributary of the Kolyma River, Arctic Ocean drainage, Province of Jakutsk, 1901-1902; Pfizenmayer-Vollosovic, on the Sangajurach River, in the Arctic coast region opposite the New Siberia Islands, 1908; and Vollosovic, on the Liakhoff Islands, southernmost of the New Siberia Archipelago, Arctic Ocean, 1912-1913.

The Beresovka Expedition was the first to profit by the rapid transportation facilities of the then new Trans-Siberian Railway. But even from Irkutsk, the last railroad station on their route, nearly 4,500 miles had to be covered on foot, horseback, and sleigh to the Beresovka River and back. In order to continue the work of salvage in the intense cold a hut had to be built over the partially exposed remains and stoves kept burning. After tremendous hardships and in the incredibly short time of ten months all that was worth while to be had of the mammoth was transferred to Petrograd. As it reached there the middle of February, most of it was still in frozen condition. This was the first time that the almost complete skin of any fossil mammal could be mounted for exhibition. Nearly all the hair had come off, but some of it was put back later. For many reasons it was found advisable to represent the mammoth in the position in which it had met its untimely death. Careful study of the exceptionally perfect skeleton of this young bull, in which but one tusk was lacking, brought out many points of interest. Modern scientific methods of collecting made possible a number of unique results in the study of various parts, such as tongue, feet, tail, stomach, muscles, hide, fat, blood, as well as its food.

The Sangajurach Expedition, under the leadership of Dr. Pfizenmayer, seemed at first but little favored, for the greater part of the mammoth had been washed downstream or destroyed by Arctic foxes before the party arrived. But some lucky cause had preserved large pieces of the hide of the body and limbs with complete hair covering in place. Even more fortunate was the recovery of some of the upper portions of the head and the nearly complete trunk. In the case of the Beresovka ice-mummy, the destruction of these particular parts as well as of the back by decay and carnivores had been a keen disappointment to all at the time.

The Vollosovic Expedition was financed by Count Stenbock-Fermor, who presented the results to the Paris Museum. This mammoth proved to be in as good condition as the Beresovka specimen and has helped to confirm and extend many of the researches made on the material from the two Russian expeditions.

Following this the late Czar issued an imperial ukase prohibiting the exportation of any mammoth or parts thereof found in Russian territory, reinforcing a former order whereby all mammoth ivory and bone had to be submitted to a committee appointed by the Petrograd Academy of Science, that might retain any parts desired.

The field observations and researches based upon the wonderfully well preserved material from the Beresovka and Sangajurach mammoths settled a number of disputed questions. Different phases of the life history of the fabulous monsters of the frozen tundra were finally cleared up, such as appearance, structure, size, habits, and even relationship. No other fossil

Skull of the adult female Sangajurach mammoth with soft parts removed except about upper portion of face. Tusks of female elephants being easily detached, especially after a slight amount of decay, in this case they were not recovered.

type has left such remarkably complete data as the Siberian mammoth and to a lesser extent its partner, the woolly rhinoceros.[6]

Part II. Description of Specimens.

Apart from its shaggy coat the main distinctions between the Siberian mammoth and living elephants were its much shorter, more massive body and above all its large, bulky head. The big skull had to furnish support to the enormous, spiraled tusks and weighty molars.

As in recent elephants the tusks are variable in form and much smaller in the females. Their sockets run nearly parallel. At their point of emergence from the skull the tusks first diverge —sideward, forward, and upward—and then slightly converge in the general direction of the shoulder, with tips curved inward and downward.

The tremendous size and peculiar shape of mammoth tusks have aroused many discussions. Was so excellent a student as Adams[7] right when he suggested that the hooked extremities thereof may have been used for pulling down and retaining branches of lofty coniferous and other trees? Or is there reason to follow Pfizenmayer in his explanation that some apparently abnormal tusks with obliquely forward and downward directed tips served to break the crust of snow and scrape together food? Did these tusks grow to such gigantic proportions merely so the males might have a better chance to secure plenty to eat? Seldom would they care for the weaker among them. Nature would not treat in so step-motherly a fashion females and young, on whose welfare the continuity of the race depends.

In nearly all larger mammals the horns, antlers, and tusks, serve essentially as weapons. In each case they are applied in the most suitable fashion. Among elephants the strongest bull of the herd enforces his right to perpetuate the race by battering every contestant with his tusks. Just one wrong blow during the fury of a contest and these ivories snap off like glass. Not rarely have large African bull elephants left one of their tusks on their battlefields. Of course the extremely large, recurved tusks of mammoths, describing in many specimens fully three-quarters of a circle, undoubtedly became useless even for such a purpose. Neuville may be correct in looking upon them as more embarrassing than useful and as showing degenerating influences at work.

The largest Siberian mammoth tusk, preserved in the Petrograd Zoological Museum, measures along the outside curve thirteen feet, seven and three-quarter inches, and weighs 186 pounds. The American Museum of Natural History possesses one from the Liakhoff Islands somewhat heavier, weighing 200 pounds, but only twelve feet, eleven inches in length, with a greatest circumference of twenty-one inches. Lucas[8] reports one from Alaska but slightly smaller, twelve feet, ten inches.

The trunk, as instanced by the Sangajurach specimen, from which only the tip was lacking, was dwarfed and weak in comparison with those of recent elephants. With all proboscideans it is an important organ, the cornerstone of touch, scent, respiration, and constantly used to secure food and drink, as well as for defensive and offensive purposes, and during swimming, when the body is submerged.

In the mammoth, however, there is relatively little space reserved for the trunk between the huge, closely set tusks. Correspondingly small are the chief points for its support about the nasal and premaxillary bones. Evidently the principal function of this organ was to pluck grass from the forest meadows. Perhaps the Crô-Magnon cave man of Combarelles, Dordogne, France, whose rudely sketched outlines of the huge beast showed a two-fingered tip to the trunk, may still earn his fame as an observing naturalist.

We might conclude from the very slight development of the trunk that, influenced by the boreal climate, the mammoth's temper was of a milder sort. It seems not to have been used as an instrument of fury to devastate, break, and tear whatever may have been in its way, as is the case with the well developed trunk of its African cousin.

The ears were considerably smaller than those of the Indian elephant, measuring in the old Adams' bull only about fifteen inches in length and six and three-quarter inches across their greatest breadth. They were densely covered with short, woolly, and longer, bristly hairs.

The bony structure of the digits of the feet showed a pronounced tendency towards reduction. Some at least of these mammoths had already lost most of what in other mammals

[6] Preserved parts of a mammoth and rhinoceros also were unearthed in 1907 in pits of mineral wax in Starunia, Galicia (Poland).

[7] Adams, Andrew Leith. 1870. *Notes of a Naturalist in the Nile Valley and Malta.* Edinburgh. *p.* 231.

[8] Lucas, F. A., 1901. *Ann. Rept. Smithsonian Inst. for* 1899. Washington. *p.* 355.

A piece of frozen mammoth skin from the upper part of the thigh with most of the hair still in place. Where longest this shaggy coat measured about one foot six inches.

would correspond to the thumb and big toe and were four-toed (tetradactyl) and not, like living elephants, five-toed (pentadactyl). The random numbers of toe-nails of the Paris mammoth were ascribed by Neuville[9] to degeneration. Many of these supernumerary horny growths had striking resemblance to the normal nails, others were extraordinarily long and upturned, like those recorded from some menagerie elephants.

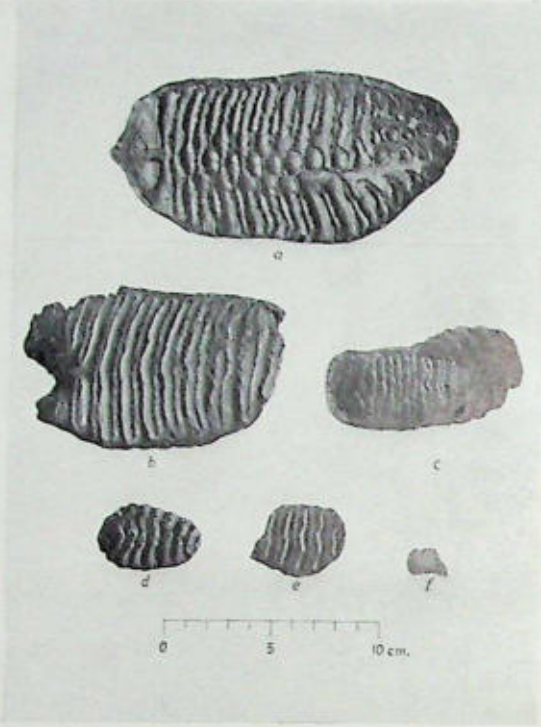
More decisive evidence of the mammoth's truly boreal habitus was furnished by its heavy, shaggy coat. It covered the entire body, but even where longest it did not form a distinctive mane. In general appearance and arrangement it resembled that of the musk-ox. The dense, matted, woolly underfur, varying from fawn to golden brown, attained according to location up to two inches in length. A longer, coarser, yet fluffy hair had an average length on the body of a foot and a half; in color it was deep rusty brown, sometimes darker, sometimes lighter, according to peculiarities of preservation; its texture somewhat resembled the fibers in the hard outer covering of cocoanuts. Outstanding from this were the scarcer, flattened, considerably longer, black, but flexible bristles that apparently were evenly distributed over much of the body. Particularly graced with them were such parts as the chin, eyelashes, and ears. On the tip of the short tail they formed a long, fan-shaped tassel, but even there were only one mm. thick. The trunk was well covered with dense, short hair. On fore and hind limbs the longer coarse hair had an average length of one foot, two inches; at the lower portions it was considerably shorter.

As usual in mammals with dense underfur, the epidermis in the mammoth was extremely thin and rather smooth, in that respect quite unlike the thick, horny, rugose, sparsely bristled skin of living tropical elephants. The leathery portion, however, according to various researches, proves to have been as thick as or thicker than that of present-day proboscideans. The histological character is essentially the same in both, neither of them possessing sudoriparous or sebaceous glands. Neuville suggests that the mammoth in evolving from ancestors living in a warmer climate and adapting itself to boreal conditions greatly reduced its epidermis.

No more important factor could be cited indicating the coldness of the climate in which the mammoth lived, than the abundance of fatty tissue just below the hide. On the belly of the Beresovka male this layer was three and a half inches thick. Fat of any kind is practically absent in recent elephants, as is usual in game of tropical Africa except the hippopotamus. Its presence positively shows that at the time of death the mammoths preserved as ice-mummies were not on the verge of starvation. What better protection against the oncoming rigors of winter could be imagined than such an accumulation of fat, common in many boreal land and aquatic mammals and always in those that hibernate.

Several lucky circumstances have contributed towards our fairly satisfactory knowledge about the feeding habits and food of mammoths. From what we know about living elephants the experienced can tell from a glance at the molars that the mammoth secured its livelihood essentially by grazing and not by browsing. In this case the cheek-teeth present a densely crowded condition of the component transverse plates with a comparatively even, yet a characteristic-

[9] 1919, *L'Anthropologie*, XXIX, p. 267.



Various stages in the development of upper and lower molars of the mammoth (*Elephas primigenius* Blumenbach). Anterior portion pointing toward left.

The molars, as in other elephants, after emerging from the gum gradually move forward in the jaw. As the upper portion, the grinding surface, is worn down the originally long, anteriormost roots are absorbed or "eaten up" within their sockets by special cells, the osteoclasts. Thus only a flat, thin, center portion of the anterior part of the molars remains. As this is pushed out beyond the forward part of the socket the thin pieces of the composing plates break off easily, the worn ones being replaced by succeeding new ones from the rear. In this way the rather voluminous and heavy molars are easily accommodated in so limited a space and retain their efficiency till a relatively advanced age.

a. Third right lower molar at height of efficiency. Enclosed within the high rims of enamel of each of the numerous transverse lamellae or their parts lies the softer and lower dentine. The lamellae in turn are surrounded and united by cementum. Anteriorly this molar is worn low.

b. Second right upper molar. Some of the anterior transverse lamellae have been shed, and the remaining ones are more worn in Fig. 1.

c. Third right lower molar. Some of the posterior lamellae have not yet moved up from the jaw to the grinding surface.

d. Second left upper milk molar before piercing the gum. The individual transverse lamellae, still crested, have not yet been united by cementum.

e. Second left upper milk molar well worn, some of the transverse lamellae in front having been shed.

f. First left upper milk molar with a grinding surface of only 12 mm. This cheek-tooth belonged to a calf probably not more than a year old.

ally rough, crown surface. Their peculiarity and efficiency are greatly influenced by the singular action of foodstuffs under the pressure and friction of mastication. It is the amount of silicate, grit, and other hard materials contained in the food that causes an unequal rate of wear of the three principal substances composing these grinders. Under these circumstances the excessively hard enamel parts always remain as ridges, whereas the softer dentine and cementum form alternating depressions. The transverse plates of the cheek-teeth vary somewhat in complexity and number; from three in the first (milk molar) to as many as twenty-seven in the sixth or last molar. Osborn[10] has shown that Jefferson's mammoth (*E. jeffersoni*) of the American Pleistocene, from Indiana, may have as many as thirty in the upper molar and from twenty-four to twenty-six in the lower.

The masticating surface of the large, broadened molars* of the mammoth forms an efficacious milling apparatus for the grinding to pieces of the rather tough, but very nourishing, boreal meadow plants. A similar arrangement would not answer so well for the bulky, succulent masses of tropical vegetation on which the living Indian and African elephants subsist. The relatively compact nature of the fodder of the mammoth may have helped lessen the need for accommodating immense digestive organs and finally have led to a general reduction in size of the animal's body, back of the head, as mentioned above.

Borodin[11] was able to identify the plants found between the molars and in the stomach of the Beresovka mammoth. Above its ice mausoleum the flora of these Siberian forest meadows still showed essentially the same characteristics as thousands of years ago at the time of the victim's entombment. The average temperature may have then been responsible for a more uniformly milder climate, somewhat lacking the intense severity of present winters and allowing the forests to reach as far as about 74° North. The food gathered in abundance by the Beresovka mammoth just before death consisted of various kinds of grasses (*Alopecurus, Hordeum, Agrostis, Atropis,* and *Beckmannia*). Sedges were represented by two forms of *Carex*. A mint (*Thymus*), pods of a leguminous plant (*Oxytropis*), wild poppies (*Papaver*), and seeds of the northern butter daisy (*Ranunculus*) made up the list. Some pine needles and bits of wood figure as incidental occurrences.

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[10] Osborn, Henry Fairfield, 1922, *Amer. Mus. Novitates No.* 41, *pp.* 1-16.

[11] In: Salensky, W., 1905, *Compt. Rend. Sèan.* VI *Congrès Internat. Zool.*, Genève, (1904), *p.* 72.

From the above enumeration of characters it appears out of question, as formerly believed, that Indian elephants could be modified forms of the Siberian mammoth and had merely wandered southwards into the more luxuriant forests of tropical Asia and in adapting themselves, had lost their heavy pelt and gradually changed otherwise. As shown above, the Siberian mammoth was in many ways too highly specialized to figure as an ancestor of the living Indian elephants, which must have evolved from some other form.[12]

Continued in the March Number.

MUSSEL SHOALS.

By A. E. Ortmann.
Carnegie Museum

THE Mussel Shoals of the Tennessee River in northern Alabama (between Lauderdale and Colbert Counties) have received their name from the immense number of species and individuals of freshwater mussels (Naiades) which used to be found at this locality. Thus the common and now official spelling "Muscle Shoals" should be discarded for the more correct one "Mussel Shoals." There is no other place upon the whole wide world which could be compared with this one in this respect. The cause for this unusual development of Naid-life (as well as other freshwater life) of this region is found in the fact that here two old faunas, in themselves exceptionally rich, come together, the so-called "Cumberlandian," belonging to the upper Cumberland and upper Tennessee Rivers, and that of the "Interior Basin" (Ohioan fauna).

I have tried to compile a list of Naiades known from the Mussel Shoals, and have found that about eighty different species and varieties are represented here, belonging to twenty-nine genera, and this number is increased by some additional types known from the tributaries of the Tennessee River in this region.

This extraordinary fact has been recognized at a very early time. Exactly ninety years ago, Conrad[1] wrote:

"The bivalves are * * * peculiarly abundant in those rivers of North Alabama and Tennessee, which have cut their channels in the carboniferous limestone, and where generally a long grass affords them a secure hold against the rapid current of these mountain streams. The expansion of the Tennessee River, known by the name of Muscle Shoals, is of the character I have described; it is shallow, ornamented with a number of small islands, and its bed is full of the long grass which abounds in various species of Naiades. The lover of the grand and the beautiful in natural scenery, as well as the student in science, will here find abundant sources of interest. He will be delighted with a noble river, whose beautiful and numerous islands are clothed with gigantic trees; whose high and undulated shore on the one hand is ornamented with thriving villages, and on the other spreads out an extensive alluvial, rich in all the gifts of Ceres, or rises abruptly from the river a mural escarpment of carboniferous limestone, which reflects its blue and sombre aspect in the crystal waters at its base. Like many other spots, however, remarkable for their liveliness, the subtle messengers of death have chosen it for their abode, infusing the poison of their breath into the serenity of autumn, when the transparency of the air and the purity of the sky, together with the gorgeous scenery, present at first to the unconscious traveler sensations alone of health and enjoyment."

At the present time, the above description holds good only in a small part. The beautiful islands, and the general features of the river itself are gone, as well as a large portion of the fauna, chiefly that of the mussels, which depend on the ecological conditions once presented here. For a dam has been built, the "Wilson Dam," just at the lower end of the "Little Mussel Shoals," about two miles above the town of Florence, ponding the river for many miles, and drowning entirely the "Little" as well as the "Big Mussel Shoals," beginning about four or five miles farther above. With the destruction of the conditions favorable for Naiad-life also the Naiades have been destroyed, which is so much more to be regretted, as there were forms among them which have been found only at this locality, and very likely will be, sooner or later, entirely extinct.

There are some shells yet present in this region, chiefly below the dam; but this is only a small remnant of the original richness of the fauna, and there is great danger that also this remnant will gradually disappear, due to the pollution of the waters which will be a consequence of further "improvements" connected with the dam. And then the "glory of the mussel shoals" will be entirely gone. Those characteristic and unique features which would

[1] Conrad, T. A., *New Freshwater Shells of the United States*. Philadelphia, 1834, *pp.* 12, 13.

[12] Osborn, Henry Fairfield, 1910. *The Age of Mammals*, New York, *p.* 419.

rather have deserved to be kept intact and preserved as a "natural monument," second only to very few other monuments of the United States.

Only one part of Conrad's description has been intensified and emphasized by the present conditions: this is the part which speaks of the "subtle messengers of death," undoubtedly alluding to malaria (and mosquitoes), although Conrad, of course, did not know anything about their connection. But the fact is that mosquitoes and malaria are increasing to such a degree that the inhabitants of Florence and other towns in the vicinity are becoming alarmed, and are beginning to discuss preventive measures.—*Science*, December, 1924.

LAST MINUTE NEWS OF GAME CONDITIONS IN JACKSON HOLE, WYOMING, FROM OUR OLD FRIEND, S. N. LEEK.

Jackson, Wyoming.
February 17, 1925.

Dear Dr. Hornaday:

Some little time since I have written or heard from you, and I write now to give you direct information about conditions here.

Outside of one short very cold spell, we have, I think, had so far the most moderate winter I have seen, snow-fall so far much less than usual, and the elk are wintering unusually well, and unless unusual storms come the loss will be next to nothing.

Three years ago we had, I think, not to exceed 7,500 elk. Last Fall I watched them as they came stringing down into the upper end of our valley, and estimated that 15,000 head passed in about four days, and the number of elk killed was not unusual considering the lateness of the closing season. Our State Game Commissioner, I believe, puts the number killed at 300; this may be too conservative, 500 would be nearer correct.

Now there are large areas of ground bare of snow, both over the level valley and among the foothills, and it looks like the Government will have a very large portion of their elk hay left over. Owing to the drouth last summer, the ranchers' hay for stock is getting pretty low, but with no late storm, there probably will be plenty.

I received very flattering reports from the mountain sheep range in the Gros Ventre mountains. Considerable numbers were reported seen, and among them many young sheep, including a good number of young rams coming on; and this winter quite a number are wintering almost within sight of the ranches.

I am almost sorry to say some domestic sheep are being brought into the valley; but even so, if the Forest Service is just to all interests, this fact need not be alarming, for now there is much range, isolated from other portions, where there is principally no game during the summer, or winter, and where poison weed is so plentiful that cattle cannot be ranged there.

Some reports I have seen published of heavy loss of elk in here this winter, seem to me an injustice to the Biological Survey, to the Forest Service, to the State of Wyoming, and to the citizens of the valley. I do not deny that there is a small area that should be purchased and added to the Government Ranch. But one fault advocated, I think, is the effort to collect all the elk at that one point, when the elk and their winter range is strung out for a distance of about forty miles up and down the valley. At least two other feeding places should be establishd, and these join the winter range, where the elk naturally feed, and thus need not have to be driven to the feed yards.

I wish you could get away for a vacation in here. I would like to take you around a little over the elk winter range, also their summer home, and have you take some of our big lake trout. We got one last summer of 30 pounds, another of 25 pounds, and there seems to be plenty of them.

Sincerely yours,

S. N. Leek.

WHO PLANTS A TREE

Give fools their gold, and knaves their power;
Let fortune's bubbles rise and fall;
Who sows a field, or trains a flower,
Or plants a tree, is more than all.

—*John Greenleaf Whittier.*

Find a Scelidotherium.—Naturalists of the Argentine Museum of Natural History have discovered fossils of five glyptodons and one scelidotherium, a fossilized human skeleton and a fossilized human skull in the deposit along the banks of a lake near Chasoomus, in the Province of Buenos Aires.

While the Argentine pampas yields fossilized animal remains in abundance, human fossils are rare, although it is contended by local scientists that there is plenty of evidence that man lived on the pampas in company with these prehistoric beasts.—*Times* (N. Y.)

New York Zoological Society

OBJECTS OF THE SOCIETY

¶ A PUBLIC ZOOLOGICAL PARK. ¶ A PUBLIC AQUARIUM. ¶ THE PRESERVATION OF OUR NATIVE ANIMALS. ¶ THE PROMOTION OF ZOOLOGY.

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ELWIN R. SANBORN, *Editor*

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THE DISCOVERY OF THE FLIGHTLESS CORMORANT.

Through inadvertence, due to unavoidable haste in preparation, an omission in regard to the discovery of the flightless cormorant occurred in William Beebe's book, *Galapagos: World's End.* In an interesting letter from Mrs. Mary H. McCullough, addressed to our Honorary President, Professor Henry Fairfield Osborn, the matter has been brought to our notice

The writer says:

"My brother, Charles Miller Harris, commanded the expedition to the Galapagos, which went out under Mr. Walter Rothschild's auspices in the year 1897. . . . During this expedition my brother discovered the flightless cormorant, which Mr. Rothschild named for him *Phalacrocorax harrisi.* It seems to have been one of the most interesting and valuable discoveries made in the Galapagos. Mr. Beebe gives four pages of description to it, closing as follows: 'They escaped the attention of Darwin, and all expeditions down to twenty-five years ago.' My brother is no longer living, having passed on last fall."

In behalf of Mr. Beebe, we take pleasure in placing on further record the facts of the discovery by Mr. Harris. In 1897 a party on the schooner *Lila* and *Hattie,* commanded by Charles Miller Harris, and under the auspices of the Hon. Walter Rothschild, spent several months exploring and collecting in the Galapagos. The most important avian discovery was the flightless cormorant. In the *Bulletin* of the British Ornithologists' Club, *Volume* VII, *page* 52, 1897, Mr. Rothschild described the new wonder as *Phalacrocorax harrisi,* and named it in honor of its discoverer. Later on, a new genus was made, to separate the bird from its congeners which retain the powers of flight, so that the flightless cormorant now stands as *Nannopterum harrisi.*

PROFESSOR OSBORN'S PORTRAIT

A portrait of Professor Osborn has been presented to the Society in memory of his long services as Chairman of the Executive Committee, 1896-1903, 1907-1909, and as President of the Society from 1909-1925. The portrait was painted by Julian Lamar and will be on exhibition at the Administration Building.

The donors of the portrait were his associates on the board, namely: Madison Grant, Frank K. Sturgis, Percy R. Pyne, Anthony R. Kuser, Cleveland H. Dodge, C. Ledyard Blair, Lispenard Stewart, Charles F. Dieterich, George F. Baker, Edward S. Harkness, Wm. B. Osgood Field, Ogden Mills, Frederic C. Walcott, Archer M. Huntington, George C. Clark, Jr.

CONSERVATION RESOLUTIONS

At the thirty-first Annual Meeting of the New York Zoological Society, held at the Waldorf-Astoria on Tuesday, January 13, 1925, the resolutions following were presented and read by Dr. Charles H. Townsend, Director of the Aquarium.

Whereas, the elephant seal of Guadalupe Island was long supposed to be extinct but is now slowly increasing in numbers under the protection of the Mexican government; and

Whereas, the Guadalupe fur seal, formerly abundant on that island, is possibly still surviving there; and

Whereas, both of these seals were of great commercial importance in the past and should be preserved for the future;

Now, Therefore, be it

Resolved, that the New York Zoological Society communicate with the proper authorities in Mexico and request a continuance of the protection of these animals in Mexican waters, and further that it communicate with the United States Biological Survey and recommend that steps be taken to protect these seals in California waters.

Whereas, the authorities of British Columbia, Washington and Oregon have, at the instigation of salmon packers, permitted the killing of large numbers of sea lions on their breeding grounds by dynamite, machine guns and other means of destruction;

Now, Therefore, be it

Resolved, that the New York Zoological Society urge upon the proper authorities the protection of these animals.

Whereas, the remnant of the giant tortoises of the Galapagos Islands are threatened with early extinction through the destruction of their eggs and young by wild dogs and pigs, and by the slaughter of the adults for oil; and

Whereas, there is no hope for their perpetuation on the Galapagos Islands;

Now, Therefore, be it

Resolved, that the New York Zoological Society take steps to capture and transport such tortoises as can be secured, to a suitable place, preferably an island within the jurisdiction of the United States, where suitable climatic conditions would favor their increase and perpetuation.

TO EXPLORE THE SARGASSO SEA

Tropical Research Staff of The Society Sail for the Sea of Mystery

The *Arcturus*, a war-built wooden ship, with William Beebe directing, will sail from Tebo's Basin, foot of Twenty-third street, Brooklyn, in February on one of the strangest fishing expeditions ever known.

With a large equipment of traps, hooks, nets and dredges the *Arcturus* will visit the Sargasso Sea, a vast floating area of seaweed that lies between Cuba and Africa in the middle Atlantic Ocean.

Below the surface of the Sargasso Sea are strange forms, whose like according to marine tradition has never been seen on sea or land. The scientific explanation for this is that millions of fish are caught in the net of seaweed and their decaying carcasses serve as foods for undersea life, of varieties which exist in no other spot on the globe. Many of these are queer phosphorescent creatures that flash and glimmer in the shadowed depths.

Octopuses of large size, capable of dragging a small vessel under the water, are said to roam this region. In ancient times the place was dreaded by sailors as a supernatural and haunted spot.

It has never been thoroughly explored. The *Arcturus* will move slowly through the sea weed collecting specimens. The expedition, was organized by the Department of Tropical Research of the New York Zoological Society. Marshall Field, Harrison Williams, Vincent Astor, Henry D. Whiton and other wealthy men of the Society are financing the undertaking.

The Voice in the Dawn.

There's a voice in the dawn,
  Word upon liquid word,
Heard in a dream, then gone—
  The mockingbird.

No reed pipe of Pan
  Ever such music made;
No clear flute of man
  Ever thus played.

So bid me ope my eyes,
  Bird, when the sunlight nears,
That I may daily rise
  To the song of the spheres!

Clinton Scollard, *Sun* (N. Y.)

True Ermine.—The original or true ermine is the fur of the European weasel, there called the stoat in its white winter dress. The snowy white pelt, set off by the jet black at the end of the tail, attracted attention centuries ago and was adopted as the royal costume for the kings of England. It is said that Edward III forbade its use by any one not of royal blood. This ancient royal costume adorns the "king" in packs of playing cards. Later it became the distinguishing fur of nobility, and especially of judges, who represented the royal power and were regarded merely as the King himself acting through his agents in dealing justice among his people, says the Detroit *News*.

Value of Fisheries.—Fisheries, next to agriculture, are the most important sources of food.

AN IDEAL TYPE OF AVIARY IN THE ZOOLOGICAL PARK

In every instance, the Society has planned to eliminate as far as possible the idea of captivity from the various outdoor installations. Combined with the utility, architectural grace and beauty of the structure is this old-fashioned garden of hardy perennials established along the entire front of the aviary for large birds of prey.

OBSERVATIONS ON ZOOLOGICAL PARK FOUNDATIONS

By Dr. William T. Hornaday

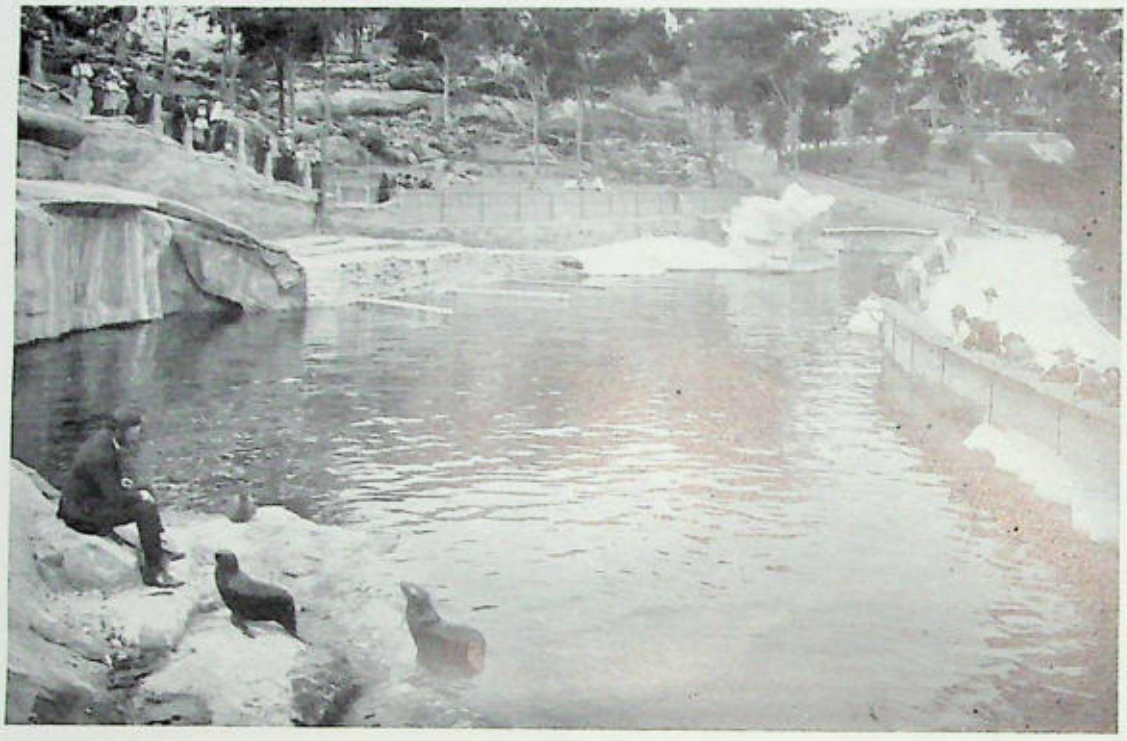
An address read before the American Institute of Park Executives.

A MAN may select a gun, a watch, or a wife, according to the dictates of his own fancy and the peculiarities of his own sweet will. The results concern few people other than himself, and his own bank account pays the cost. The man who designs and helps to found and develop a public institution that is paid for with money either privately or publicly contributed, is in quite a different case. His responsibility is broad and far-reaching. In designing and constructing he can not afford to make mistakes, because if he does so the cost thereof will be upon innocent persons.

In view of the fact that hundreds of thousands of dollars are now being annually expended in the United States upon the construction of municipal zoos, and the additional fact that in the near future millions of dollars are to be so expended, I feel impelled to offer a few observations that are intended to be helpful. My purpose is to promote the avoidance of costly mistakes in permanent improvements.

Every public improvement that turns out when finished to be a failure, either in design or in construction, quickly becomes a public eyesore and a calamity. No mayor nor park commissioner cares to assume the responsibility of tearing down a new building blunder, and therefore the mistake endures. When a wealthy private individual erects a folly palace that disfigures the earth and advertises the owner's mental deficiencies, it is his own funeral. When he dies his children refuse to live in it, and sometimes it descends to his servants, the rats and the bats. The eyesore public building, like the brook, goes on forever.

At this moment there are thirty-four cities in the United States that either have zoological parks or gardens or zoos, or are endeavoring to establish them. Of these thirty may be listed



AN IDEAL ENCLOSURE FOR SEALS AND SEA-LIONS

This is the way that the pinnipeds are exhibited in the Taronga Zoological Park, in Sydney, Australia. The idea of captivity is entirely remote.

as being in the early stages of their development, and four only can be regarded as actually settled in life. These figures mean, if they mean anything, a very large aggregate of expenditures in the near future, running well up into millions of dollars.

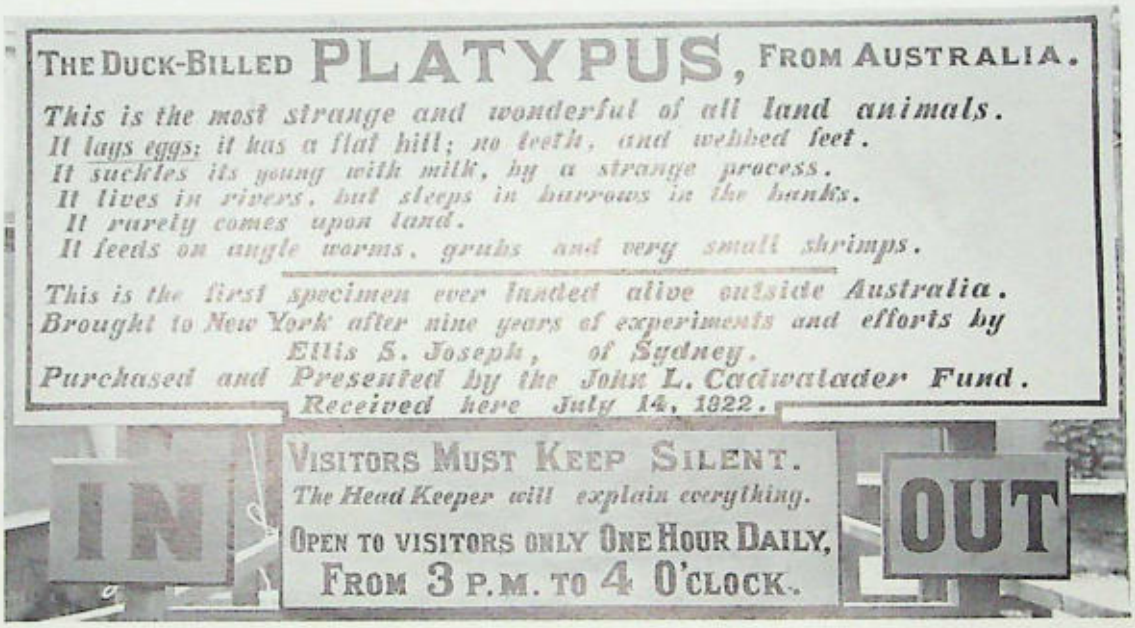
There are no buildings so difficult to design correctly and economically as buildings for housing and exhibiting living quadrupeds, birds and reptiles. The chances for errors and extravagance are deplorably numerous. This paper is offered as a solemn warning to all founders of new zoological gardens, parks, and zoos to mind their steps in the early stages.

In the first place, no society, city or other municipality should begin the development of a zoo without carefully studying a general plan, designed to fit a carefully selected location. In the selection of a site for a zoo, there are about ten requirements to be considered, not one of which can safely be ignored and of which the greatest possible number should be met.

Sometimes it happens that on account of the ignorance or indifference of a municipal population the far-seeing and broad-minded people who seek to start a zoo feel that they dare not come out in the open with a proposal for a zoo that will cost a sum in six figures. To the man who never has traveled, $20,000 per year for zoo maintenance looks like a huge sum. In all such cases it is wise to defer the initiative, conduct a campaign of education and wait until the proletariat concerned has acquired sufficient intelligence to appreciate a good free show of wild animals, and become willing to pay a few cents per capita for its maintenance. Why waste valuable years in hammering cold iron, or to induce stupid people to create public benefits for themselves? In an intelligent community the founding of a new museum, art gallery, library or zoo becomes a pleasure.

I now will offer a few suggestions in the hope that they will prove constructive and useful. They will be addressed particularly to park commissioners and to other men of public spirit who appreciate wild life, and at the same time desire to do something worth while for their home cities. The number of men who sincerely desire to leave the world brighter and better than they found it is really quite large.

I advise and urge every zoological park founder to take with the utmost seriousness the



GETTING THE PLATYPUS BEFORE THE PEOPLE

"Because of the fact that the Society originally designed and determined to develop a Zoological Park as an educational institution, the well-to-do citizens and taxpayers as a whole have made the Zoological Park what it is."

obvious necessity of securing expert advice and skilled assistance. Ordinarily, I shun the word "expert" because it has of late been so fearfully overworked in the commercial world, but I mean it, just the same. The men of "big business" long ago learned the value of expert knowledge, and for their enterprises they buy the very best they can get, no matter what the cost. They have learned that in difficult enterprises, cheap help in foundation work is altogether too expensive.

But how is it with the groups of men who decide to found a city zoo? Do they raise money with which to pay cash for the best experts available? I think that only a very few have done so. The majority find that money-raising to pay for nothing but advice is so difficult that they put the cart before the horse by first taking on some live animals. In all logical zoo development, the live animals should be the last things to be acquired, not the first. At all times shun temporary installations, for they are apt to prove leaden weights on the car of progress.

The founding of the New York Zoological Park, in a city already crowded with costly institutions for all-highest education, was a supremely difficult task. The Zoological Society spent two years of diligent effort and $12,000 in money, in developing and laying down before the tax-payers of New York its elaborate general plan of the proposed foundation. On that plan every building, den, aviary, range, and corral that was desired and intended was carefully located and shown. Every road, walk and pond appeared. When the city chamberlain asked to know the annual cost of maintaining such an establishment as that, at the risk of his life the director desperately answered, "$100,000."

Then the question in each mind was, "Will those figures kill the plan, or cure it"? The answer came quickly, and from that day to this it has remained New York City's answer. Said General Anson G. McCook, "Well, an institution like that would be worth $100,000 a year to the people of New York City." And the bargain was quickly closed.

Because of the fact that the Society originally designed and determined to execute a zoological park as an educational institution and not a spectacular understudy of Luna Park at Coney Island, the wealthy men and women, the well-to-do citizens and the city taxpayers as a whole have made their zoological park what it is. The average American citizen and taxpayer is willing to pay reasonably for the creation and support of fine educational institutions that will benefit his children. If he and his children can derive both recreation and knowledge from a public institution, it is difficult for him to re-

THE ZOOLOGICAL PARK IDEA OF EDUCATION

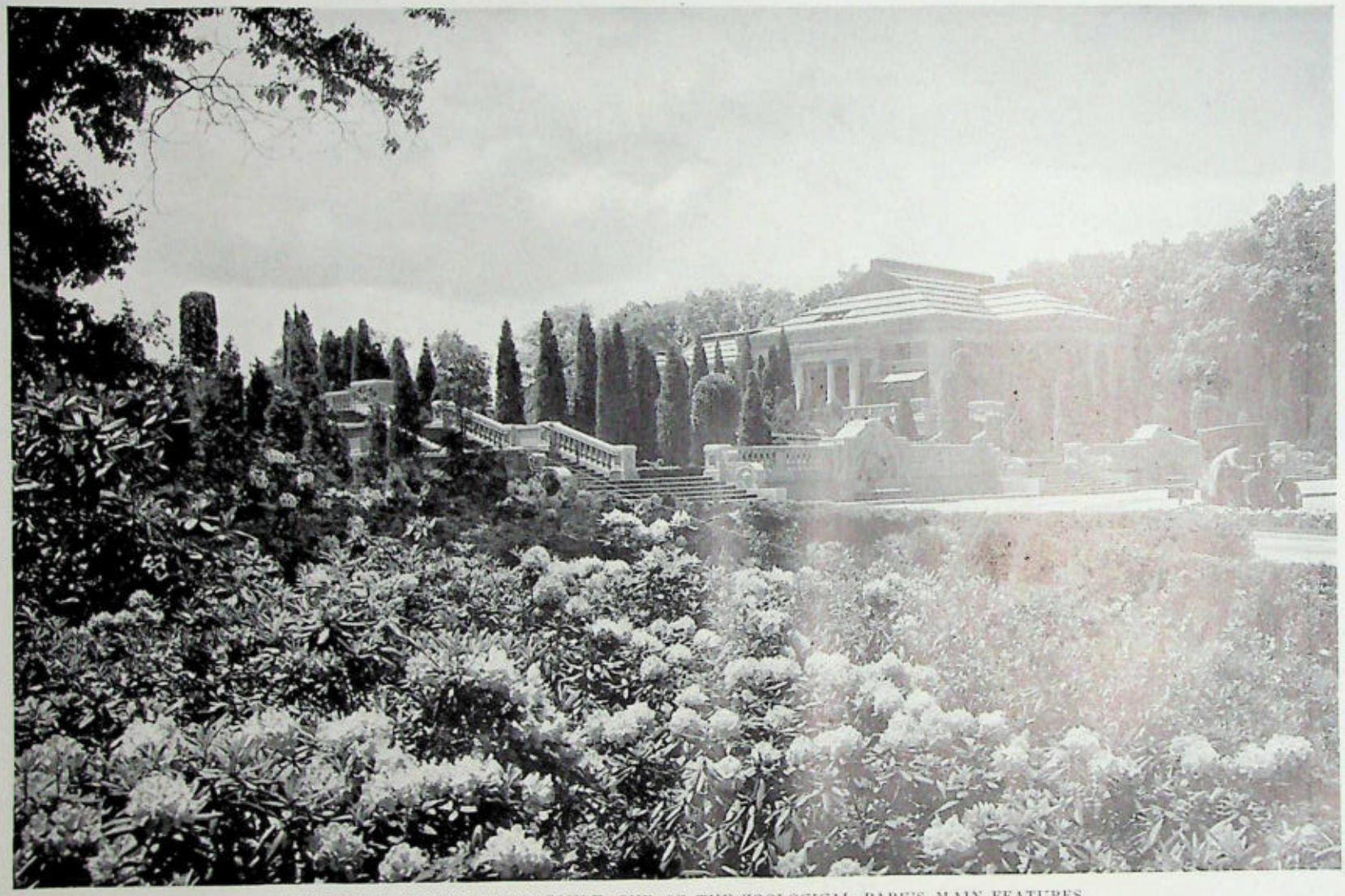
Head-keeper Toomey daily demonstrates the living Platypus. The average American citizen is willing to pay for the creation and support of the fine educational institutions that will benefit his children.

fuse to support it. The best people are most interested in the finest work.

I am convinced that many of the founders of municipal zoos lose much by not strongly exploiting and stressing early and often, the practical and pronounced value of even the smallest and humblest zoos as educational factors. It is easier, and far less expensive, to found a zoo or zoological park on a thoroughly-recognized educational basis than to build one on a spectacular basis. The creation of a tremendous mountain and cliff spectacle on a level plain in a zoo is a hazardous undertaking, and in proportion to the number and kinds of living animals that can be displayed the cost is enormous. Both in Europe and America there are to be found spectacular installations for lions, tigers and bears that display to the visitor a huge maximum of artificial rocks, such as those animals never inhabit in their wild lives—and a minimum number of animal species and specimens. As educational exhibits, I advocate more species of animals, closer acquaintance between visitors and animals, and far less cost.

This spectacular idea originated in 1898 with my dear friend Carl Hagenbeck, greatest of all wild animal collectors, and in that same year he offered it to us for the bear dens of our unborn zoological park. After careful consideration, it became clear to me that for an educational exhibit of the many species of bears of the world, it would yield too little, and cost too much. But even more serious than its extravagant cost, I found that Mr. Hagenbeck's plan would push the animals so far away from visitors that fully one-half their potential educational value would be lost. People who would study animals always desire to get as close to them as possible.

Educational value in a zoo can be secured only through precise zoological knowledge employed first in the designing and planning of the establishment, and afterward in the collecting, exhibiting and management of the living things displayed. An architect without zoological knowledge is no more fit to plan and erect a reptile house or monkey house without expert co-operation than a zoologist is fit to erect and equip an astronomical observatory. Years and years ago, the city park commissioners of America learned the wisdom of sending for Frederick Law Olmsted, or Warren H. Manning, or H. A. Caparn, to journey as far as might be necessary, to advise and assist them in the laying-out of their municipal parks. But do they ever do like-wise in designing animal buildings for their municipal zoos? I know of only two American cities, Boston and Chicago,



THE NORTH END OF BAIRD COURT, ONE OF THE ZOOLOGICAL PARK'S MAIN FEATURES

An ideal picture in June is this planting of Rhododendrons, the sculptured entrance of the Italian Garden with its stand of graceful coniferous trees, and the temple-like dignity and beauty of the House for Perching Birds, against a background of hardy deciduous trees; the approach to the Park's most inspiring centre.

whose park commissioners ever have done so. I now hear, in my mind, a question which says, "But where are trained zoological garden zoologists to be found?" To this I answer: Because there has been up to this date no real demand for such men, there is not as yet a good supply! Whenever the young men of America become convinced that in the new zoos of America there is a real field for zoo zoologists, it is very certain that many desirable young men will specially fit themselves to enter it. Until such a demand is assured, why should any capable man specially fit himself to fill it?

As a matter of unevadable duty, the New York Zoological Park has accepted several young men for courses of practical study, and training in the care of wild creatures in captivity. Some of these are now head-keepers, some are curators and superintendents, and one writes his name above the word "Director."

Following the bad examples of most European gardens, in the great majority of American zoos the labeling of the exhibits is given but scant attention. The result of this deplorable habit is a distinct loss to the public, and also the zoo itself. It is not a good thing to treat the very serious business of labeling with open indifference. Visitors readily recognize this spirit. Long ago the museum curators of America awakened to a realization of the virtues of descriptive labels, but none of them has in this industry anything "on" the Zoological Park of New York. Twenty-five years ago, we began to put up all the descriptive labels, maps and charts that we thought the traffic would stand. This was done partly as a duty and partly as a pleasure. After a quarter century of effort, we believe that this educational industry has resulted in a very marked increase in correct zoological knowledge, and of public interest in wild animals.

Every zoological establishment, great or small, should have, high up on its staff, at least one zoologist who is competent to handle, along with his other duties, the educational side of its exhibits. The business of feeding and cleaning is highly necessary but it is not all in all in zoo maintenance.

In cataloging the difficulties in zoo creation and maintenance, there are several that have strong claims to first place. Of course, the first difficulty is money; but there are others. As the greatest difficulty to be surmounted, I place expert service. This is a requirement that is universal, from the president's chair down to the assistant cleaner. To ignore it is dangerous, and sometimes fatal. In coping with this difficulty in a short market, both patience and money are necessary. If a candidate is good but not quite up to the mark, invite him to complete his education, and acquire some special training before he enters upon his work.

To the credit of the men in municipal offices who are apt to be spoken of carelessly as "politicians," it is to be said that today all save a few of them appreciate the fact that in zoos, of all places, appointments must be based on special fitness and ability, and that good men must be let alone so long as they continue to make good. I think that today it is only the most hard-boiled mayor who has the hardihood to destroy the discipline of his city zoo in order to prevent incompetent keepers from being removed, or to force an incompetent man into a position that he cannot fill.

In the selection of animal keepers, a strict observance of the rules of a civil service commission is almost certain to result in the insertion of a large percentage of round pegs into square holes. The best civil service examiner is the director or superintendent who is to be held responsible for the work of the men under him, and the more a civil service commission heeds his judgment in making his selections, the better for the service. I hold that the head of every zoological park or zoo absolutely requires complete freedom in the selection and discharge of the employees for whose acts he is held responsible. For twenty-five years it has been a rule in the New York Zoological Park that no head of a department shall be forced to accept or to continue the services of any person who is not satisfactory to him. One result of this rule is that every head of a department goes quite to the utmost limits of patience and forbearance before finally asking that an employee shall be discharged.

In planning installations for captive wild animals on public exhibition, there are certain fundamental principles that are permanently fixed. To enumerate here even the half of them would mean the writing of another chapter. They involve generous space allotments; perfect floor conditions; good light, good air, whatever shade and seclusion is necessary; the companionship of other animals; humane wire netting instead of iron bars, wherever netting is possible; playgrounds for bears, apes, monkeys, hoofed animals and birds; abundance of pure water, and freedom from annoyance and destructive feeding by visitors.

OPEN-AIR CONFINEMENT IN A MILD CLIMATE
Exhibit of baboons as it has been evolved in the Taronga Zoological Park, Sydney, Australia.

An animal that can not be kept in comfortable captivity should not be kept at all. Real solitary confinement is a horror that should not be inflicted upon any healthy warm-blooded animal. Solitary animals, by which I mean animals than can see no others, suffer from loneliness just as men do. Let animals confined singly at least see their neighbors.

A fine show of animal collections, well fed, clean, happy and well labeled, is enough to make any zoo popular with the public, and enlist generous support.

AN INDIAN RHESUS MONKEY

Notes on Her Life in Captivity.

By O. E. H. MELTZER,
Los Angeles, California.

OUR monkey, a young specimen of a Rhesus, (a female), was brought from Calcutta by a young friend of ours who had just returned from a voyage. She was about a foot in height, and we called her "Timmie." She had a pretty little face, her eyes were of a bright hazel, and her mouth was adorned with a set of spotlessly white teeth. Her fur was of a yellowish brown and in contrast to this the skin covering the chest and abdomen was of a delicate blue.

It was a winter's evening when she arrived in a small cage. The first thing she did was to take a quick, restless survey of everything in the room.

A bright fire burnt in the grate and asleep on the hearthrug were our two cats, one a black (Pat) the other a finely marked tabby (Jack). Pat was plump and glossy, whilst Jack in contrast was very slim.

Timmie's eyes glanced as if fascinated at the two cats, especially at the black one. To see what would happen we opened the door of the cage. Out leapt Timmie and made for the black cat.

The battle was brief but decisive, Pat's claws quickly caused Tim to retire to a safe distance where she remained, chattering.

Although Timmie often saw Pat afterwards, she never again interfered with him. Jack (the tabby) fared worse for he showed timidity, and having noticed that, Timmie at once took advantage of it, and chased him about. It was very laughable to see the monkey approach

Jack. She would never face him (having no doubt strong reasons for remembering Pat's claws) but always tried flank attacks, and it was intensely comic to see the stealth employed to this end.

A larger cage was soon built for Timmie, filled with fresh hay and placed in a lumber room. She was regularly fed morning and evening with fruit and biscuits, and was frequently washed with soap and water, enjoying the bath immensely. Her sense of hearing was remarkably acute, the first footstep in the morning over head, however gentle, she immediately detected, and she at once started giving harsh shrieks like those of a cockatoo. Her language was very limited. Beside the parrot shriek, she sometimes gave a clear, high whistle, and an exclamation of a sound something like "Durrah, Durrah," and when one approached her cage with food, she would frequently say in a long drawn, plaintive manner "Ah! Ah!"

Timmie's fear of dogs was very marked. If one said to her "Tim, there's a bow wow," she would at once jump up to the window, gaze eagerly out, quickly move both ears and grunt, "Durrah! Durrah!" with an expression of much valour, but really ready to fly for her life from her dreaded foe.

Her aversions were numerous, especially to the color black. She had a great terror of things that were new to her; for instance, a pair of nut crackers when presented to her terrified her greatly. The noise and sight of a lawn mower caused her the utmost fear.

In the garden was a tortoise. It was intensely comic to see Tim approach the tortoise, touch its head, and when the animal drew it in with a jerk, she would leap high into the air as if shot. Tim had a great aversion to mice and we frequently found their dead bodies in her cage.

There being no fireplace in the lumber room, where stood her cage, Timmie was often allowed to come into the dining-room where she would sit in front of the fire, picking up on her way, any crumbs that had fallen from the table. Some of these she would place upon the hot bars, and when she considered them sufficiently toasted, would snatch them up quickly and eat them. In this proceeding there seemed a glimmer of human intelligence.

After a while she would get tired of being at the fire, and begin springing from chair to chair, oust Jack from his slumbers, and chase him round the room. At length she would become so boisterous, that it ended in her being put back into her cage which she did not at all relish, making attempts to bite.

We gave her porridge with which she filled both cheek pouches, looking then just like some grotesque imp. If she were now approached by a stranger, she would show her teeth allowing some of the porridge to escape; the picture was an intensely funny one.

Timmie was a most accomplished thief. Many a time has she dashed onto the tea-table and as quick as lightning snatched one or more pieces of sugar from the sugar-basin, these she thrust into her cheek pouches and then leapt off the table. When scolded she would look up at the ceiling with an almost sanctimonious air of innocence that was irresistibly funny. The writer one morning was seated in a corner of the room engrossed in an interesting book; Timmie the while apparently doing nothing wrong.

Suddenly there was a slight creaking noise, the writer looked up from the book and discovered that Tim had stealthily pulled open the unlocked sideboard door, and had transferred to her cheek-pouches a quantity of butter. Neither scolding nor chastisement could correct this pilfering habit, and Timmie remained an inveterate thief. The restless eyes (which take everything in at a glance) are very marked in this species of monkey. We sometimes held her head to try and make her look at us straight in the face, but to no avail, the restless eyes would look everywhere, but not at us.

Timmie's last method of explaining that she was hungry, was by opening her mouth to its fullest extent, and then thrusting the finger tips of both hands several times into the open mouth.

At first we thought she had swallowed something that had stuck in her throat, but as she did this always before being fed, we found out what she meant.

As before mentioned, the lumber room in which stood Timmie's cage had no fireplace, and for that reason it seemed cruel to keep her there through the winter. Moreover the Rhesus monkey is gregarious in its habits, that is to say, that in the wild state these monkeys are not solitary but associate in bands. It seemed cruel under the circumstances to keep the animal alone, so we presented her to the Zoo. We were sorry to lose her as she had caused us much amusement, but the knowledge that the animal would be well cared for, and not solitary, offered some recompense for her loss.

A BIRDSEYE VIEW OF THE GIRAFFES

Viewing the giraffes from the top of a twenty-five-foot extension ladder, reduces their spectacular height in such a manner as to convince one that the vertical elevation viewed in a normal way is no greater than the horizontal measurements. In other words the giraffe is as long as he is tall, which stimulates the thought—what other animal corresponds in the respect?

ITEMS OF INTEREST

Eyes and Eyelids.—What are eyelids for? It is obvious that the occasional shutting off of light is only one of their functions. Another is to distribute gland secretions over the surface of the eyeballs, keeping them smooth and preventing drying up, cracking or tearing. Eyelids are also a protection against chemical or mechanical irritation. The moistening of the eyeball is not necessary in aquatic animals.

It is only mammals that have upper and lower eyelids. They are extremely movable and are fringed with eyelashes. In lower vertebrates these eyelids are either wanting or slightly developed, but the work of cleaning and protecting is done by a third eyelid, lying beneath the lower eyelid, or in the angle of the eye. The little red fold in the corner of our own eye is all that remains of a third eyelid.

The chameleon's great eyes move independently of each other. The crocodile has a protective third eyelid, while in the snake there is a peculiar structure known as the snake's spectacles. Instead of upper and lower eyelids the snake has a simple curtain made up of fused eyelids. The space between the curtain and the eyeball is always full of tears. This arrangement gives the snake its stony stare.

A Whale Ashore.—A forty-foot whale which grounded on a shoal 150 feet from Brant Beach, N. J., is causing residents some concern. Suggestions of methods to dispose of the carcass are cordially invited. Sea gulls and other marine birds are doing their best, but their efforts are regarded as insufficient.

A Pugnacious Peacock.—It is to the female of the species that the mirror is of the greatest service—in plate of polished silver, fair Helen gazed upon the image that made gay Paris tremble and for which great nations went to war; to the male it reflects the obstreperous collar button—the recalcitrant tie or, the correct application of the shaving brush. These are the extremes of its use among the sexes.

Ages look down from the mirror of Helen to the polished sides of a modern automobile.

Long before the siege of Troy—peacocks were peacocks, but the automobile was something else.

It is thus comparatively simple to perceive that evolution has been rapid with means of locomotion, but has been tardy with the peacock; the peacock is perfect enough and with this conclusion most all peacocks entirely agree. There is nothing in the world so satisfied with itself as the peacock.

True to the primeval inheritance, this fashion plate of the bird world adopts for himself a parade ground; a place where he can display his attractiveness to any—and to all who wish to behold him—even in lieu of animated audience, to nothing at all.

"In the spring when a young man's fancy lightly turns," seems to fit in nicely with the moods of the peacock; at that time he is utterly enveloped with the desire.

The selection of the proper spot is the only opening in his armor, the chosen locations and his proud way do not seem to be in accord.

"Get the habit, there's a reason," is a popular slogan; he gets the habit, but there does not seem to be any reason; to him all is gold that glitters.

Attracted by the graceful lines of a motorcar standing in the kitchen yard of the Park restaurant, I stopped to admire, and my attention was directed, not more to the car, than the curious performance of a magnificent peacock in perfect plumage.

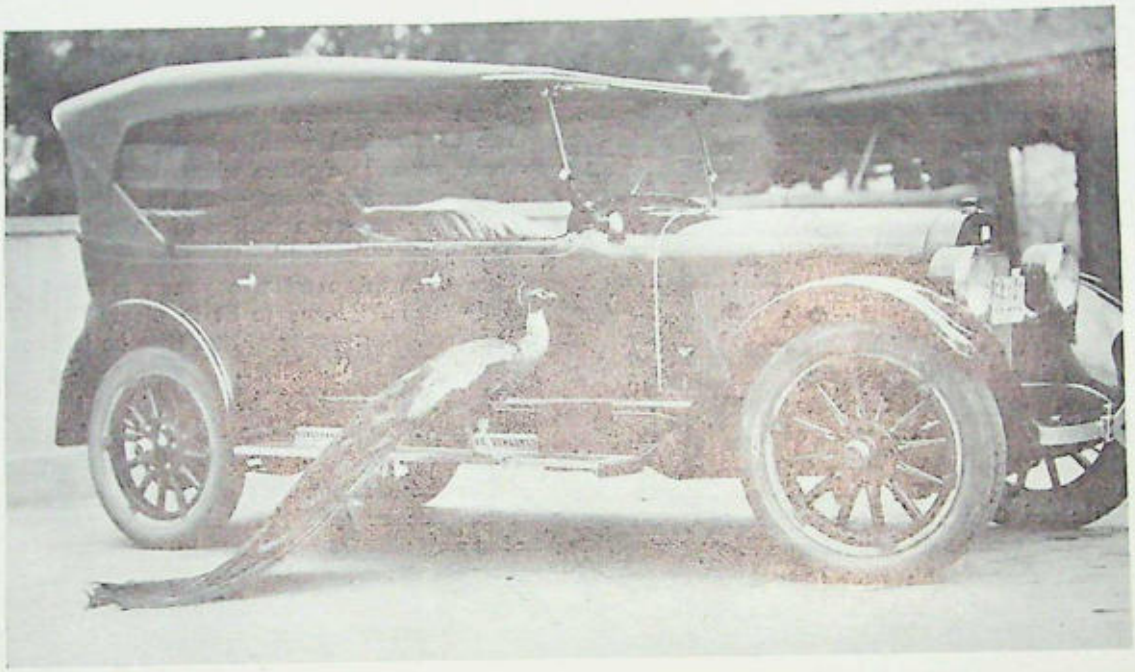
Utterly oblivious of all else he walked very sedately 'round and 'round the machine, graduating his movements to a slower pace, when he finally stopped directly before the forward door and gazed intently at the polished side of the car.

It was so indefinite a gaze and the object seemed so blank, that I was reminded of Bill Nye's analysis of the man suffering with strabismus, "one eye gazed into the unfathomed future, while the other ransacked the gloomy past."

After a moment's hesitation he hopped lightly to the running board and made a closer inspection, thereby revealing the cause of his curiosity; it was his reflection on the polished surface of the door and as it shifted with his movements his excitement arose tremendously.

His plumage ruffled, his eye sparkled and without awaiting to put on his shoulder the proverbial chip—shades of Don Quixote, Sancho Panza and the windmill—he launched himself into the air, struck the car a furious blow with his spurs and by the intensity of his action was precipitated to the ground in complete confusion.

Having no faithful servitor to aid him, he pulled himself together and without waiting to brush himself, dashed around on the other side at top speed to seek the hated enemy, cutting



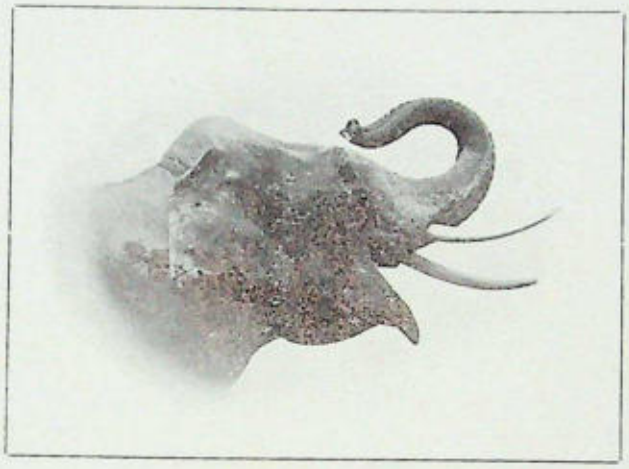
A PUGNACIOUS PEACOCK

Observing his image in the polished side of a motor car, this intrepid avian Don Quixote attacked the elusive image which most effectually evaded him.

the corners at a great pace, seeking this elusive foe that was forever out of sight.

When he had made about a dozen laps around the motor, his ambition cooled as his sprinting powers waned, thus bringing him gradually back to the reflecting point, where he again gave a perfect demonstration of the law of physics that two solid bodies cannot occupy the same space at the same time.

At this moment a heavy voice punctured the episode with: "Well, well, this is a high old time; the blooming bird will spoil my car," and Mr. Joseph saved the combatant from further disgrace by shooing him off the field.



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Typical Valley "Biala Woda," White Water.

ZOOLOGICAL SOCIETY BULLETIN

Published by the New York Zoological Society

VOLUME XXVIII MARCH, 1925 No. 2

THE GREAT PROGRAM OF POLAND AND CZECHOSLOVAKIA FOR NATIONAL PARKS

By DR. WALERY GOETEL
Member of the Polish National Commission for the Protection of Nature
Professor of Geology, Krakow Academy of Mines.

OUT of the welter of post-war chaos and economic stress in Europe, the world will read, and consider with profound satisfaction, the news of the creation of these important national parks on the international boundary between Poland and Czechoslovakia, "for the protection of the natural beauties" of those two nations. The movement reveals a degree of spiritual recovery, poise and vigorous enterprise that is worthy of the utmost admiration.

It is encouraging to note that these parks are projected together, instead of one only; and all of them are being founded and developed along the most modern principles of scenic, forest and wild life conservation. The most successful American models have been closely studied, and praiseworthy efforts are being made not only to preserve the works of Nature, but also to make them available, and enjoyable by all people who love the great outdoors.

The largest, the finest and the most conspicuous of the three national parks of Poland and Czechoslovakia is the middle one, embracing about 1,000 square kilometers of the High Tatra Mountains. This magnificent domain includes a great variety of elevations and mountain scenery, and presents a truly grand ensemble. It will furnish suitable homes for many different kinds of wild life, and it presents great opportunities for work by acclimatization societies.

We have been brought in touch with this fine East-European program of national park and sanctuary development through the kindness of Dr. Walery Goetel, Professor of Geology, Krakow Academy of Mines, because of our meagre efforts to be of some service along certain practical lines, relating to the development of a plan of foundation of international workability. Of the various printed documents now available,—which make an excellent exhibit,—there is nothing quite so clear or so well adapted to the needs of the American reader as Dr. Goetel's own absolutely unchanged letter of information, written in English, which comes to us accompanied by a splendid series of photographs of the Tatra International Park. It were a pity to edit or in any way mar this valuable document, and we trust that the reader will therefore not take too seriously Dr. Goetel's far too generous references to the small services that we endeavored to render as requested.—W. T. H.

THE STATE COMMISSION FOR THE PROTECTION OF THE NATURAL BEAUTIES OF POLAND

Krakow, Poland, October 20, 1924.

Dr. William T. Hornaday, Director,
Zoological Park, New York City, U. S. A.

Dear Sir:—As a member of the Polish Commission for the Protection of Nature and Commissioner of the Polish Government for the boundary settlement with Czechoslovakia, I wrote to you in May of this year through Monsieur P. A. Chappellier of Paris, asking you for information about the National Parks lying on the frontiers of the United States and Canada. M. Chappellier was good enough to send on to me through the Polish Embassy in Paris your letter of June, which gives a series of most

SUMMITS OF THE HIGH TATRA NATIONAL PARK
A Tatra winter landscape.

valuable suggestions and recommendations for us, who are establishing our National Parks, as well as a concrete plan for administering the same on the frontiers of Poland and Czechoslovakia.

I now venture to send you our most cordial thanks for the interest and good will you have shown toward our undertaking, and for the very valuable materials you have sent us. Please forgive us for thanking you at this late date, but my wish was to send you at the same time certain information about the matter in hand. The newest developments have come in these last days, thanks to the holding of several conferences with the representatives of the Czechoslovakian Government.

It is a very curious thing that our plan has arisen out of the dispute about the boundary between the two States in the Tatra Mountains, concerning the area known as Javorzyna. This dispute, which has been through all the international courts during several years, e. g. the Ambassadors' Conference in Paris, the International Tribunal at the Hague, and the League of Nations, has been ended in keeping with the higher ideals of civilization and humanity, by a protocol on which we have agreed, made in Krakow on May 6th, 1924, between me as the Polish representative and Eng. W. Roubik as representing Czechoslovakia. In this document all matters in dispute were arranged by common agreement, and Par. II of the same reads as follows:

> "Apart from the questions settled by the text of Appendix A of this protocol, the Commissioners discussed a series of matters of a more general nature, connected with the work of settling the boundaries and with the

DOOR-SILL OF THE ICE GROTTO

NATIONAL PARK IN THE CARPATHIAN MOUNTAINS
In the Mountains around Hoverla.

cultural interests of the whole frontier line. They came to a common agreement, to recommend to their governments the earliest possible concluding,

(a) of a special agreement with regard to Summer and Winter Touring, which will make possible and facilitate along the whole mountain frontier of the two peoples the development of this occupation, especially granting passport and communication facilities.

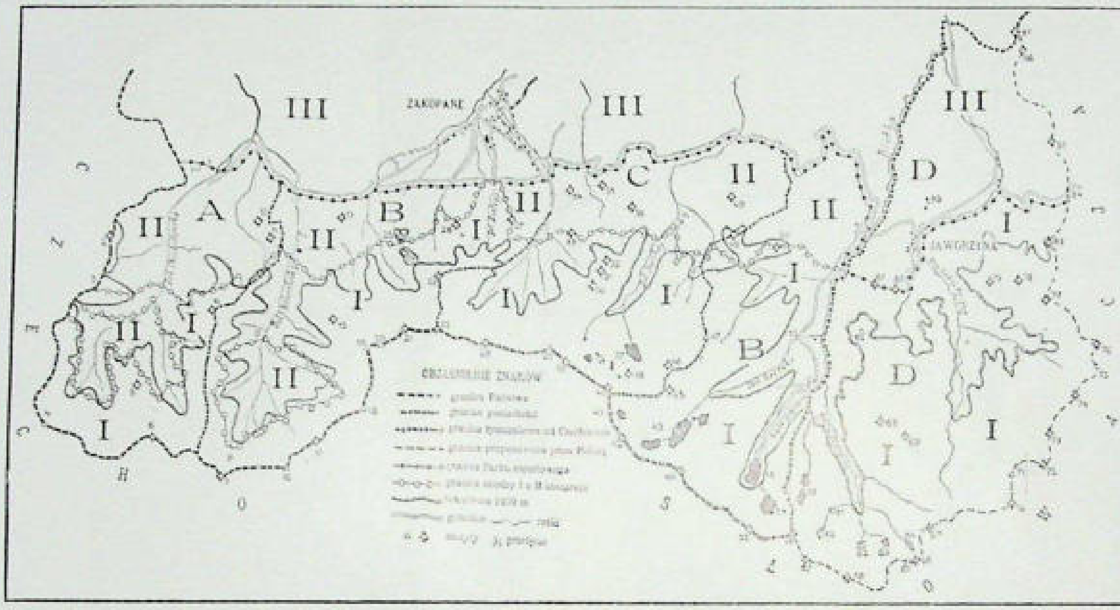
(b) an agreement to cover a National Park Reservation, on the analogy of those existing between the United States and Canada; which would create along the frontier areas set aside for the culture of fauna and flora and for preserving the wild beauty of nature."

This document was confirmed in the last weeks by the League of Nations and the Conference of Ambassadors and has become valid. Without waiting for this, however, M. W. Roubik and I laid before our governments our respective plans and held a series of conferences in Zakopane in the Tatras during September at which representatives and experts of both sides were present. At this meeting we prepared sketches both of the agreement with regard to Touring and with regard to National Parks along the frontier.

ENTRANCE TO THE ICE GROTTO

At the moment we have in mind to found four National Parks at the most interesting points of the Polish-Czechoslovak frontier which reaches almost the full length of the Carpathian chain: i. e. (1) on the wooded slopes of Babia Gora, 1,700 m. above the sea, (2) in the heart of the High Tatras, up to 2,600 m. above the sea, (3) in the heart of the Pieniny district, 900 m. above

THE SAVAGE GRANDEUR OF THE TATRA SUMMITS
In the new Polish-Czechoslovakia National Park.



TATRA MOUNTAINS NATIONAL PARK OF POLAND AND CZECHOSLOVAKIA
I—High areas of absolute protection. II—Lower areas of partial protection. From "Tatry Jako Park Narodowy," by Stanislaw Sokolowski, Krakow, 1923.

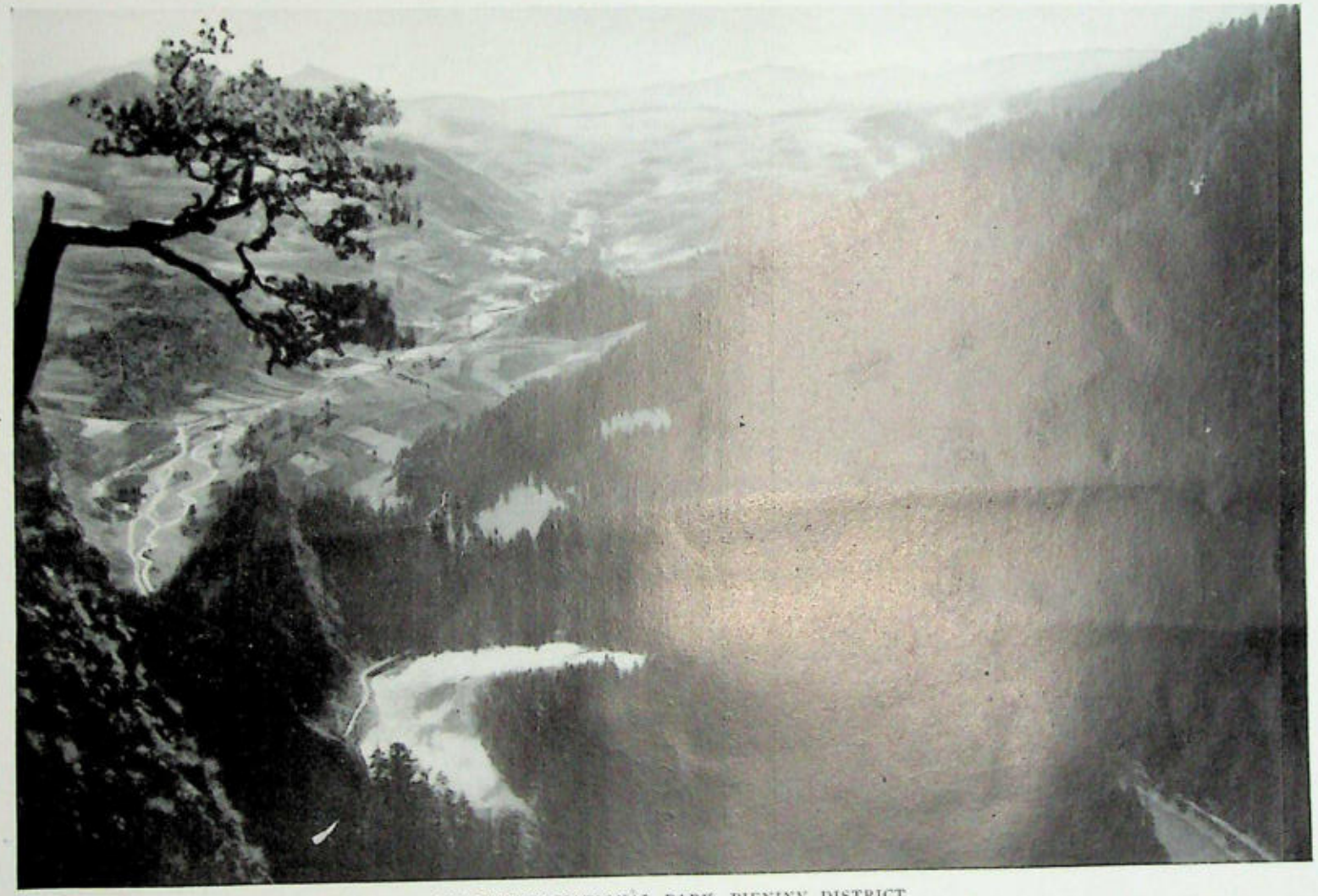
sea level and (4) in the high range of the Eastern Carpathians around Hoverla about 2,000 m. above sea level. The places in which these reservations are planned are noted on the map which I enclose with fair exactness. As you see from this map the areas concerned are not large, especially if compared with the National Parks of America, but here in Europe we must work on a very small scale. These areas do deserve special attention, however, for this reason that every one of them presents a very peculiar type, or rather variety of types of landscape, and possesses a fauna and flora quite distinctly its own in Central Europe.

Of the preparations made toward realizing this idea those connected with the park in the High Tatras are most advanced. These mountains have a character of their own, being the one properly Alpine group in Central Europe, and are known as the Tatry. My wish is to give you certain details with regard to them.

Above all the principle on which we are resting the founding of the National Park in the Tatras is the one which you propose in your letters, i. e., by the use of separate State edicts. I was greatly pleased when on the arrival of your letters I discovered that our initial plans were moving in the same direction as your suggestions based on so many years of experience. Our last doubts, therefore, in this regard were removed at once.

The chief principle, therefore, which we have accepted on both sides is the setting up of independent plans for administration for the two sides of the boundary which will be based on the above mentioned Section II of the Krakow protocol: which plans will be as far as possible identical in form and in content. They will only be adapted to the laws prevailing in the separate States, and will give precise directions in regard to the protecting of landscapes, rivers, fauna and flora, to the administration of the Parks, etc., etc. At the moment we are busy with the preparing of these plans, and as soon as they are ready I shall send them to you with a request that you favor us with your valuable counsel also in this matter. For the moment I can report that virtually all of your suggestions have been incorporated in our plans and were of enormous help to us.

Our greatest difficulty, which is also a difference between the National Park in the Tatras and your parks in America, lies in the fact that our frontier areas are not as with you completely virgin nature, but are mixed, having sections that are quite untouched, and others that are highly developed by human devices, or at least full of tourist facilities. When one remembers that the great Polish plain has very little highlands and that even for the Czechoslovakian world no such mountains as the Tatras exist elsewhere, it is easy to understand that the areas



PROJECTED NATIONAL PARK, PIENINY DISTRICT
Overlooking the valley of the Dunajec River.

THE EAGLE OF THE TATRA
In the projected Tatra National Park.

A VALE IN THE BABIA GORA NATIONAL PARK
Carpathian Mountains.

ORCHIDS OF THE TATRA
Cypripedium sp. ?

set apart for the National Parks have been occupied for a long time by the tourist trade.

The regulating of this tourist trade, which apart from its good side has begun more and more to show up certain evils, such as the altering of nature's beauties in order to make the mountains more accessible, is one of our most important problems. We are working on its solution in common with the Tourist Clubs of both nations. The greatest disputes and opposition arise from the necessity of completely closing certain areas to tourists in order to protect rare species of animals, e. g., bears, goats, prairie-dogs, etc. Another difficulty is the destruction of the forest and the excessive pasturing of the meadows by the native born with which we are carrying on a constant war.

Finally, we must contend with the speculations of hotel owners and traders, with the wish to exploit the water power, with the destruction of animals and fish, and with poaching. In order to handle these problems we are introducing into our plans two reservation belts, one where the preservation is absolute, and the other where it is partial. In the former, every kind of exploitation on the part of human beings is forbidden, with the exception of carefully controlled pasturing of cattle by the native born. In the latter, partial exploitation is allowed, but carefully limited by special rulings. The belt

A SKY PASTURE IN THE TATRA
The Tatra National Park.

CROCUSES OF THE TATRA
A meadow in The Tatra National Park.

of absolute preservation is to include the central and highest portions, while the other will include the lower lying ones, with the exception that certain spaces of partial preservation may be included in the other if the natural conditions demand it.

Our plan for the National Park in the Tatra Mountains, based on these principles, has been worked out by my colleague Professor Sokolowski of the Forestry Department of Krakow University in a pamphlet which I am sending to you. On the map included with it the belts of absolute protection are marked "I," those of partial protection "II." The map includes the Polish Tatras and part of the Czechoslovak ones, and the Javorzyna area. There are several photographs in the text which illustrate the nature of the country.

On another map which I also send, I have noted more or less exactly the boundary of the Park itself. One sees that the area of the park is for our European conditions quite large, including over 1,000 sq. kil. For your information as to the general appearance of the Tatras and the Park, I am sending you a series of photographs which will give you for the time being some conception of what our main parks on the frontier will look like. At a future time, if you wish, I will send you other and larger photographs.

TATRA PINE (*Pinus cenibra*)
A wind-stripped summit pine that wouldn't give up.

New York Zoological Society

OBJECTS OF THE SOCIETY

¶ A PUBLIC ZOOLOGICAL PARK. ¶ A PUBLIC AQUARIUM. ¶ THE PRESERVATION OF OUR NATIVE ANIMALS. ¶ THE PROMOTION OF ZOOLOGY.

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Members of the Zoological Society are entitled to all publications, Reports, Bulletins, Zoologica, etc., (Zoologica mailed by request only) and no effort will be spared to ensure their delivery. Changes of address, forwarding points and non-delivery of mail should be stated promptly. Contributions pertinent to the objects of the Bulletin cordially welcome. Stamped and return envelope should accompany communications. Address Editorial and Subscription Offices, Zoological Park, New York City.

ELWIN R. SANBORN, *Editor*

VOL. XXVIII MARCH, 1925 No. 2

I regret very much that I cannot yet send you any publications or documents in the English language about our work. I am enclosing, as a sample, one of our periodicals (published in Polish) especially for the protection of the natural beauties of the country, together with a copy of a French publication prepared for the last Congress held in Paris in 1923.

It is my warm desire to know intimately the splendid and spacious National Parks of North America, and especially those lying on state and national boundaries, which can best serve as models for us. For this purpose I should dearly love to come to America as soon as time and means permit, to see on the spot all that the American people have done. Meantime I shall be extremely grateful to you if you will be so good as to send us either direct or through the Foreign Ministry in Warsaw, or through your American Embassy here, any material or publications, or copies of your State papers bearing on the question of National Parks. I make this request moved by a sense of the kindness with which you have met our former demands and in the conviction that what you send me will give us further and valuable help in the useful task we are engaged in. Perhaps in this way the work we are doing for the first time in Europe, and along the lines you have begun in the New World, may come before long to be realized in fact.

During the winter further conferences will be held here on this subject, and I shall keep you informed as to their results.

I remain, with deepest respect,

Yours truly,

WALERY GOETEL.

COLONIZING QUAIL

The California Quail in New Zealand and Argentina.

There is material for thought in the fact that, while America's game birds are slowly but surely decreasing in numbers, at least one of our native species is providing not only sport but food in other lands. Mr. Charles L. Fagan, wireless operator for the Grace Steamship Line, recently brought me the information that a small game bird was very abundant in the markets of Valparaiso, Chile. This naturally aroused my interest and I asked for a specimen. On his next trip, Mr. Fagan secured one of the birds and brought it to the Zoological Park. It proved to be a fine and lively male specimen of the California quail.

This bird has been introduced into Argentina —just where, thus far, I have been unable to learn—and evidently is thriving beyond precedent. Mr. Fagan assures me that during the period of the spring months of our North Temperate Zone, (autumn, of course, in southern South America), thousands of California quail are brought to Valparaiso from Argentina, via the railroad which tunnels the Andes. They are shipped alive, tightly packed in flat crates, and offered for sale at very small prices.

A recent visitor from Christchurch, New Zealand, Mr. Edgar F. Stead, furnished some interesting details as to the success of the Cali-

fornia quail in the Antipodes. There are vast birdless tracts in New Zealand, from which the scant native species have been driven through inability to adapt themselves to rapid clearing of the land. A new avian population has been built up by importation from many countries and New Zealand's birds are now a strange conglomeration.

In the dry lowland districts of the Christchurch area, the California quail evidently has found an ideal home. Because of the density of the scrub it inhabits there, shooting is difficult. Mr. Stead's description of quail shooting in New Zealand is amusing: the party, consisting of three or four guns, drivers and retrieving dogs, makes its way to a spot where quail are known to be abundant. Selecting a suitable number of trees, somewhat taller than their fellows and standing in a semicircle, each man breaks down the top at a point ten or twelve feet above the ground. On this he takes his precarious position and has a fair view over the lower scrub.

When all is in readiness, the drivers are sent in and as the birds emerge, each gun takes pot-luck. When the shooting is over the retrievers are brought into use, for without their services it would be impossible to find the dead birds in the thick undergrowth. Conditions of this sort probably would be unpopular for quail shooters in California, but they certainly would be appreciated by the birds. L. S. C.

TWO GIFTS.

To the endowment fund of the Zoological Society, Mr. Edwin Gould has generously subscribed $15,000. In this day of many "drives," for all kinds of causes, such manifestations of interest in our Society are trebly welcome,—because the need for them is very great.

Mr. Richard Thorne Tjader, grandson of our Mr. Samuel Thorne of cherished memory, has presented to the National Collection of Heads and Horns the truly grand mounted head of the large African elephant shot by his father, the late Richard Tjader, in British East Africa, in 1906. This head as prepared in the field and afterward mounted by Mr. Herbert Lang, the famous field naturalist and collector in Equatorial Africa for the American Museum.

The Tjader elephant stood eleven feet four inches high, and carried a very fine pair of tusks, which of course appear in the mounted head. Beyond doubt, Mr. Thorne Tjader's welcome gift is one of the very largest and finest elephant heads in existence. It will very soon be transferred from the first picture gallery of the Administration Building to a permanent position in the Heads and Horns Museum.

W. T. H.

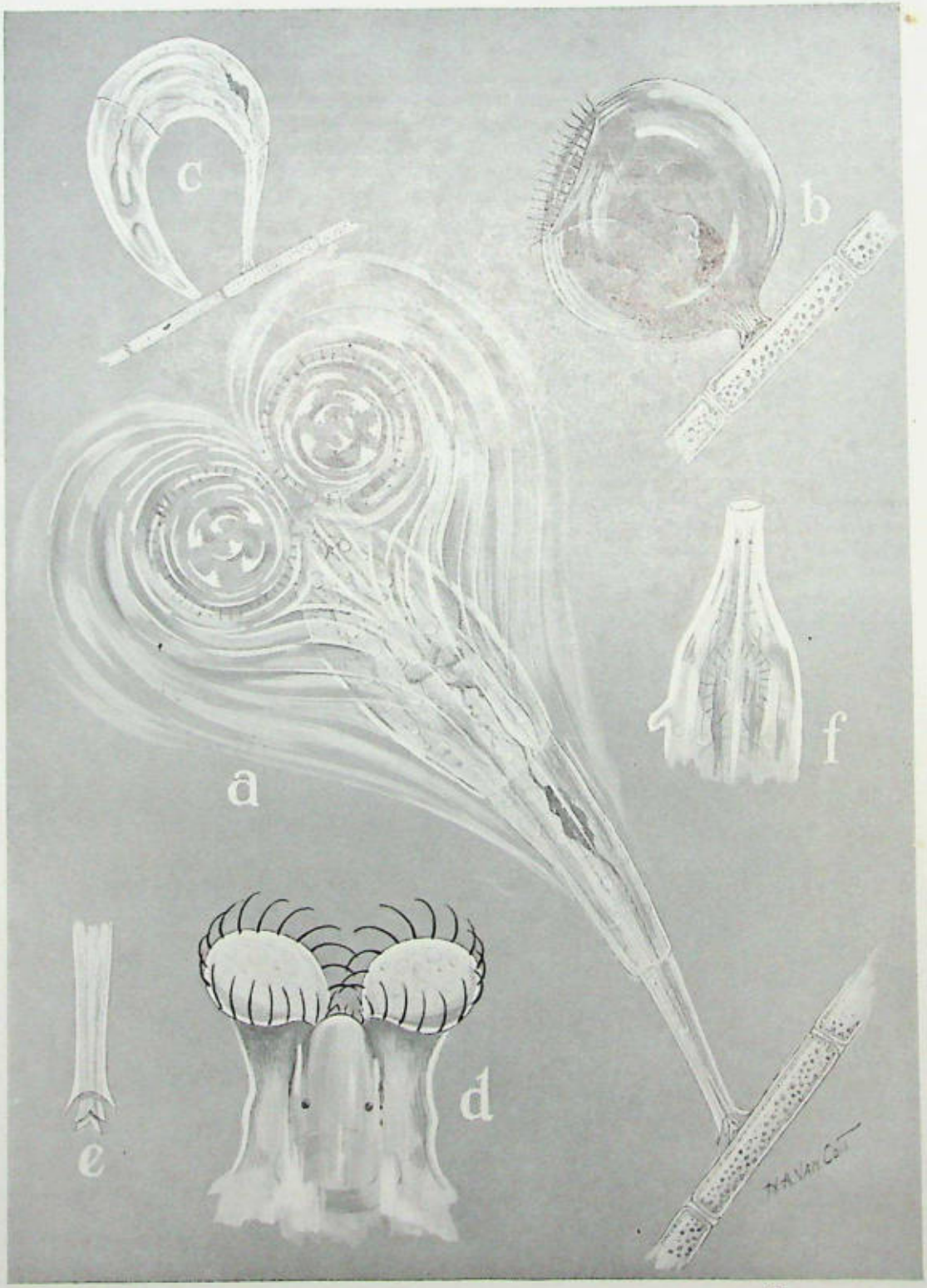
THE EUROPEAN STARLING

Although investigation has shown that the European starling, which is firmly established in the eastern part of the United States, is not so harmful as it is reputed to be in the Old World, many people look upon the bird as an undesirable alien. In a comprehensive report in 1921, the Biological Survey of the United States Department of Agriculture showed the economic value of the species, and makes available additional information about this bird in Department Circular 336, Spread of the European Starling in North America, by May Thacher Cooke, biological assistant. This publication traces the introduction of this species, its methods of spread, and the present extent of its range.

The permanent establishment of the starling in North America dates from 1890-91, when about 120 birds were released in Central Park, New York City. From this center the species has spread east to the Penobscot River, Maine, north to the Ottawa River, Canada, west to central Ohio, and south to Georgia and Alabama; though in the greater part of this territory it is still of only local or accidental occurrence.

The starling is a prolific species, raising usually two broods of three to six young a year, and its rapid increase in numbers requires constant reaching out for new food supplies and nesting places. It seems to prefer the vicinity of water, and, at least in New England, is most abundant near the coast and in the lowlands of the river valleys. This preference has had a marked influence on the dispersal of the species. In its spread it has followed the coast and up the Hudson and Connecticut Rivers. Western New York was reached by the Hudson and Mohawk valleys and the lake region. The route to Philadelphia was probably via the Passaic, Raritan, and Millstone Rivers to the Delaware Valley.

The year 1916 saw the territory occupied by the starling greatly extended. The first specimen found west of the Allegheny Mountains was taken at West Lafayette, Ohio, in that year, and at least one pair nested about this time near Washington, D. C.



A COMMON ROTIFER (*Rotifera vulgaris*)

Rotifers are found all over the world, chiefly in fresh water. They are distinguished by their circles of cilia, sometimes single, sometimes double, which through the microscope appear like revolving wheels. Many of the species can be desiccated, kept in a dry state for months and then be revived by applications of moisture.

From a wash drawing by Harvey A. Van Cott.

Marked extensions of range were noted in various succeeding years, and starlings have been reported from many localities beyond the farthest limits of the territory at present considered their breeding range. They have been seen within the past year at Athens and Thomasville, Georgia, at Lake Jackson, Florida, and at Detroit, Ann Arbor, and Vicksburg, Michigan. The western-most records to date are Milwaukee, Wisconsin, and the bank of the Mississippi near Baton Rouge, Louisiana. Many of the outlying occurrences are probably due to the habit which these birds have of gathering in large flocks and roosts after the breeding season. In these roosts, especially in marshes, they become associated with red-winged blackbirds and cowbirds, and when these migrate, some of the starlings apparently move on with them.

Throughout most of southern New England, southern New York, northern New Jersey, and eastern Pennsylvania, the starling is now very abundant, in some places outnumbering the English sparrow. The barrier of mountains having been crossed all the Central States will in time be occupied by the starling, but it will probably take many years for the bird to become of economic importance in that region. The northern limit of its range may already have been reached.

The undesirable qualities of the starling appear to arise from its choice of nesting sites, its proneness to drive native birds from the vicinity of houses, and the flocking habit. Its food habits are in some cases more beneficial than those of many of the birds it supplants. In places where feeding stands are maintained, starlings are liable to consume all the food provided for the other birds. The greatest danger from the starling seems to be from its habit of gathering into large flocks.

LIFE IN A DROP OF WATER

An Interesting Story From a Pond in the Zoological Park

By Harvey A. Van Cott

"WHAT a strange creature!" Such expressions are often heard in the Zoological Park; and there is no doubt that to the mind of the layman, many creatures are strange. I have wondered what these same people would say were it possible to place before them many of the inhabitants of the Park, whose very existence is known to only a favored few! Animals of most grotesque form and interesting habits that live their marvelous cycle of life outside of cages and escape-proof inclosures, never depending on attentive keepers for forage or protection, self supporting in every respect, thriving in their element in countless numbers, unseen and unknown by the passing visitor year in and year out.

On one of my recent visits to the Zoological Park, I purposely carried a small half-ounce glass vial with a tight fitting stopper, which I filled at a small still-water pond just south of the Bear Dens; a beautiful wild spot surrounded by elder, many other varieties of shrubbery, and tall grasses and semi-aquatic plants, with a partially submerged log lying close to the water's edge, from the exposed sunny top of which scampered several painted turtles, frightened by my approach.

The surface border of this tiny pool, for at least an average distance of two feet from the shore, was thickly matted with a profuse growth of a minute aquatic plant commonly known as "duck meat." Intermingled with this were many light green threads of the ever present algae, which tied the growth into a dense green mass and effected a beautiful contrast with the more somber greens of the shore and the blue, reflected surface of the little pond.

A small quantity of this floating growth, with the sediment from the bottom and sufficient water to fill the vial was procured, the cork adjusted and the sealed specimen stored in my pocket for safety.

Upon arriving home some few hours later, as the contents of the bottle were very much agitated and clouded in appearance, I removed the cork and placed the small container on a shelf in my study where it remained for several days until I could find an opportunity to give it attention.

When prepared to proceed with my investigation, I found the cloudiness had completely disappeared, the sediment had come to rest at the bottom and the little plants were floating at the surface; the whole having the appearance of a very small aquarium, with the exception that fish could not be seen swimming about. If animal life were all that was needed to make it an aquarium, it was an aquarium indeed, for I knew that it was literally teeming with minute creatures, which could be revealed only by the aid of my microscope.

So, with the microscope, paint brushes and pen I will disclose to my readers one of the most common forms of the minute animals that flourish in a tiny globule of pond-water, and I

think that this little organism is so interesting in form as well as habits that the expression "what a strange creature!" is most appropriate.

With a medicine dropper, a globule of the water from the vial was placed on a glass microscope-slide and a section of a thread of algae laid across the drop on the slide, an area no larger in circumference than a buck-shot and the depths of this tiny aquarium were brought into focus by manipulating the stage, and focusing screws of the microscope.

Slowly the thread of algae began to travel lengthwise across the field of view. Motion within the water was soon apparent, because of the currents carrying minute particles of opaque suspended matter, giving warning that something alive might be expected. In fear of missing what ever might be causing the agitation creating the currents, the adjustment of the stage and focus were slowed down, diminishing the progress of the thread across the field until movement was barely perceptible. Suddenly there shot into view what appeared to be, under the magnification of the microscope, two giant pin-wheels revolving at tremendous speed, each in close proximity to the other, both turning in opposite directions, and causing the currents of water and its suspended matter to whirl rapidly about them in ever increasing circles.

Suddenly these strange living pin-wheels whirled out of vision and nothing remained but the agitated water.

Slowly the creature was again brought to the center of the field, and a slightly lower power of magnification employed, which permitted the entire animal to be observed. What a curious creature, entirely unsuspecting that it was being intensely observed, and performing its natural functions just as though it were free in the little pond in the park.

It was never at rest for an instant, the "pin-wheels" revolved continuously and the body rotated back and forth around its anchorage to the algae.

The body proper of the animal appears to be composed of a transparent amber colored substance, in appearance not unlike gelatin, throughout which could be faintly noted many longitudinal canals and other internal organs. Motion was discernible within certain of these organs just below the "pin-wheels," which were carrying out the functions of the mouth and mastication. Minute pellets of an opaque character, that appeared to be masticated food-matter could be seen revolving within these mouth organs and, later, slowly passing downward through what evidently was the alimentary canal, thence into a very opaque organ constituting the stomach.

The complicated internal structure of this little animal would of necessity require a description of a lengthy degree, I assume that an analysis of its movements and external structure will prove far more interesting.

Referring to the illustration, (a) gives an impression of the animal in action, showing the "pin-wheels" which revolve at a tremendous speed and create the circular currents of water. The animal is here fully extended with its foot grasping a thread of algae. Here also can be noted the plainly marked segmented body.

In (d) we see a greatly enlarged view of the head parts, which are funnel shape in form. The outer rim of the funnel is lined with a row of bristle-like hairs, known as vibratile cilia. The detection of the cilia can be accomplished only by bringing the little animal into a state of quiet by applying a narcotic to the water in which it is being observed. There is but little resemblance between the cilia at rest and in action. Certainly the drawing (d) does not create the impression of "pin-wheels," and the marked pin-wheel phenomena is fully due to an optical illusion, caused by the exceedingly rapid whipping motion of the cilia in the water.

Never for an instant does it stop its little "wheels" from turning, or the slower swinging motion of the body. Its full time is employed in seeking food, for which it works with a persistence that I have never noted in any other animal of a higher type. A sharp tap with a pencil on the stage of the microscope brings about an instantaneous reaction that baffles the power of the human eye, even with the aid of powerful magnifaction, to follow. The "wheels" as well as the body of the little creature have apparently disappeared. If it were not for the fact that a mental note had been made where the animal was attached to the thread of algae, we would be inclined to believe that it had jumped completely from the drop of water, except for the fact that at the point of attachment may be seen a globular mass, perfectly motionless and somewhat opaque in appearance. Just this and nothing else holds the attention and impels us to concentrate on this tiny spot, which is in the exact location previously occupied by our subject. Close scrutiny reveals the attachment to the algae thread by the claw-like extensions of the foot, which slowly forces us to realize that this little ball of matter must be the same animal.

But how could this be possible? Apparently it is but one quarter of the size of the original subject that we had under observation a moment ago, and, surely, it could not be compressed or contracted to so small a mass. Strict attention now as we observe the globular mass changing in form; slowly it is getting a trifle oval in outline and more of the foot-part is coming into view, while the whole is gradually lengthening and assuming a form so similar to the first observed animal that we are almost certain it must be the original subject. If this is the same animal with the "pin-wheels" it strikes the observer as though it were very much afraid to reveal its identity and was assuring itself that all danger had passed, before exposing its true form. Then without warning, there is a slight, convulsive movement, the ciliated lips burst forth and the "pin-wheels" are whirling again.

This remarkable contraction is almost beyond comprehension and the procedure can be realized only after continual study. Reduced to ordinary terms, its movements may best be described by comparison with the mechanical action of the closing and opening of the telescope.

The foot-segment slides within the segment above, these two combined segments into the next, the cilia fold down within the funnel shaped lips, the lips fold within the mouth, and the whole is drawn within the head part, then all is drawn within the only remaining section containing the first two segments described. A further contraction now takes place in the "telescoped" animal and the whole assumes a globular form. Throughout the change the animal looses its previous transparency and becomes more opaque as the contraction increases, until finally it is quite dark, as in (b).

This animal practices two forms of locomotion; swimming being the most frequently employed, which it can do quite rapidly, when in the form shown at (b), by breaking the grip of the foot, letting go with the foot and keeping fully extended, the whirling cilia draw it, aeroplane fashion, through the water with a speed almost impossible for the eye to follow. Less frequently it moves about along the surface to which it has been attached by contracting its cilia and mouth parts, then extending the head until it assumes the form of the neck of a bottle as in (f). Stretching out, then arching its body, as in (e), it secures a hold with its head and releases the foot, bringing the latter by a greater arching of the body, up to the head. It then takes a new hold with the foot, releases the head and continues the movements, which are identically the same as those of a measuring worm, until it has traveled the desired distance, when it again unfurls its "pin-wheels" and proceeds to feed.

Two little "dark-spots" are always seen in the head section as shown in (d). Their appearance and position lead one to consider them as eyes. Whether this is the case, I cannot say. If they are not eyes, then the little animal is endowed with a most remarkable and sensitive sense of touch as is evidenced by the fact that a number of them swimming free in a drop of water, in their characteristic rapid manner, never have a collision with each other or with any submerged object; always allowing a margin of clearance in every case.

Space does not permit me to fully note and explain the many other extremely interesting habits of this microscopic animal, but I may arouse your further interest by stating that it is but one of many hundreds of equally strange lower forms of animal life to be found in similar waters that one can observe and study with the aid of the microscope, in the quiet of your home.

If this creature could be captured and placed on exhibition as are the higher forms of animals in the Park, its cage would bear the following label: *"Rotifera vulgarus*, habitat, the freshwaters throughout the world."

Lion Slaughter.—The death has occurred at Gwelo Hospital in Bulawayo, South Africa, of George Allen, known as "Yank Allen, the Lion Shooter."

Mr. Allen, who was a native of Texas, went to South Africa seventeen years ago as a professional hunter and did a lot of work on the British South Africa Company's ranches up and down the country. He accounted for 258 lions, which must stand as a record, writes the Continental edition of "The London *Mail*."

Like most genuine big game hunters, Mr. Allen was somewhat reticent in talking about his adventures, but he takes to the grave some scratches on the arms—mementoes of one narrow escape.

His description of a lion was that it was nothing more than a great big dog, and it was safest not to open fire until the lion was within twenty yards of the gun. Mr. Allen had "laughing cavalier" eyes, in which was mirrored that intrepid spirit which made him master of the denizens of the forest. For years he suffered from miner's phthisis, contracted on the Rand, and this caused his death.

The famous frozen mammoth of the Indigirka River, Siberia. From Beukendorf's romantic story, Mrs. E. Rungius Fulda pictures the ice-mummy with hind limbs still anchored in the unthawed banks. Later, when the ground, together with the mammoth, was carried away by the force of the onrushing floods, the discoverers had a narrow escape. Reproduction from W. T. Hornaday's "Tales From Nature's Wonderland."

FROZEN SIBERIAN MAMMOTHS. (*ELEPHAS PRIMIGENIUS*)*

Some Facts Concerning Their Discovery, Expeditions to Their Primeval Burial Grounds, Zoological Status and the Romance and Commerce in Their Ivory

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Continued from the January Number.

Part III. Zoological Status.

As an argument against the boreal character of the mammoth there has been advanced the fact that in southern regions its remains were found mixed with those of such tropical types as the cave hyæna (*Crocuta crocuta spelaea*) and the cave lion (*Leo leo spelaea*), that actually had gnawed its bones. The Pleistocene European hippopotamus (*Hippopotamus major*) has been cited to the same purpose.

It is not so uncommon a feature among various groups of recent mammals to travel about in regions having relatively great differences in temperature and presenting a variety of environments. Our American bison once roamed from the plains of northern Mexico to the woodlands of Canada beyond Slave Lake. Another example is our puma, of which Theodore Roosevelt writes in his admirable account: "It is found from the cold, desolate plains of Patagonia to north of the Canadian line, and lives alike among the snow-clad peaks of the Andes and in the steaming forests of the Amazon."

In Africa the browsing elephant (*Loxodonta africana*), with its preferred haunts in denser wooded parklands, roams also over trackless swamps and enters arid desert stretches. The grazing buffalo (*Syncerus caffer radcliffei*) leaves the plains and invades forests, making itself at home even at 10,000 feet. Both on Mounts Kenya and Kilimanjaro records of the two visiting snowfields and glaciers are at hand. More surprising still are the giraffe (*Giraffa camelopardalis tippelskirchi*), exploring the mountain forests of Kilimanjaro, and the eland (*Taurotragus oryx pattersonianus*), going even beyond to the mountain meadows. The lion in East Africa ascends from the lowlands to above 7,500 feet as in the Rift Valley and within the range of the mountain gorilla (*Gorilla beringeri*) on Mount Sabinyo,[13] reaching altitudes where the temperature during the night may drop below the freezing point. The lion has been bred with success freely exposed to the wintry rigor of the climate of Dublin. Leopard (*Panthera pardus suahelica*) and hyaena (*Crocuta crocuta germinans*), also typical animals of the lowland, go to over 9,000 feet on Mount Kenya. There, up to 15,000 feet, near the border of eternal snow, hyraxes (*Procavia mackinderi mackinderi*) too occur, differentiated only subspecifically from the lowland form. Colobus monkeys (*Colobus abyssinicus kikuyuensis*) are none the worse for icy-cold nights at 10,000 feet though equally at home in the hot valleys far below. River-horses (*Hippopotamus amphibius*) even in captivity seem not to be so susceptible to cold as generally believed. In the zoological garden in London at least they were known to take their tubs in frosty weather.

Africa, with its very restricted mountain areas, gives no fair basis as to what happens in Asia with its more extensive ranges and mountain plateaus, or to what might have taken place in this respect during the glacial periods of the Pleistocene. Even among recent mammals the list could be increased considerably. One need merely mention the hardy, long-haired Manchurian tiger and the well-furred snow-leopard with firmly established haunts in colder climes though their closest relatives inhabit the tropics. The camel (*Camelus bactrianus*) and the yak (*Poephagus grunniens*), that survive the icy blasts of the Tibetan plateaus, show not the slightest effect in their welfare or reduction in breeding on descending into more temperate zones.

Certain it is that many of the high lands of the Pleistocene presented a wide, open expanse with an abundance of excellent pasturage, as indicated by the large herds of gregarious mammals. There should be no surprise that some of the southern carnivores, like the lion, hyaena, and others, followed up such promising

[13] Philipps, J. E. T., 1923, *Geogr. Journ. London,* LXI, p. 247.

* The photographs and some of the data in this article have been kindly contributed by Dr. E. W. Pfizenmayer, Curator, Natural History Museum, Stuttgart. Formerly: Assistant, Petrograd Zoological Museum; Member of the Beresovka Mammoth Expedition; Leader of the Sangajurach Mammoth Expedition.

prey. Perhaps the borders of rivers in the summer offered also an abundance of choice fodder to the hippopotamus. All points considered, there is no reason why the hairy mammoth should not have wandered south. Its rambles may even have been undertaken during the colder season.

Part IV. Habitat.

Being great nomads, like most of their relatives, the mammoths unquestionably wandered back and forth through most of the northern countries of Europe, Asia, and America. During the moist, cool climate of the third glaciation they made their first appearance in Western Europe, going as far west as the British Isles, at that time a peninsula, with the North Sea firm land; and even to Denmark and Scandinavia, where it was probably the remaining glaciers that stopped them at 62° North in Norway at Sæjervaskter in Vaage; attaining, however, to 65° 30′ North in several places in Finland bordering the extreme north of the Gulf of Bothnia.[14] They also went southward to northern Spain and to Italy within the neighborhood of Rome. From northern Siberia they passed over to Alaska and America by way of Bering Strait or the Aleutian Islands before the separation of these continents took place, thence to California and across to North Carolina.[15] On the American continent their evolution progressed into still more gigantic forms as they reached evidently more inviting regions farther south.

Encouraged by slight fluctuations of temperature while glaciers were slowly advancing and retreating during the Pleistocene period, the mammoths, like other mammals, shifted according to seasonal changes, either north or south, just as some of the African elephants nowadays accommodate themselves to dry and wet periods by traveling from the lower plateaus into the mountain forests, and to escape from the annual grass-fires of the savanna into the safety of extensive swamplands. At the close of the glacial periods their haunts must have vitally changed. The mammoths apparently were not able to follow any more in the wake of the retreating ice and must have encountered conditions that sealed their fate.

Most interesting is the evidence of what the gigantic beasts must have meant to the cave-dweller of Europe. The Crô-Magnon men of France[16] were the first to leave for posterity authentic outlines of these monsters they had hunted. One of the finest examples is the sketch of a huge, shaggy tusker cut into a slab of mammoth ivory found in "La Madeleine" cave. This and other equally characteristic pictures, such as a curious little figure of the mammoth found at Predmost, furnish proof of the absorbing interest early Paleolithic man evinced in glorifying the enormous beast his heroes succeeded in overpowering. These early artists evidently wished to commemorate the bearer of so bountiful a supply of meat. They undoubtedly used parts of it as talismans, as in the case of a child's necklace of mammoth ivory beads found at Predmost.

Part V. Decimation and Extinction.

In all probability the extinction of the mammoths was a gradual process and may have lasted hundreds of years or more. No single cataclysm, as Howorth[17] believed, could have been widespread enough to account for their abundant, mostly scattered remains throughout the Holarctic regions preserved, as they are, in such different ways. Besides innumerable traces in northeastern Siberia, the neighboring Polar Sea, and the American continent, great accumulations of their fossil bones occur also in certain places in Europe. Predmost in Moravia, where some 800 or 900 individuals were counted, is particularly famous, but the mammoth deposits near Cannstadt in Würtemberg and Hofstade in Belgium illustrate similar instances.

According to all authentic reports the mammoths preserved as ice-mummies, and found under various conditions of entombment, perished singly. Some of them were in prime condition, as young and fat individuals prove, and had plenty of fodder in their stomachs. These facts strongly favor the view that they met with accident, as instanced by the Beresovka and other finds. For this reason they have hardly any direct bearing on the real causes of extinction of their race that is to be set at a much later period. In a way they might be compared with the frozen body and a skeleton of the African buffalo found by Ross[18] and Mackinder respectively at about 14,000 feet on the glaciers of Mount Kenia. Wandering away from one of the many herds in the plains these

[14] Holst, Nils Olaf. 1913. *L'Anthropologie*, XXIV, *pp.* 363-364.

[15] Matthew, W. D., 1915, *Mammoths and Mastodons, Amer. Mus. Nat. Hist.*, No. 43 Guide Leaflet Series, *p.* 6.

[16] Osborn, Henry Fairfield, 1921, *Men of the Old Stone Age*, 3rd Ed., New York, *pp.* 397-398, *figs.* 197-199.

[17] Howorth, Henry H., 1887, *The Mammoth and the Flood*, London, *p.* xviii.

[18] Ross, W. McGregor, 1911, *Journ. East Africa and Uganda Nat. Hist. Soc.*, II, *p.* 63.

rovers had perished on their unknown, but curious excursion.

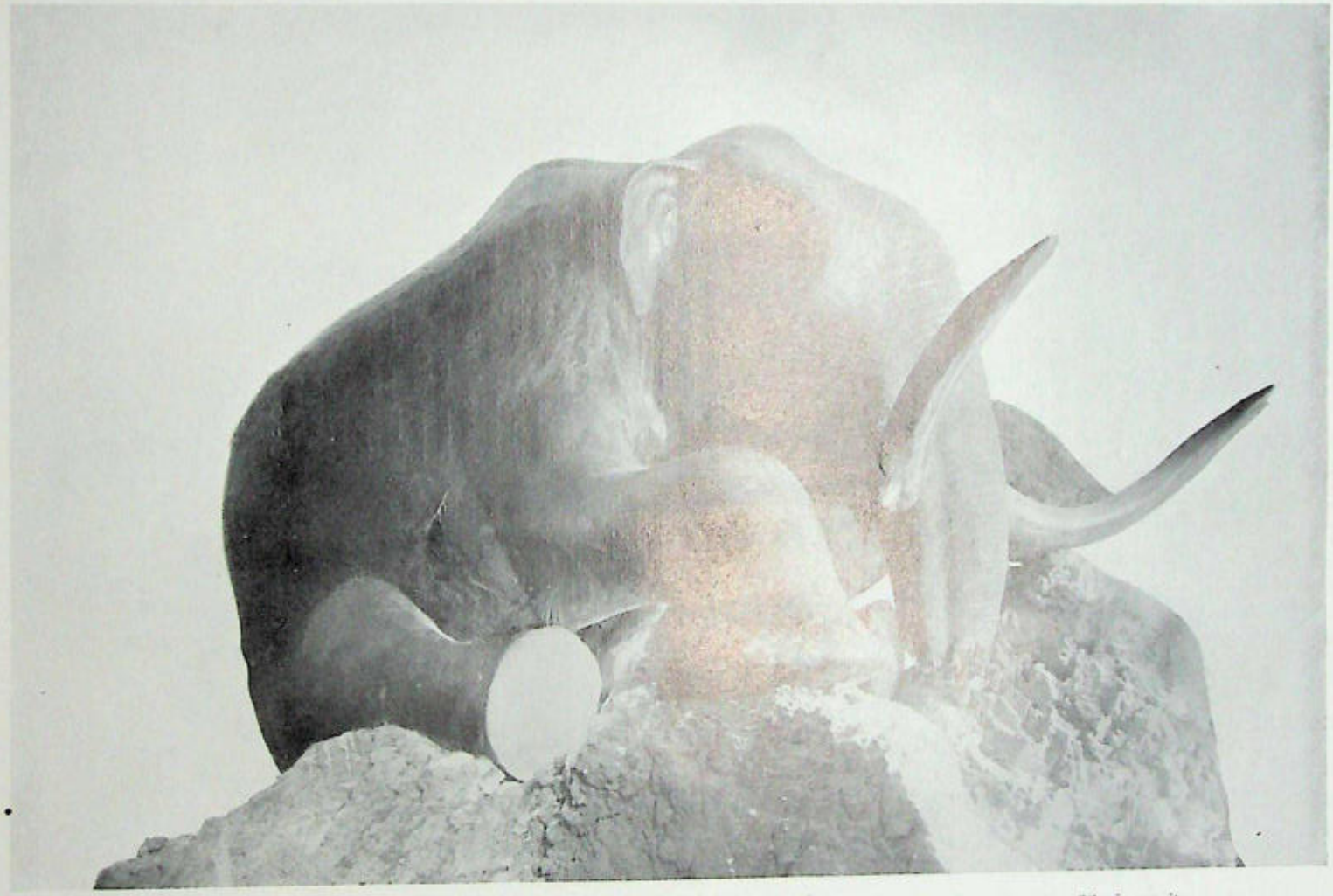
It is significant that only the most gigantic mammals of this decidedly gregarious Pleistocene fauna have been transmitted to posterity in frozen condition. Their tremendous weight and relative clumsiness seem to have played an important rôle. Did they slip and fall, or were they precipitated to depths where cold would preserve them? Or were some of their bewildered troops devoid of the necessary agility and grit to extricate themselves from overwhelming storm and deep snowdrifts? Or did furious gales and blizzards cover them alive with icicles that quickly grew to encasing blocks of ice? As regards greater catastrophies, subsiding land-masses may have brought their doom, or inundations engulfed them. A few may have found their final resting places in swamps and bogs. Considering the various finds, certainly some and perhaps all of the contingencies enumerated contributed their share to the final extinction of the mammoth.

Every spring as a result of the setting in of warmer weather the important Siberian rivers move enormous masses of ice towards the Polar Sea. The clearing away of these obstructions is watched with intense excitement by the inhabitants of these ice-bound regions. A few months of river navigation means new freedom of traffic. They again can rove far and wide. It is then that hungry dogs may lead their masters to the masses of strongly smelling meat of the "mamonto" that has incidentally been uncovered along the thawing coves and banks.

Mighty are the struggles oncoming spring leads against the wintry forces. For a while great portions of these streams are dammed up by mountains of constantly shifting ice floes. When these finally break through, parts of a new channel are often enough quickly ploughed up. After the generally sudden subsidence of these temporary floods, the old, abandoned stream-bed freezes over again, imprisoning huge blocks of ice, debris, and all. Some of the water for a while held below the icy cover drains off and here and there large scattered pits are left between the chaotic masses. After years have leveled out these sites, ponderous beasts like mammoths wandering over such treacherous places might easily break through, be instantly killed, or become hopelessly mired. Later on erosive material piled over all may have formed the basis for the surface soil that practically furnished permanent protection. A few frozen bodies found in what was considered alluvial soil, mixed with pieces of ice, in a position as if ready to walk off, may have perished in this manner.

The cramped position, broken bones, large amount of clotted blood in the body cavity, as observed in the Beresovka mammoth, point, as Salensky shows, towards instantaneous death by accident. The victim did not even have time to throw out or swallow the quantities of fodder between its molars and in process of mastication. Salensky gives a cause for such a tragedy. During extremely rigorous winters the formation of wide fissures in the ground is not rare in northeastern Siberia. With the oncoming warmer season these clefts rapidly fill with water which may cause extensive subterranean washouts. Later some colder spells may cover such basins with a sheet of ice, below which the percolation of the remaining water continues in other directions, thus giving rise to what really amounts to an underground cave. Subsequent strengthening of the surface ice and final covering with humus, until level again, would form a sufficiently strong cover for everything except the weight of so colossal a beast as the mammoth or rhinoceros. Later in summer such places might be specially weakened and the unfortunate animal crashing through into the cavities would be instantly imbedded in the masses of ice and frozen debris loosened by the accident. Severe storms and periods of intensive freezing that usher in winter would soon remove all traces of the entombed. For thousands of years the victim might never be moved, except through the infinitely slow processes of floods and similar erosive actions.

Without question all those mammoths discovered frozen in practically fresh condition were at the very moment of their destruction surrounded by a temperature that completely excluded decomposition. The perpetually frozen ground of northern Siberia acted much like a modern refrigerator. For periods variously estimated at anywhere from 12,000 to 25,000 years, such ice-mummies may have reposed far below the protecting mantle of tundra vegetation. Here, as in the vast expanses of the "taiga," the swampy Siberian forests, they were, so to speak, permanently protected, the ground being frozen generally at three feet below the surface even during the hottest of summers. That great numbers of these and other mammals perished without being preserved in such perfect fashion is sure. In some places the earth and the shores of certain islands along the Polar Sea were literally



The mounted mammoth unearthed in 1901 as an ice-mummy on the banks of the Berezovka River, northeastern Siberia, as it appears on exhibition in the Zoological Museum of Petrograd. The animal has been partly restored. Much of the real skin could be used in the mounting. Some of the hair has been replaced.

crammed with their bones. The solid clay of higher sites inland preserved them pretty well, but elsewhere climatic conditions fostered the more rapid decay of others, or without doubt there would be many more.

Part VI. Tusks: History and Romance.

Mammoth tusks have for many reasons aroused considerable interest. To the scientist they are the permanently growing, second pair of upper incisors, composed mainly of a solid but peculiar dentine, the "ivory" of commerce. To the poor Siberian hunter, with his pick and ax ready to chop into pieces whatever tusks he can discover on his migrations in the wilderness, they are "white gold." To the Chinese artist the delicate, fine texture and peculiar pallor of the easily carved substance brings new incentive for his varied talents.

Strongest is the claim of the superstitious. Small parts of mammoth ivory have meant to him the chance of his life. They have served even as relics of Christian saints. We are told that devout prayers addressed to them have given earnestly hoped for succor and success. Heathens with still stronger beliefs deeply implanted in their hearts as regards the occult powers of this marvelous substance have had their satisfaction too. Equally many-sided were the supposed medicinal virtues of mere scrapings. The Chinese have been more beguiled by them than by their "dragon bones." And Western Europe did not free itself so very long ago from faith in such wonder cures. With their application, hemorrhages, ulcers, broken bones, epilepsy, fevers, plague, and cholera[19] would all vanish, according to the fancy of many. For that very reason they furnished princely revenues. As many as sixty tusks from the fossil mammoth deposits at Cannstadt were sent to the pharmacy of the Court, and became the precious powder of the "Licorne."

Gross credulity has been carried even into other channels. What of the warrior whose sword hilt, carved of mammoth ivory, is worth more to him than one wrought of gold or silver?

In the matter of art Siberia itself has made little use of its great supply of ivory. Only a few figurines, animals, characteristic scenes of the native land, often in heavy relief or bold freedom, combs, vases, and boxes, are made in certain centers. Export of the crude tusks after all has been the mainspring of their efforts.

A great impulse to the exploitation of Siberian mammoth ivory along the edge of the Polar Sea, its cliffs, and islands near the mouth of the Lena, was given when Catherine II, Empress of Russia, took a personal interest in the matter. In October, 1771, she wrote to Voltaire[20]: "But what proves, I think, that the world is a little older than our nurses tell us are the finds of bones of elephants long ago extinct in these regions and imbedded several fathoms below the surface of the ground in northern Siberia. Scientists * * * have said that it is fossil ivory, but, how is it possible? Fossils do not grow in the form of very complete elephants."

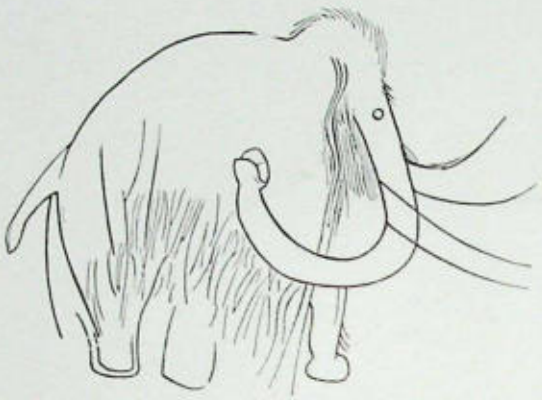
Some time before, she had given orders to investigate the archipelago later known as the "New Siberia Islands," whose highest point attains 1,200 feet. The southern two, low, and completely uninhabited Liakhoff Islands were named in honor of the fur merchant who, following the tracks of an enormous herd of reindeer coming from the north, discovered what later proved to be inexhaustible mines of mammoth ivory. The Czarina also had conferred on Liakhoff the exclusive right to hunt and to collect ivory on them.

Many huge tusks were partly sticking out of the sand and others, together with bones, were constantly swept up on the shores by the waves. To what depth do these marvelous deposits cover the sea bottom no one seems to know. Did these vast stores of wealth come from further inland, and were they carried out to sea with the crushing masses of ice in the spring? Here and there a frozen mammoth might have been moved thus along when whole sections of the partly thawed up river banks were undermined or torn out. Or did countless numbers of these huge beasts make their last desperate stand in these regions before the land was swallowed up by the sea?

Evidence for subsidence of land-masses is more certain, as apparently much of this expanse once formed part of the Asiatic mainland. On some of these islands Silurian coral and Devonian limestone, volcanic rocks, indicate that uplifts, as might be expected, had a part in the present physiographic configuration. On the northern-most, Hedenström found Tertiary strata with fossil bituminous tree trunks in horizontal and upright positions, over 200 feet above sea level. Other rich deposits of the same age with their interesting fauna and flora indicate a climate once very much warmer. But some of the lower islands off the coast show a few peculiar granite boulders and are covered

[19] Kunz, George F., 1916, *Ivory and the Elephant*, p. 239.

[20] Boule, M., 1917, *L'Anthropologie*, XXVIII, p. 187.



Outline engraving of woolly mammoth carved by Aurignacian man of early Magdalenian times on the rocky walls of the cavern at Combarelles, Dordogne, France. After Capitan and Breuil, 1901.

with a deep mantle of drift formed chiefly of sand, and buried ice in separate layers and incongruous blocks. These deposits were particularly rich in ivory tusks and masses of mammoth bones. Associated with them were the remains of other of the northern Pleistocene mammals, such as the woolly rhinoceros (*Coelodonta antiquitatis*), Siberian bison (*Bison priscus*), wild horse (*Equus caballus fossilis*), moose (*Alces latifrons*), reindeer (*Rangifer tarandus*), and musk-ox (*Ovibos fossilis*).

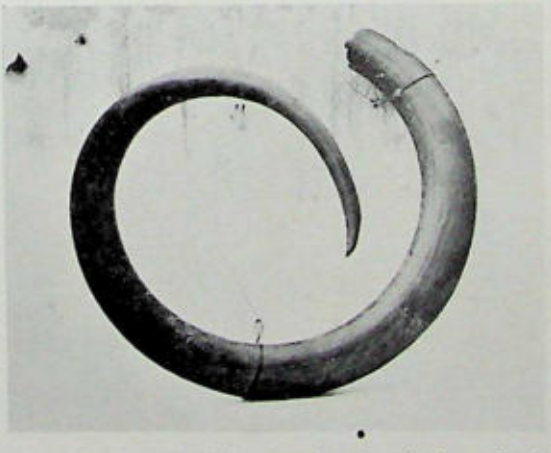
Unquestionably the mammoth was boreal in habits and most abundant in the colder regions. In northern Siberia, it flourished in all the territories between the Ural Mountains, Obi, Yenisei, Lena, Indigirka, and Kolyma, and particularly in the adjacent islands of the Polar Sea. These, therefore, with their fabulous stores of ivory, are the greatest graveyard of mammoths known. Von Wrangell described some parts of this region as containing hecatombs of such remains before they were ransacked by those in search of the valuable tusks. Should we wonder that for over a hundred years organized ivory collecting flourished without any apparent diminution of the supply?

The rigor of the climate imposed by far the greatest drawback to this greedy quest. At Liakhoff Island the open season lasts really but a few months. Bunge[21] in 1882-1884 records 90° F. below freezing point in winter, with snow falling half through July. But even under such trying circumstances enormous quantities of ivory have been removed. In 1821 one trader alone sent off 20,000 pounds. Middendorff, in 1841, estimated the annual output for the preceding twenty years as at least a hundred pairs of tusks. In 1881 Nordenskiöld,[22] basing his opinion partly upon the amounts still shipped, considered this figure as rather too low than too high. He arrived at the conclusion that since the conquest of Siberia select tusks from 20,000 mammoths had probably reached the markets of the world.

From Westendorp we know that the fairly well stabilized imports to Europe of fossil ivory in 1872—with London then the chief market—amounted to 1,635 mammoth tusks or about 245,250 pounds, granting an average weight of 150 pounds apiece. The proportion of well preserved ivory among such lots is surprisingly small—only 14 per cent; and a slightly larger amount, 15 per cent., is absolutely useless. But even the really "bad," amounting to 54 per cent., and the "still workable," 17 per cent., when treated properly and fashioned into the plainer objects passed in the trade.

For the most part these could not have been tusks of mammoths entombed in ice, the ivory of which compares well with that of recently killed elephants, but evidently had been subject to various disintegrating influences. So great was the demand for this remunerative article that in Europe mammoth tusks of far inferior quality to the Siberian product were formerly dredged in quantities from the Doggerbank by the North Sea trawlers.

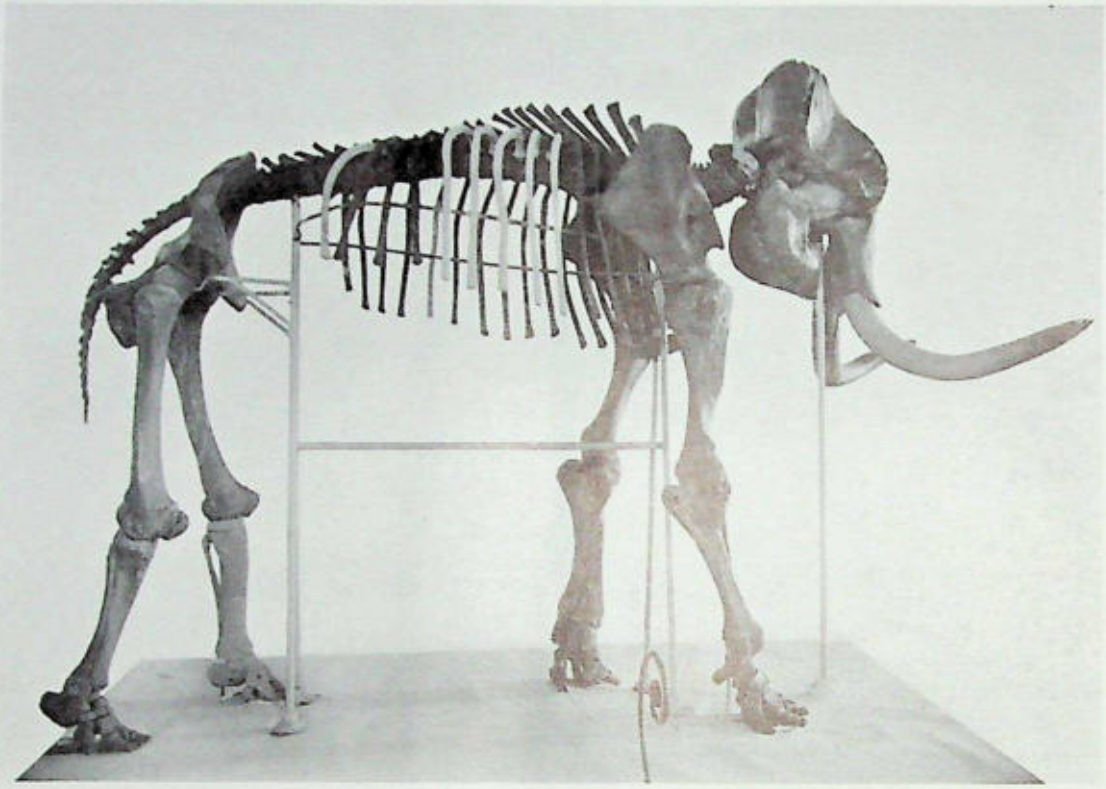
In rare cases mammoth ivory is slowly impregnated with certain metallic salts and then known as odontolite or blue ivory. Used for jewelry it is highly prized for the delicate, yet



An abnormally spiraled mammoth tusk. Perhaps all of the part rooted in the socket, and more, is missing from the worn tip, one might presume the ivory was a bothersome burden for its bearer. Much rubbing at the point somewhat reduced its thickness.

[21] Bunge, 1893, *Congrès Internat. Zool., Moscou, Session* II, (1892), *pt.* 2, *p.* 282.

[22] Nordenskiöld, A. E., 1881, *The Voyage of the Vega around Asia and Europe*, London, I, *p.* 404 footnote.



The Beresovka mammoth skeleton as mounted in the Petrograd Museum. One tusk and several ribs had to be replaced. To the top of the head, the animal's height is given as ten feet, nine inches.

vivid, blue, turquoise-like luster. The Eskimos of Alaska, according to Gilmore, are fond of a blue dye they secure from the phosphate of lime (vivianite) formed by the decomposition of mammoth tusks.

Many hundreds of thousands of these enormous tusks must have completely decayed. What great herds of shaggy mammoths may have roamed during Pleistocene times in the proximity of the circumpolar area can be deduced from Darwin's computations[22] about the possible increase of the recent elephant, considered the slowest breeder of known animals. If, at a minimum rate of natural increase, between the ages of thirty and ninety years, only three pairs of young be raised, he comes to the conclusion that "at the end of the fifth century there would be alive fifteen million elephants, descended from the first pair."

The Pleistocene mammoths during several hundred thousands of years had totally adapted themselves to a life in a monotonous, frigid zone. Uniformity indeed is the hall-mark of boreal regions as much as diversity is that of the tropics. During so long a period they gradually became highly specialized, long-lived monsters. Being excessively slow breeders they entered a stage where further evolution or even slight adaptive changes were reduced to a minimum. This meant the death warrant of their race. Perhaps in the boreal climate the balance of endocrine functions had long before been disturbed so that undesirable specialization went on unchecked and possibilities of forming varieties of greater vitality were practically eliminated. But whatever the causes of their final extinction, here, at least, nature has preserved from the enormous numbers of these shaggy monsters a few victims of individual accidents as ice-mummies. They have now become a unique source of information. Still others rest in frozen Siberian ground waiting to disclose more secrets of bygone ages.

[22] Darwin, Charles, 1860, *On the Origin of Species*, 2nd Ed., *p.* 63.

IN NATURE'S WILDERNESS

Stranger, if thou hast learned a truth which needs
No school of long experience, that the world
Is full of guilt and misery, and hast seen
Enough of all its sorrows, crimes and cares,
To tire thee of it, enter this wild wood
And view the haunts of Nature.

—*William Cullen Bryant.*

ITEMS OF INTEREST

An Ancient Tree.—A juniper tree, believed to be not less than 3,000 years old is still standing in the Cache national forest in Utah. Experts who have examined the heartwood have found that the first two inches of growth took 200 years. Later the tree grew at the rate of two inches in sixty years.

Barnacles not Color Blind.—The fouling of the bottoms of ships by barnacles may be greatly lessened as the result of recent experiments with bottom paint by the U. S. Bureau of Fisheries. It was discovered that barnacles collect in large numbers only on blue and black plates, and that white, yellow, green and red plates are practically free from them.

Planting Trout.—Through the co-operation of the United States Bureau of Fisheries and the Montana State Bureau of Fisheries, 18,635,200 Lock Leven and brook trout fingerlings and black spotted trout fry and eyed eggs were planted in the lakes and rivers of Yellowstone National Park during the past year.

Most of the fish planting operations have been in charge of the Bureau of Fisheries, which maintains a hatchery at Yellowstone Lake, although the planting of nearly 100,000 fingerlings supplied by the Montana State Bureau of Fisheries was done by park rangers.

Snows Imperil Birds.—The heart of every Northern lover of game birds must go out to those feathered creatures that brave the snows and icy blasts of winter, laughing at their rigors until nature sends rain and frost to create an icy prison from which there is no escape for bobwhite or the larger and equally hardy ruffed grouse.

Such heavy snowfalls as we have had recently mean little to these birds. Secure under the shelter of hedgerow or fence or in the lee of a ditch bank grown over with weeds, the quail is snug and warm. But when a frost follows a thaw or rainfall it is a serious matter for the hardy warriors. Oftentimes the coming of spring reveals a tragedy quite as gruesome as when a fox or other "varmint" leaves traces of his feast in a pile of fluffy feathers.

Quail were in evidence in the neighborhood of the metropolis last fall and until recently this winter. They were fed daily in many localities, but since the recent sleet storm few have appeared in their old haunts in Westchester County, or in Fairfield County, across the New York border in Connecticut, where the residents take delight in their cheery notes, whether heralding the coming of a new day or sounded as a call to roost at the approach of night.

Unless there is a change in the weather shortly there will be fewer quail and grouse to delight the ear and charm the vision of bird lovers in territory where Jack Frost is accustomed to hold sway.

A Huge Bison Herd.—The next great trek of the buffalo on the Western plains will be by box car, if it takes place at all. The herds of buffalo at the Wainwright National Park in Western Canada, have increased far beyond the number which could be supported in a dry year. It is estimated that no more than 5,000 head should be held at Wainwright, as the total number which the range will support year in and year out does not exceed this figure. At the present time, despite the slaughtering of many hundreds of buffalo last year, there are still more than 8,000 head. Only young buffalo would be shipped, as it is considered impracticable to transport the older stock.

Longevity of Camels.—Thirty years is reckoned by the Arabs to be the extreme limit of age for camels, whose females may produce ten or twelve calves in a lifetime. The normal age of a camel is reckoned to be something between 15 and 25 years, the span of a generation, the period, as the Arab counts, between the marriage of two generations of the same family. A camel, which comes in its youth to a man as his bride's dowry, being expected to still be "under him" on the occasion of his son's marriage, says the Detroit *News*.

The meat of a camel properly cooked and served with rice is said to be considered a morsel of delicacy by the Arab, but to a person unaccustomed to it, it is said to have little to commend it, except in the absence of other food.

Wasps vs. Flies.—The Department of Agriculture is encouraging the propagation of a species of wasp from California which is an enemy of horseflies, says the Indianapolis *News*.

Training Troupials.—The common troupial of South America is a relative of our own orioles and is brilliant orange and black in color, says *Nature Magazine*. Thoroughly tame birds are entirely fearless and have most entertaining ways. The natural song is a clear whistle and

occasionally one sees specimens that have been taught to reproduce elaborate military airs.

Fossil Elephants.—The collection of fossilized bones at the Los Angeles museum, belonging to sundry animals that lived more than 30,000 years ago, was augmented recently by the lower jaw and a gigantic molar of a Columbian elephant, a type of prehistoric mammoth of which fragmentary remains have been discovered only once before in southern California, says an Associated Press dispatch from Los Angeles.

The specimens were unearthed at a depth of sixty feet in a gravel pit. The face of the molar, which is nearly eight inches long, is covered with thick plates of enamel, while the jaw bone, which had been broken off, has a length of eighteen inches. Both tooth and jaw were petrified. Their original owner lived in the Pleistocene period, in the opinion of Dr. W. A. Bryan, director of the museum.

Silver Fox in England.—A dispatch from London states that England's first venture in silver fox farming will get under way soon, as a result of a shipment of twenty pair of foxes from the Island to the Old Country. The forty animals, which cost $40,000, will be installed on a plot of ground near Oxford, and it is claimed by the promoters that the climate of England is ideally suited for the rearing of silver foxes.

Ambergris.—Cape May, N. J., Feb. 13.—Friday the 13th proved a lucky day for John Rhodes, a beachcomber living near Fishing Creek. Walking along the beach today, he stumbled over a clot of ambergris worth about $1,000.

It is thought the substance, used in the manufacture of perfumes, was cast up by whales which have been observed off the Jersey coast in the last month.—*Herald-Tribune* (N. Y.)

Protection for Wild Fowl.—Richmond, Va., Feb. 10 (Associated Press).—A hugh sea wall will be built to save far-famed Back Bay, Virginia's paradise for the duck hunters of many States, according to W. McDonald Lee, Virginia Commissioner of Game and Fisheries, who recently inspected the district after receiving complaints from hunters that salty waters from the Atlantic threatened to kill all food for wild fowl in the vast area.

The waters of Back Bay are saline but not enough to prevent a wild variety of grasses and plants from growing on its shores and marshes. But, said the commissioner, the Atlantic Ocean has broken through its natural barriers of sand dunes and is pouring in too much salt for the plant life to survive. A sea wall to withstand the mightiest storms will be thrown across the weakened beaches.

Wild Life Preserve.—A wild life preserve, not for deer and elk, but for predatory animals such as mountain lions and wolves has been proposed by Prof. Charles C. Adams of the Roosevelt Wild Life Forest Experiment Station, at Syracuse, N. Y.

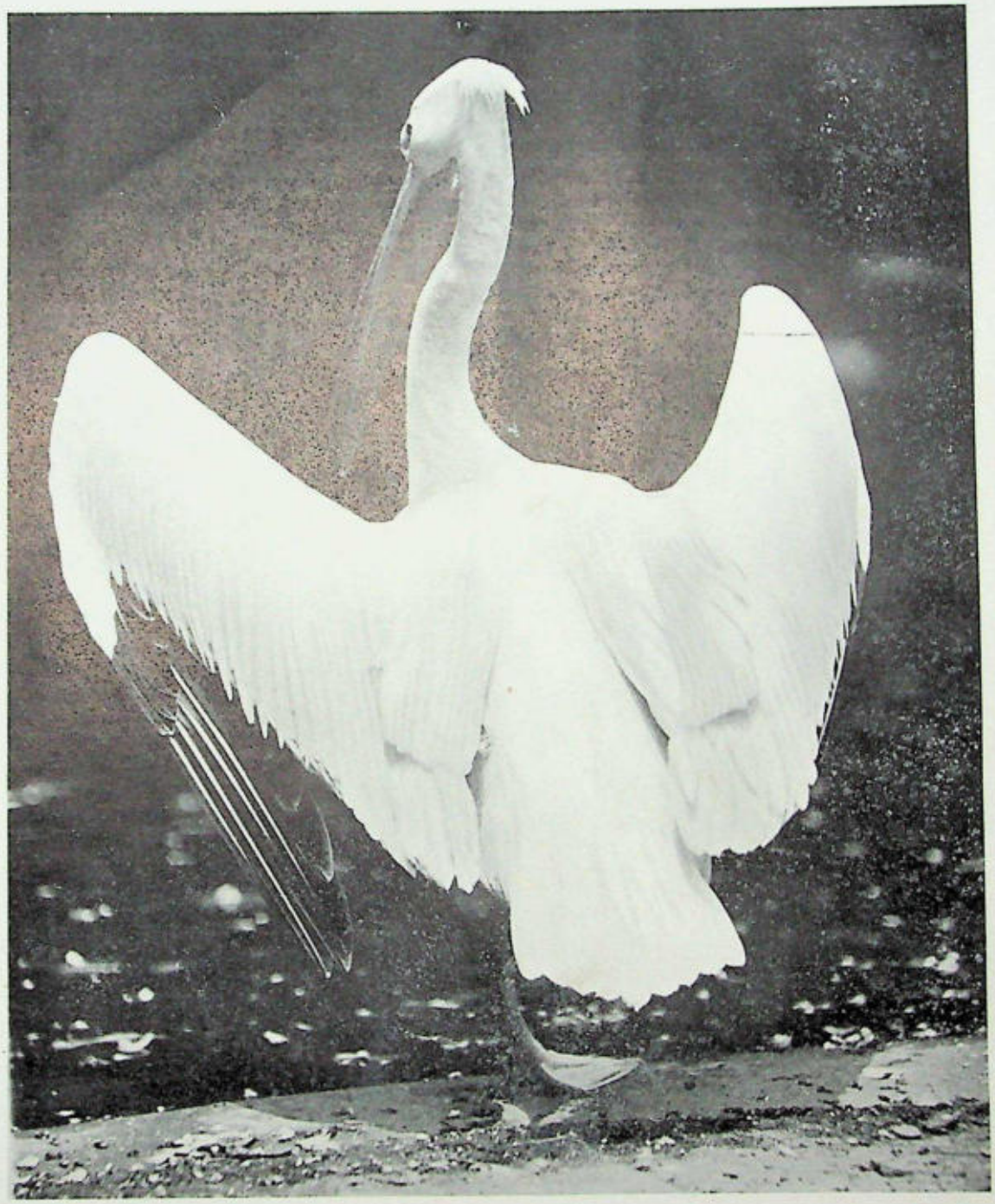
Prof. Adams points out that at present all the protection goes to the game animals and live stock, and that the beasts of prey, which are in their own way very interesting animals, are in danger of being wiped out. He suggests that some isolated spot far from cattle ranges and game preserves be left to them, and to the animals on which they prey—a sample of absolutely primordial wilderness as it was before man arrived on the scene.

Such a thing is not possible, he pointed out, in the national forests, which are organized and run for economic purposes. Neither is it possible in the national parks, which are set aside primarily for the recreation of great numbers of people whose presence necessarily disturbs natural conditions. Such a reservation, he concluded, would have to be in an entirely new category, though it might well be administered by either the forest service or the national park service.—*Sun*, (N. Y.)

Moose Stops Trains.—The Christian Science *Monitor* writes, that railroad trains in southeastern Oregon lately have been delayed by a moose using a trestle there as a footpath. Not content to travel toward greener pastures by the usual trails, this moose has discovered that by walking across the long, high trestle considerable time may be cut off from the trip.

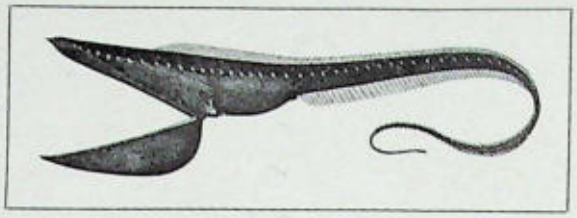
The time saved is only on the part of the moose, however, and train crews are at a loss to know how to keep the trestle clear.

"Lady Moose" is the name of the animal, according to Capt. A. E. Burghduff, State game warden, who had her brought with five others to Oregon from Alaska two years ago. Six moose were captured in the north for transportation to that State. "Lady Moose" frequently goes to the home of John Miller at Knool for food, Mr. Burghduff said.



THE GREAT WHITE PELICAN OF EUROPE

In writing of the white pelican of North America, Dr. Hornaday says "he is a grand bird, big, clean and immaculate," and this analysis can be as aptly applied to this European cousin who differs in having black wing-coverts. Directly after the mid-day meal of fish, the pelicans solemnly assemble on the edge of the pool of the Flying Cage where they spend a leisurely time drying out and digesting the food. The pictured bird was caught just on the take-off of a flight. The spread of wings is enormous. They are graceful fliers, and skillful divers and swimmers.



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ZOOLOGICAL SOCIETY BULLETIN

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SERGEANT MAJOR AND PRETTY HORSE
The latter fish has the longitudinal stripes

ZOOLOGICAL SOCIETY BULLETIN

Published by the New York Zoological Society

VOLUME XXVIII MAY, 1925 NUMBER 3

THE PASSING OF THE ALBATROSS[1]

By C. H. TOWNSEND

AFTER nearly forty years devoted to oceanography and fishery service in Atlantic and Pacific waters, the steamer *Albatross* a twin-screw, brigantine-rigged vessel of 1100 tons displacement, has passed out of the control of the Bureau of Fisheries.

Her career as a deep-sea exploring ship has been a notable one. With her launching in 1883, the field of marine investigations of American naturalists was extended from the shallow waters of coasts to almost the greatest known depths of the sea. During three cruises in the tropical Pacific under the direction of Alexander Agassiz, dredging was carried on in deeper water than ever before, animal life being brought up from a depth of 4173 fathoms or more than four and a half miles. Her deepest sounding was 4813 fathoms (nearly five and a half miles). Agassiz described her as "the best deep-sea dredger in existence," and later wrote, "I can hardly express my satisfaction at having had the opportunity to carry on this deep-sea work on the *Albatross*. While of course I knew in a general way the great facilities the ship afforded, I did not fully realize the capacity of the equipment until I came to make use of it myself. I could not but contrast the luxurious and thoroughly convenient appointments of the laboratory of the *Albatross* for work by day and by night with my previous experience."

Never actually out of commission except for a year or more before her sale, her record of service includes, besides many winters devoted to deep-sea investigations in tropical waters, long summers spent in surveying northern fishing banks, remote Alaskan harbors, and the estuaries of valuable salmon rivers, fur-seal investigations in Bering Sea, surveys of the California-Hawaiian cable route, and gunboat service during two wars.

During her long career, this fine old explorer found her way into the uttermost parts of the sea; at one time tugging at her anchor in a wild Fuegian fiord as fierce williwaws from the high mountains fairly lifted the water; at another, lying off a fur seal rookery at the Komandorskis while officers tried to land on rocky beaches without smashing boats.

Leaving Easter Island, where colossal stone idols have stood on the hills and cliffs since the disappearance of the unknown race that set them up, she might next be found slipping through a break in a coral reef, between far-reaching lines of boisterous surf, seeking shelter in the lagoon of a South Sea atoll.

While dredging was done in deeper waters adjacent to all fishing grounds investigated, there were many voyages for purely oceanographic research. The oceanic regions included in such explorations were the western Atlantic from Newfoundland and southward through the Caribbean Sea to the Strait of Magellan; the eastern Pacific off the coasts of North, Central, and South America; the tropical Pacific through Polynesia to Japan; and the western Pacific from the Japanese Archipelago to China, the Philippines and Borneo.

If ever the American people received the fullest possible value from a government ship they received it from this one. The benefits to science, the fisheries, and commerce springing from her almost continuous investigations—the results of which have all been published and widely distributed throughout the world—are incalculable. The results of her deep-sea work—overshadowed, it is true, by those of the famous "*Challenger* Expedition," which were embodied in fifty quarto volumes—would assume even larger proportions could they have been published in the same uniformly sumptuous style as those of the *Challenger*. The *Challenger* was a pioneer ship in oceanographic work and must remain the leader in the liter-

[1] From *Natural History* for September 1924, by permission of the American Museum Natural History.

A FAVORING GALE
The *Albatross* under sail and steam. In the Bering Sea in 1889.

ature of the science. The *Albatross* entered the field much later, but thanks to her more modern equipment and longer service, her collections were naturally much more extensive and the bulk of her published results was perhaps also greater.

A bibliography of the *Albatross* compiled by the writer in 1901, contained nearly three hundred titles, including documents in preparation; since then, the number has been more than doubled. Many of the publications on the results of dredgings by the *Albatross*, more particularly those issued by the Museum of Comparative Zoology, are large quartos superbly illustrated.

Comparisons are not in order, but it is of interest to record that once from a depth of 1760 fathoms (two miles) the *Albatross* brought up more specimens of deep-sea fishes at a single haul of the dredge than the *Challenger* collected during her entire period of service. The writer and his assistants counted them at the time and, having the *Challenger* reports on board, looked up the record. There are in the National Museum and in the widely scattered laboratories of specialists many *Albatross* deep-sea collections awaiting examination. While serving as resident naturalist of the ship, the writer sorted, packed, and shipped to the Bureau of Fisheries and to research workers in museums and universities at home and abroad, actually carloads of *Spolia albatrossia*.

Naturalists connected at various times with the scientific staff of the *Albatross* were Agassiz, Mayor, Kofoid, Bean, Jordan, Gilbert, Evermann, Bigelow, Sumner, and more than a score of others. The writer, after several agreeable years on board, reluctantly left the ship when assigned to duty at headquarters. Among the score of naval officers detailed to the "Albatross" during her earlier years of service were many now on the list of rear admirals, including Benson, Rodman, Eberle, Wilson, Hughes, Burrage, Anderson and Johnston. Captain Tanner, her notably efficient and devoted first commander, contributed more than any one else toward the perfecting of the vessel's equipment.

Occasionally a beam trawl-net was torn away by the weight of its load, but I do not recall a single break in the five-mile-long wire cable.

IN TROPIC SEAS
The *Albatross* at the Tonga Islands, 1900.

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DREDGING AT SEA

The dredging boom may be seen out to starboard, and the port boom is rigged for surface towing. The *Albatross* after nearly four decades in the service of the government, in the course of which she participated in a number of important scientific expeditions, recently passed into private ownership.

Tanner was a master at this sort of work but succeeding naval commanders learned to do it as well. It was reserved for Captain Moser to make the deepest successful haul—more than four and one-half miles—and all accomplished in ten hours. Think of reaching that far down through the darkness of the ocean for a load! Imagine an air-ship similarly equipped and miles above the earth letting down a cable in the night-time for a haul from the surface of the earth!

This ship went through forty years of service with little more of damage than ordinary wear and tear.

Still staunch and seaworthy, she went to the highest bidder on the day of sale, for a sum so small that unemotional Uncle Sam virtually threw her away.

It is to be regretted that funds could not have been found for the continuance of her deep-sea investigations, for which no vessel was better fitted. The Commissioner of Fisheries told me that any qualified group of American scientific men could have had her for the asking. Her buyer says she will not be broken up.

When the late Sir John Murray, formerly of the *Challenger*, visited the ship at San Francisco, he paused at the top of the gangway, where the officers awaited him, lifted his hat, and said, "Gentlemen, I salute The *Albatross*."

An interesting coincidence in connection with the passing of the *Albatross* was the sale of the *Hirondelle*, the splendid steamer built by the late Prince of Monaco for oceanic research. In accordance with the terms of his will, the proceeds from the sale of the vessel were applied to the endowment fund of the Oceanographic Museum at Monaco, which he founded.

SPELLING THE PLURAL OF FISH

By Ida M. Mellen

THERE are few people, even among those who spend their lives studying fishes, who always spell correctly the plural of fish.

The rule is that in referring to fish for the table, one should say fish, but in referring to specimens used for scientific study or as living exhibits, *fishes* is correct. Yet we may hear an expert stoutly aver that one should never speak of living specimens as fish, but only as fishes, and almost immediately thereafter refer to "forty goldfish," confident that this is the right usage.

AT THE GALAPAGOS ISLANDS
The *Albatross* anchored off Charles Island, 1891.

How, then, can a layman be expected to spell correctly the plural of fish?

We may refer to a dozen smelts, or a slice of cod, as fish for the table (even though we say "a smelt" and "two smelts"). Yet, while we, as anglers, bring home a string of fish—as collectors, we return with fishes! We cook a pan of fish, and we display a tank of fishes.

These differentiations are quite clear and simple. But there are complications. We have the problem mentioned, of what word to use as the plural in referring to a live fish, a part of whose name is fish—as goldfish, blackfish, weakfish, etc. Ought we to say "one weakfish" and "two weakfishes?" The dictionaries avoid plurals, and as no ichthyologist except Dr. Carl H. Eigenmann of the University of Indiana appears to have committed himself, even slightly, upon the subject, we wrote him.

Mrs. Eigenmann (also an ichthyologist of note) very kindly replied that in her opinion the singular and plural of bass and cod and mackerel are the same, unless we refer to several species, when we should say "the basses," "the cods," "the mackerels;" that in speaking of a fish like the tench, of which there is only one species, we should use the word tench for both singular and plural; whereas the plural of roach becomes roaches. The layman in this case is at a disadvantage, not being likely always to know the number of species.

Mrs. Eigenmann thinks that when a fish's name ends with fish, the plural should be fishes, as goldfishes, weakfishes, grayfishes. But when it comes to such a fish as the pudding wife, she confesses that she does not know how to spell the plural. Parenthetically we may add, however, that the plural of alewife is often written "alewives."

FISHES AND FISHERIES OF NEW YORK STATE[1]

By IDA M. MELLEN

THE fishes of New York state, like those of all states bordering upon the sea are of both salt and fresh water kinds. Some, such as the sharks and skates, remain continuously in salt water, and some, such as pickerel and black bass, remain continuously in fresh water; others, notably the shad and marine sturgeon, leave the sea and enter the rivers to breed, and one fish, the eel, leaves the lakes and rivers and goes far out to sea to lay its eggs, never to return.

The smallest fish on our New York coast is

[1] Prepared for the Chairman of Self Government, Inc. for Citizenship Training, who requested a "short summary about the fishes and fisheries of New York state, for young people," being unable to make anything out of the standard works on fishes.

the sheepshead minnow a handsome little creature in blue and orange and the largest is the shark which has never been deemed worthy of a beauty prize.

The smallest fishes of our fresh waters are minnows and killifishes and the largest are the Great Lakes sturgeon and muskallunge or giant pike. The prettiest fish of our fresh waters is by general consent, the brook trout, although the sunfishes, with scales that glitter as though set with living gems, are close rivals.

The fresh water fishes of New York state number 141 species.

In 1918 the fresh and salt water fishes occurring within fifty miles of New York City, numbered 247 species, of which about fifty are popular as food. Among these we find the familiar bluefish, cod and butterfish, the mackerel, flounder and sole, also the porgy, eel, weakfish, and many others. As a matter of fact, nearly all fishes are edible, but many have not yet become fashionable for the human table. In New York City the fishes used for food are chiefly marine species, whereas Chicago markets handle ninety per cent. more fresh water fishes than ours do.

Statistics for 1921 (the latest available) show that in that year 7,145 persons were engaged in commercial fisheries in New York state, with an investment of $13,836,455. The products for the year amounted to 210,377,152 pounds, valued at $4,986,918. Commercial fisheries, however, include not only fishes, but lobsters, crabs, clams, oysters, mussels, and all other aquatic animals taken for the fish trade. The annual catch of fishes in Lake Erie is said to be 5,000,000 pounds.

THE PALOLO, OR EDIBLE SEA WORM

By Ida M. Mellen

ITEM appearing in various newspapers and trade journals during January, 1925:

> "The mysterious 'palolo' a tiny fish found off the coast of New Zealand, can only be caught at dawn on one particular day in the year, when they rise to the surface of the sea for two hours."

The facts about the palolo: The palolo is not a fish, but a sea worm or marine annelid; an aquatic cousin to the earthworm and also a near relation of the clam worm. Like these familiar worms, its body is divided into segments or rings; but unlike them, it is not to be had any day for the digging.

There are three species of palolo worm—Atlantic, Pacific, and Japanese—and they live in rock crevices and interstices of the coral reefs at a depth of two fathoms. Instead of laying eggs like earthworms and clam worms, they are so organized that the hinder end of the body, containing the sex products, breaks off and swims away from the head end, which goes on producing more sex segments. In one species, the hind end develops a new head. An animal having no bones can thus break itself to far better advantage than can we, who have no power of regeneration.

The Pacific palolos are regarded as such great delicacies by Samoans and Fijians that coastal chiefs send them as presents to chiefs of inland tribes. The worms are eaten alive, or baked in a covering of leaves.

The palolo spawns in October and November, always upon two certain days: the day when the moon is in the last quarter and the day preceding. Then the natives are in readiness early, and capture the worms in great numbers.

The palolo is not the only worm used for food. Another kind of sea worm, with similar habits, is eaten in the New Hebrides.

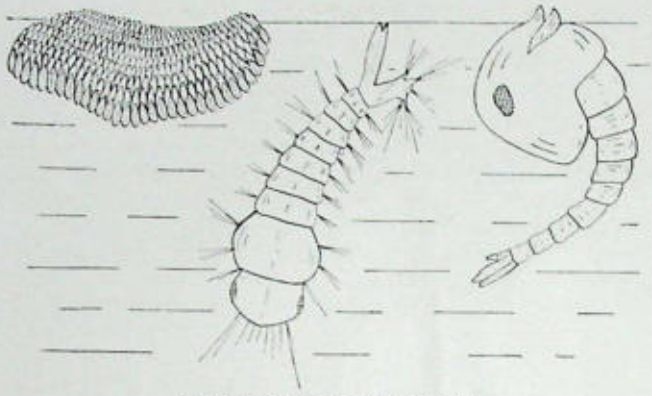
MOSQUITOES[1]

By Ida M. Mellen

MOSQUITOES are found everywhere on earth except at the poles and in the deserts; and it is estimated that not less than 700 species ply between the equator and the far north. They breed in either fresh or brackish water, and their life history, which is not unlike that of other aquatic insects, has been made rather familiar of recent years by reason of various public campaigns against the pest, following the discovery that certain species transmit malaria, elephantiasis, yellow fever, and other dangerous diseases.

In the United States, we have about 300 species of mosquitoes, some of those best known in the northern states including the malarial mosquito (*Anopheles*) and the common mosquitoes (*Culex pipiens* and *C. pungens*). The

[1] The Aquarium is exhibiting a jar containing over 3,000 mosquitoes which Mr. H. B. Maurer, Executive Secretary of the Anti-Mosquito Association of Long Island, discovered hibernating in a Brooklyn cellar. They are females, each containing several hundred eggs, which, had these mosquitoes found their way to a Prospect Park Lake or some other body of water, would have hatched enough of these annoying and dangerous insects to inoculate the whole of Brooklyn. If on Long Island there are only 1,000 cellars in each of which 3,000 mosquitoes have taken up winter quarters, each mosquito carrying but 300 eggs, it would mean the hatching and liberation in the spring of 900,000,000 mosquitoes; and there are doubtless many more cellars and many more eggs, were the facts known.



THE COMMON MOSQUITO

Eggs, larva and pupa of the mosquito. The larva's breathing tube is in the tail; the pupa has two breathing tubes in the head. Drawing by Ida M. Mellen.

common mosquitoes lay from 200 to 400 grayish-brown eggs at a time, each about one-sixteenth of an inch in length, placed on end and agglutinated so as to form a small raft that floats on the surface, thus providing air for the developing young, which generally emerge in less than two days. The malarial mosquito lays from forty to one hundred black eggs, which are not agglutinated but float separately on their sides and hatch in about four days.

Eleven to eighteen days may be required for the complete development of the mosquito from egg to imago, but in hot weather the life cycle is completed more quickly, and several generations may hatch in the course of a year. On the other hand, the larvae may live for months before becoming pupae, and have been found hibernating over the winter in ice-filled leaves of the pitcher plant when the temperature was below zero, embedded in different parts of the ice.

When not hibernating, the larvae wriggle often to the surface for air, though they can remain under water for ten or fifteen minutes, according to species. Like many other aquatic insects, their breathing organs are situated in the tail; yet they feed under water, living principally on microscopic organisms and plant substances. The larva of the common mosquito while breathing at the surface, hangs head down, while the malarial species takes a horizontal position. After moulting three or four times, they turn into pupae, requiring only about seven days for this transition if the water is warm. The insect is still active in its pupal stage, and like the larva, frequents the surface; but its respiratory organs are now reversed and placed at the head end, and it floats with the back of the thorax nearest the air. It partakes of no food in this state, intermediate between babyhood and maturity, as though biding its time for the feasts to come. The thorax after two or three days splits, and the imago stage is reached, the winged insect drawing itself out of the pupal skin—not always an easy task—and taking to flight.

Near a pond early in spring or summer, it is sometimes possible to see thousands of infant mosquitoes just out of the water, flying off in clouds; but only a small percentage of the billions that are hatched ever draw human blood.

In certain European mosquitoes the males are equipped with biting organs, but among American species only the female bites. The male is believed to be exclusively vegetarian, and will sip beer, wine and molasses, so that it has been jocosely observed that if the female is the more deadly, the male is the natural alcoholic!

The normal food of the female mosquito is fruit, watermelons, juicy plants and such vegetable substances, and she drinks water when she cannot get blood. Students of pathogenic mosquitoes have kept adult specimens alive for weeks in glass cages, by feeding with banana, boiled potatoes, and water.

Human beings are not the only prey of the mosquitoes, which have been observed to feed on chrysalis of butterfly, tiny fry of fishes, cicadas and their pupae, and also to attack turtles and birds.

Male mosquitoes are distinguished by their feathery antennae. The malarial mosquito can be distinguished by the spots on its wings, which the common mosquitoes lack; the malarial mosquito has visible palps and mouth parts resembling three stings, while the palps of the common varieties are barely visible to the naked eye. The common mosquitoes rest in a position parallel with the surface selected, while the malarial mosquito rests with the body diagonally opposed to the surface.

Adult male mosquitoes do not survive the winter, but the females, like the larvae, hibernate in ice and also in cellars, garrets, barns, and other sheltered places. Winter exterminations of these adult females is important, for with each hibernating mosquito destroyed there are destroyed several hundred eggs destined otherwise to hatch in the spring. If cellars and similar favorable hibernating places are examined for mosquitoes during the winter, with a view to killing any that may be found, summer comfort may ensue. Methods suggested by experts for killing the mosquitoes are disinfecting, vacuum cleaning, swatting, and

A BOTTLE OF MOSQUITOES
A collection of 3,000 mosquitoes gathered in a cellar.

whitewashing over them. Like many other insects, they are clever, and even when torpid attempt to escape fumigation by descending to the floor where the fumes cannot reach them.

It is, of course, of great importance also to destroy the eggs and young of the mosquitoes, when we consider that in a broken bottle filled with rain water, enough mosquitoes will breed within a fortnight to stock every house and garden for miles around. They breed also in the rain-filled hollows of trees and stumps, tomato cans, kettles, pans and rain barrels, wells, mud puddles, ponds, lakes and marshes; in fact, in any place where water is standing.

Kerosene and crude petroleum are effective in the destruction of eggs, larvae and pupae if the water is fully filmed, and even of adult females which alight upon it to lay their eggs. Little fishes are most effective of all mosquito destroyers, the common sunfish being an active enemy of the mosquito, as are also killifishes, sticklebacks and minnows.

Dragon flies in all stages feed upon mosquitoes. Aquatic bugs and beetles and some salamanders join with the fishes in exterminating larvae and pupae, and the adult mosquito is preyed upon by bats and night-birds such as the night-hawk and whippoorwill.

In the southern states the top minnow *Gambusia* has been found so effective in mosquito destruction that it is called the mosquito fish, and the United States Government has shipped this species to the Philippine and Hawaiian islands, to Spain, Palestine and other places, for use in mosquito control.

THE LAST OF THE WHITEFISHES

THE last of our famous whitefishes died on January 31, 1925, at the age of twelve years. It was one of several hundred hatched in the Aquarium in January, 1913. This closes the record of a remarkable achievement in fish culture.

The oldest wild whitefishes of which we have any knowledge were "recorded provisionally as sixteen or seventeen years, but possibly eighteen or nineteen."

The fry of the Aquarium-hatched specimens were fed first with herring roe; next with a few mosquito larvae; third, with the fry of pike perch; thereafter with minced beef-heart, and finally (since 1919) with beef-heart in summer and beef-heart and minced clam in winter.

Mr. John Van Oosten of the University of Michigan made monthly studies of scales from these fishes over the period of one year, establishing beyond question the complete reliability of the method of determining a fish's age by counting the growth-rings upon its scales.

—*I. M. M.*

Work of the Seahorse.—The Aquarium well-boat *Seahorse* will begin her summer collecting work this season about the first of May. The field of operation will include the Sandy Hook region and the Great South Bay near Fire Island Inlet.

Fishes are obtained with seines along the beaches and also from the large pound-nets operated by commercial fishermen. Invertebrates are often collected with the dredge.

Members' and Ladies' Day.—Members of the Society are reminded of the Annual Garden Party, May 21, 1925.

New York Zoological Society

OBJECTS OF THE SOCIETY

¶ A PUBLIC ZOOLOGICAL PARK. ¶ A PUBLIC AQUARIUM. ¶ THE PRESERVATION OF OUR NATIVE ANIMALS. ¶ THE PROMOTION OF ZOOLOGY.

ZOOLOGICAL SOCIETY BULLETIN

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Elwin R. Sanborn, *Editor*

Vol. XXVIII May, 1925 No. 3

WORK AT THE AQUARIUM RESUMED

The work of enlarging and altering certain parts of the Aquarium building which was brought to a standstill last August for lack of funds has been resumed, the City having provided the long-expected balance for that purpose.

The third story erected at the front of the building had been completed as to walls and roof but together with the dismantled second story, lacked all interior finish and remained unoccupied.

The work still to be done includes the completion of these two floors for service and the "rusticating" of the exterior walls from the ground to the roof. The exterior finish will be in gray instead of the discolored and peeled brown stone finish put on years ago, the rustication process giving it the effect of stone work.

Following the completion of these improvements, the next step will be the construction of additional glass-fronted tanks at the rear of the building, which will permit of a great increase in exhibits. The administrative office of the Aquarium, which has for many months been located in a building across the park, will be installed once more in its proper location, and the staff of the Aquarium relieved of the serious inconveniences connected with the occupation of an outside office.

During the fall and winter the employes of the Aquarium cheerfully undertook the labor of re-painting the walls, ceiling and columns of the main exhibition hall, no fund for contract painting being available. Although only a single coat of paint was applied a great improvement in appearance has been effected. It is twenty years since the interior of this great hall has been brightened by painting. This is no small accomplishment for an undermanned institution like the Aquarium which has a working force of four men less than it had a dozen years ago. —*C. H. T.*

CONSERVATION MATTERS

By C. H. Townsend

The New York Zoological Society, at its thirty-first annual meeting on January 13, 1925, adopted resolutions relative to the preservation of elephant seals in Guadalupe Island, Lower California, and sea lions inhabiting the coasts of British Columbia and the United States.

These resolutions, together with certain publications of the Zoological Society on the commercial value of elephant seals and sea lions, were sent to fishery and other officials in the regions concerned. The U. S. Biological Survey offered support in the case of the elephant seals, proposing to confer with the Customs Service as to the possibility of preventing the clearance of American vessels intending to kill elephant seals. The preservation of the elephant seal in the waters of Lower California is chiefly dependent upon the protection afforded by the Mexican Government. A cordial letter received from the biologist attached to the Mexican agricultural service in Lower California indicates a decided interest in the matter. This official has visited the elephant seal herd at Guadalupe Island for three years in succession and proposes to do so again.

Letters of approval were received from points in California. A letter of protest from the California Academy of Sciences to a state senator against the proposed killing of elephant seals and sea lions was given publicity in the

newspapers. The resolutions adopted by the Zoological Society were also sent to the state senator, whose unfavorable attitude has been prompted by commercial fishermen.

One west coast journal published in full the lengthy report of the Zoological Society on the value of the sea lion and registered an editorial protest against the killing of either sea lions or elephant seals.

Another resolution adopted at the annual meeting of the Society related to the giant land tortoises of the Galapagos Islands. These remarkable and valuable animals are threatened with early extinction through the destruction of their eggs and young by wild dogs and pigs. There being no hope of their preservation on their native islands, the Executive Committee of the Society will take such tortoises as can be secured and transport them to a suitable place, preferably within the jurisdiction of the United States, where suitable climatic conditions would favor their increase and perpetuation.

While the Zoological Society has long been an acknowledged influence in conservation, its efforts in that direction admit of no respite. The tendency to destroy wild creatures always exists.

The commercial fishery interests are frequent offenders, often seeking to camouflage their exhaustive or wasteful operations by agitation against sea lions or pelicans or anything they may declare to be "terrifically destructive to food fishes." Misguided anglers destroy many kingfishers, herons and other beautiful things, using the same weak excuse. It is slow work teaching the irresponsible biped with a gun to let all wild life alone except the game which he may take in season.

THE FEEDING HABIT OF THE MORAY

By WALTER H. CHUTE

Director of the Boston Aquarium

Upon the introduction of a number of snappers (young bluefish) into a tank containing a spotted moray about three feet long, one of the snappers was immediately seized by the moray, before it reached the bottom of the tank.

Gripping its prey by the head, the moray proceeded to tie its own tail into a knot.[1] This knot quickly moved forward along the moray's slippery body, passing over its head and onto the body of the snapper. Depressing the spines of the victim in passing, the knot seemed to tighten over the posterior end of the fish and the whole body of the moray was convulsed, apparently in trying to force the struggling snapper into its mouth. Once the hold slipped off the victim's tail, and the same procedure was repeated, the knot starting at the tail and advancing until it resumed its hold on the snapper again. The whole procedure was effected with a smooth, gliding motion, deliberate but continuous.

It was particularly interesting because of the fact that in captivity morays have generally been found to be reluctant feeders, requiring to be coaxed with a piece of raw fish on the end of a stick, or even to have the food forced into their open mouths, much after the fashion in which snakes are fed at the Zoos.

[1] In the *Bulletin* for November 1916, Major Chapman Grant described a similar knotting of the body of a moray, for the purpose of disgorging when taken captive after a heavy dinner—a time when fishes, like other animals, are almost helpless against their enemies. In this instance, the fish, after tying its body in a tight thumb knot, held the hind end rigid and backed the fore part through the loop, thus forcing out five grunts and a Bermuda chub, and leaving itself free to wriggle off the dock.

The Prevalence and Perpetuation of Natural History Errors.—"Nothing is more gratifying than to make a mistake and then see it copied without credit by all the other newspapers in the same county."—Boonville *Republican*.

We might add that, judging by the continual repetition of misstatements of fact in natural history books, errors in zoology are generally passed along in the same way! One popular encyclopedia describes the salmon as burying its eggs under four feet of gravel (instead of laying them in four feet of water) and another recently issued repeats the ancient fallacy about the pilot fish leading the shark to its prey and "signalling the time and direction for the shark to dart at its victim." Almost any day one may see at the New York Aquarium gray sand sharks with pilot fishes swimming safely at the tail end of the host, just as they do in the sea when accompanying any species of shark—forming a retinue and not an advance agent or general director.

The newspapers also make egregious errors which could easily be avoided by a telephone call to the Aquarium, Zoological Park, or Museum of Natural History, if they really desired accuracy. An instance of this occurred lately in a widely circulated statement that an immense game sanctuary in France's antarctic possessions would protect the polar bear and walrus, as well as sea lions and penguins. The polar bear and walrus are strictly arctic, and these four forms are nowhere found together.

People do not seem to own dictionaries, yet the money lost yearly in wagers that a whale is a fish would purchase for the losers a handsome library of reference books.—*I. M. M.*

"JABOTY"—SOUTH AMERICAN TORTOISE (*TESTUDO TABULATA*)

Found in parts of South America and the Isthmus of Panama. This specimen from the Isthmus and now in the Zoological Park, attains a length of two feet and is closely related to the tortoises of the Galapagos.

A RELATIVE OF THE GALAPAGOS TORTOISE

By C. M. Breder, Jr.

ACCORDING to Garman[1] the origin of the giant tortoises of the Galapagos Islands (*Testudo elephantopus*, et cetera) is directly connected with the "jaboty" of South America (*Testudo tabulata*). If this view is correct we have here one of those few cases in which a species has undergone evolutionary change of a considerable degree in part, while the remainder continued surviving in perhaps unchanged form for even to-day this near relative of these nearly extinct giant tortoises, ranges in considerable numbers over parts of South America and the Isthmus of Panama.

My acquaintance with it was made while exploring the virgin territory of Darien, the eastern-most province of Panama with the Marsh-Darien Expedition. Most of our time was spent on the Pacific slope of that province and there not a single specimen was seen. In fact no tortoises at all were found, the only chelonian life being a few river turtles, whose eggs we were reduced to eating on one occasion when our larder was depleted. However, as soon as we crossed over the divide and entered the Atlantic drainage they at once became noticeable and in places exceedingly abundant.

We stayed for some time at the small Indian village of Caledonia, on the coast about thirty miles from the Colombian border. Here, where most of them were seen, they wandered with equal indifference through the village "streets," the sometimes open-sided huts and in the wooded land nearby. The villagers who seem to be very fond of pets, as primitive peoples go, often had them tethered up with all sorts of other native animals such as spider monkeys, honey-bears, parrots, parrakeets, macaws and so forth. These people speak the Cuna language and I find recorded in my note book the word yala-moro[2] as their name for this tortoise. They distinguish it from the hawksbill turtle (*Eretmochelys imbricata*) the only other common species here, by calling the latter yar-oka.[2] This latter species is of considerable importance to them as its valuable shell is traded to the occasional trading sloop

[1] Samuel Garman "The Galapagos Tortoises." Mem. Mus. Comp. Zool., Vol. XXX, No. 4.

[2] The spelling is purely phonetic, the a's are as in 'hat' and the o's as in 'more,' and the syllables are given about equal weight.

that makes Caledonia Bay a port of call. The valuable plates are removed in barbaric fashion, fire brands being brought to bear on the shell of the living animal until they begin to peal off. When they have reached this stage they are easily stripped off.

The yala-moro however seems to be of more importance to the boys that always teem in such villages. They can often be found with them although probably my presence stimulated an interest as there was the hope of a possible trinket or "real" in sight as a reward. However I would often find them tethered to some house support by means of a tough vine fastened through a small hole in the posterior margin of the carapace, in a manner practically identical with the system in vogue with our own boys in keeping the box tortoise (*Terrapene carolina*) of our eastern states as pets. In fact the attachment these naked little brown boys showed for their tortoises together with the general appearance and coloration of the latter, could not but remind me of home, where I knew the sons of my own race were likewise worrying tortoises of a superficially similar appearance in a similar way. These tortoises however averaged somewhat larger than our box tortoise, the largest shell seen exceeding fourteen inches in length although most were considerably smaller.

The islands off this coast also form a part of the habitat of these tortoises, but they are especially abundant only where there is a village, the boys probably carrying them from place to place, although food is probably more accessible in the villages for these largely vegetarian animals and may cause them to gravitate to such places. When contemplating the islands not occupied by man and inhabited by little but birds, land crabs and a few tortoises it was easy to let the fancy conjure up a picture of the possible conditions on the Galapagos when a few half starved stragglers found a haven there, grew to immense porportions in size and numbers and finally were practically extinguished by the hand of man.

PANAMA HERMIT CRABS

By C. M. Breder, Jr.

THE Pacific coast of Panama is known for its great tides and the foul and muddy flats that the tides lay entirely bare because of the gentle slope. Here a miscellaneous assortment of vultures and gulls descend to pick over the general debris in search of stranded marine worms, small fishes, molluscs and various other organisms that the retreating waters leave in their wake. Amid these avian scavengers those of a lesser sort work with equal avidity; crabs of curious pattern and cut, some adapted to an alternate

LOW TIDE NEAR PANAMA CITY

A Pacific flat with gulls and vultures searching for stranded marine organisms. Photograph by C. M. Breder, Jr.

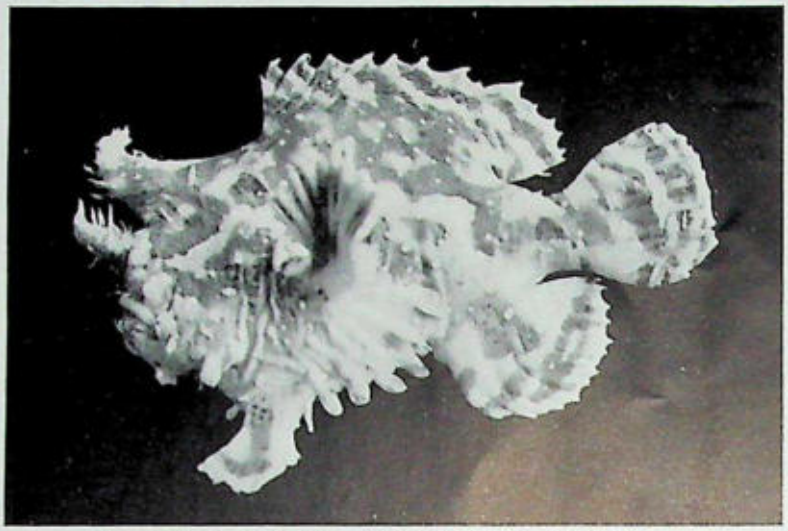
HERMIT CRABS (*CENOBITA*)

A collection of hermit crabs in the New York Aquarium, from the Pacific coast of Panama. The large light-colored shells are those of the local sand-collar snail which the hermits appropriated. Photograph by C. M. Breder, Jr.

soaking and parching, whilst others make hasty excursions from the more solid ground. Still other species seldom or never make lengthy trips below the reach of high tide. Among these is the rather large hermit crab (*Cenobita*) of this coast, which lives just above the reach of high tide and is terrestrial to all intents and purposes. The individuals of this species secrete themselves so securely that it is next to impossible to find any considerable number of them by daylight, but let the searcher prowl the beaches at night when each succeeding breaker streaks the beach with an unearthly glow, resulting from the myriad phosphorescent organisms of Panama Bay stimulated to illumination by the rough tumbling they receive, as the long Pacific ground swells trip up on the gradual shore line, for then these gregarious "hermits" may be found in abundance; so numerous indeed that it is frequently almost impossible to walk without treading on them. Every piece of flesh or vegetation cast up is covered with them as they struggle with the active bacteria of the tropics to feed before decay has reduced the material to a mere black stain in the shifting sands.

Their first reaction on approach is to withdraw within their shells but they do not remain quiescent for long, as do most animals that seek protection in stillness, for their restless nature urges them to seek safety in flight almost as soon as they have stopped. This hesitancy makes their capture easy, so it was with no bother at all that I succeeded in gathering a bag full for the Aquarium, one evening shortly before sailing homeward after crossing the Isthmus through fascinating jungle lands with the Marsh-Darien Expedition.

The hardihood of these crabs in captivity was a surprise and it was not until our severe winter set in that we had any trouble with them, but then, like most tropical animals they began to diminish and shortly their numbers were sadly reduced. However, prior to this time their growth was rapid and soon they chafed at their shells. They immediately appropriated larger sand-collar shells (*Lunatica*) from our north Atlantic coast which were then supplied, and seemed perfectly satisfied with their foreign substitutes. One individual in particular was especially interesting as he rolled and piled up three such shells together



THE SARGASSUM FISH (*PTEROPHRYNE HISTRIO*)

This little fish makes the floating beds of weed its whole world. Its color matches that of the weed; it feeds on many forms of crustacea that live in the weed, principally shrimp, and there it builds its nest, fastening the eggs to the fronds by silk-like threads. From a specimen taken by the U. S. S. *Albatross*.

with much effort and systematically went about probing each one with his soft hinder end until the most desirable had been slected. Despite their appearance they are adept and capable at climbing, and not infrequently did we find one on a trip of investigation amid the visitors. Their adopted shells seem to be ample protection from mechanical shock for I have seen them drop ten or more feet both in Panama and at home onto solid rock without apparent injury. In fact it seems to be their most rapid means of descent, apparently being used with intention, at times.

WEED MASSES IN THE SARGASSO SEA

By L. L. Mowbray and C. H. Townsend

THE British steamer *Clan MacFadyen* which arrived at Baltimore on March 11, 1925, reported encountering masses of weeds in the Sargasso Sea that impeded the progress of the vessel.

The Captain stated that the field of *Sargassum* passed through on the run from the Azores to the Antilles, extended beyond the usual area and was of greater density than he had previously observed it.

As there appears to be little definite information available respecting the impenetrability of weed masses in the Sargasso Sea, the following record by Mr. Mowbray of the Aquarium staff is of decided interest; "I have seen many thick and matted patches of *Sargassum* off the south coast of the Bermuda Islands, covering areas of several acres. On one occasion, in the pilot boat *St. George*, it took us one hour and a half to sail along the windward side of a patch of weed, the vessel going at the rate of five miles an hour. We estimated this mass to be seven and one-half miles long by a half mile in width, and found it to be many feet in thickness. While sailing along we noticed on top of the weed and near its edge, a small hawksbill turtle and put out in the dinghy to try to capture it. On reaching the edge of the patch we had to force the boat up on the weed. The sea rolling in on the windward side made it quite easy to progress until the action of the waves was no longer felt, when it became more difficult. The turtle traveling faster on top of the weed than the boat through it, we abandoned the pursuit. Getting back was still harder and after working a considerable time and making very little headway the pilot in the larger boat decided to come by and throw us a line which pulled us free from the mass.

These masses of weed contain large quantities of animal life, crustaceans, mollusks and fishes being among the most abundant forms. There is always considerable flotsam covered with barnacles.

The animal life, with the exception of the barnacle, has the protective coloration of the weed. The most abundant crustacea are *Neptunus sayi*, *Planes minutus* and several species of the gulfweed shrimp of the genus *Palaemon*. Among the fishes the Sargassum fish (*Pterophryne histrio*) is very numerous. This interesting angler builds its nest in the floating weeds. Large clusters of eggs frequently found attached to the fronds of the weed which are drawn together and fastened with silk-like fibres. These clusters are often a foot in diameter.

The pelagic pipe-fish (*Siphostoma pelagicus*) is quite abundant. A species of naked mollusk (*Scyllaca pelagica*) is also found in considerable numbers. Numerous larval stages of shore fishes, such as *Balistes*, *Holocentrus*, and *Neomaenis* are found. These forms are no doubt simply taking shelter in the weed while over

SARGASSUM WEED CAST ON THE BEACH
Cooper's Island, Bermuda, December 28, 1924. Photograph by L. L. Mowbray.

oceanic depths, and in this way are transported to many localities far from their native shore habitat. Many pelagic forms such as dolphin, young jacks and pilot fishes are found swimming leisurely behind large masses of weed. There are many pieces of paraffin wax among the weed that bear the marks of sharks' teeth.

Many of the Bermuda fishes have unquestionably been carried to these oceanic areas in larval stages in the floating weed. I am informed by the old farmers of the Bermudas, who some twenty years ago depended altogether on the gulfweed as a fertilizer for their farms, that the weed has not been as abundant in the last decade as in former years. Patent fertilizers are now used instead. Boys often piled weed on the beach, selling it to farmers at sixpence a cart load. Great quantities are sometimes driven by the wind into the bays and harbors of the Bermudas, becoming at times so dense as to impede the movement of small boats."

The U. S. S. *Albatross* once passed through a great area of scattered *Sargassum* between Bermuda and the Bahamas. While the vessel was sounding and dredging, Mr. Townsend gathered quantities of it which were examined in the ship's laboratory, but it contained no forms of animal life other than those long known to inhabit it. The species mentioned above by Mr. Mowbray were taken in abundance.

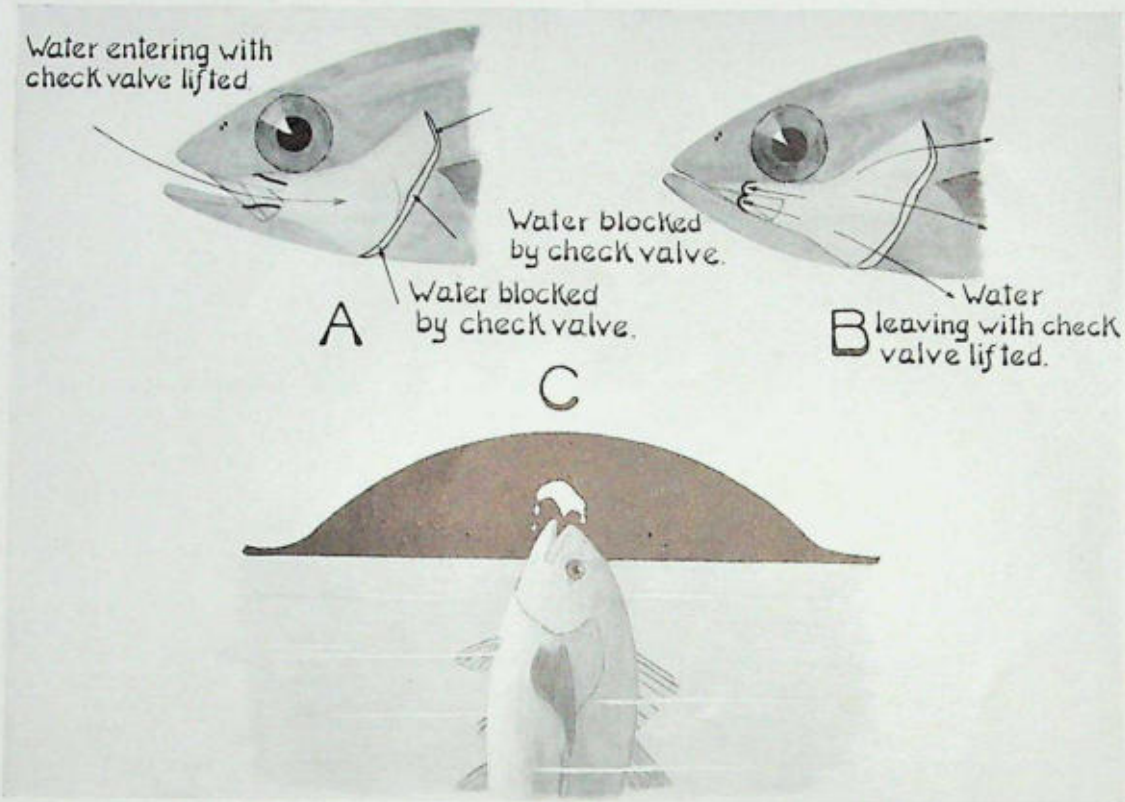
Goldfish Farms.—The United States boasts not less than a dozen goldfish farms situated in nine states. A conservative estimate of the output of these farms is 17,000,000 goldfishes per annum. An equally conservative estimate of those hatched only to be martyred, is $99\frac{6}{17}$ per cent.—*I. M. M.*

Mr. L. L. Mowbray of the Aquarium staff accompanied Mr. H. P. Bingham in the yacht *Pawnee* on a cruise in southern waters during a part of the past winter for the purpose of securing certain exhibits for the Aquarium.

The *Pawnee* visited the Bahamas and the waters north and south of Cuba. Natural history collections were made at all points visited.

Fishes were obtained in abundance along the coral reefs and also by dredging in deep water.

BARNACLES ATTACHED TO A BOTTLE
Cast ashore with Sargassum at the Bermudas.



FISH IN NORMAL RESPIRATION AND IN EXPERIMENTAL ACTION

A phantom diagram showing, A—inspiration, mouth opening, showing opening of the jaw valves allowing water to enter through the mouth and closing of the opercular valves blocking entrance of water; B—expiration, mouth closing, showing opening of opercular valves allowing water to escape under gill covers and closing of jaw valves, blocking exit of water; C—fish in experimental position immediately after mouth full of water has been expelled. Drawing by C. M. Breder, Jr.

FISHES SQUIRTING WATER

By C. M. Breder, Jr.

THE well known archer fish (*Toxotes jaculator*) of the East Indies with its reputed ability of dislodging insects from leaves overhanging the water by squirting at them is not alone in the ability to eject water from its mouth,[1] although it is probably the only one which uses it with deliberate effect on terrestrial objects, the others appearing to concern themselves with matters entirely below the surface. The triggerfishes (Balistidae) are especially adept at this and frequently dislodge small organisms from crevices in rock by literally "blowing" them out. Mr. L. L. Mowbray informs me that he has seen triggerfishes (*Balistes carolinensis* and *B. vetula*) actually excavate marine worms buried in the sands of Bermuda shores in this manner, forming a small conical depression in uncovering such a morsel. Other fishes show similar reactions to a lesser degree in the manner in which they eject undesirable objects of food from the mouth. The effect of these jets can be noted by the comparatively great recoil, the fishes backing slightly even though the pectorals be braced against it, and only completely overcoming the reaction by active swimming movements.

Considering these actions, investigation was prompted as to whether these species, which so frequently show a reversal of the direction of the ordinary respiratory currents, are especially endowed or whether it is a common ability among fishes, and whether water could be taken in through the opercular openings as well. To this end fifty-two species were experimented on, with the result that all but three showed the

[1] The Director of the Aquarium called attention to the ability of the cowfish (*Lactophrys triqueter*), the triggerfish (*Balistes carolinensis*) and the spiny boxfish (*Chilomycterus schoepfii*) in this direction, noting that they often come to the surface of Aquarium tanks and so perform but without evident purpose. C. H. Townsend "Water-throwing Habit of Fishes In The New York Aquarium," Bull. N. Y. Zool. Soc. No. 33. April 1909. p. 488.

ability to a greater or less extent. The method of experimentation was simplicity itself. A specimen was simply held firmly by the body in a vertical position so that the head protruded from the water just a trifle beyond the mouth cleft. It then followed that if respiration was carried on normally air would be forced through the gill cavities and would appear as bubbles coming from under the operculum. This was obtained but once. On the other hand if water flowed from the mouth even ever so slightly it could be readily detected, in which case if more than a mouthful was so ejected it would follow that it was taken in at the gill clefts. The accompanying table lists the species so examined:

ELASMOBRANCHS

Sharks (Asteriospondyli)
Smooth dogfish (*Mustelus canis*)
Nurse shark (*Ginglymostoma cirratum*)
Skates (Batoidea)
Clear-nosed skate (*Raja eglanteria*)

TELEOSTS

I.

Seahorses (Syngnathidae)
Seahorse (*Hippocampus hudsonius*)
Trouts (Salmonidae)
Rainbow trout (*Salmo irideus*)
Whitefish (*Coregonus clupeiformis*)
Catfishes (Siluridae)
Bullhead (*Ameiurus nebulosus*)
Sea catfish (*Hexanematichthys felis*)
Minnows (Cyprinidae)
Goldfish (*Carassius auratus*)
Tench (*Tinca tinca*)
Red-finned shiner (*Notropis cornutus*)
Suckers (Catostomidae)
Black sucker (*Catostomus nigricans*)
Killies (Poeciliidae)
Common killy (*Fundulus heteroclitus*)
Bass killy (*Fundulus majalis*)

II.

Pickerels (Esocidae)
Pickerel (*Esox reticulatus*)

III.

Croakers (Sciaenidae)
Weakfish (*Cynoscion regalis*)
Kingfish (*Menticirrhus saxatilis*)
Porgies (Sparidae)
Pinfish (*Lagodon rhomboides*)
Shark-suckers (Echeneididae)
Shark-sucker (*Echeneis naucrates*)
Flounders (Pleuronectidae)
Fluke (*Paralichthys dentatus*)
Toadfishes (Batrochoididae)
Toadfish (*Opsanus tau*)
Perches (Percidae)
Yellow perch (*Perca flavescens*)

IV.

Sunfishes (Centrarchidae)
Common sunfish (*Eupomotis gibbosus*)
Blue-nosed sunfish (*Lepomis pallidus*)
Warmouth (*Chaenobryttus gulosus*)
Rock bass (*Ambloplites rupestris*)
Large-mouthed black bass (*Micropterus salmoides*)
Small-mouthed black bass (*Micropterus dolomieu*)
Calico bass (*Pomoxia sparoides*)
Grunts (Haemulidae)
Porkfish (*Anisotremus virginicus*)
Blue-stripped grunt (*Haemulon sciurus*)
Basses (Serranidae)
White perch (*Morone americana*)
Red grouper (*Epinephelus morio*)
Sea bass (*Centropristes striatus*)
Crevalles (Carangidae)
Crevalle (*Caranx hippos*)
Rudderfish (*Seriola zonata*)
Runner (*Caranx crysos*)
Threadfish (*Alectis ciliaris*)
Moonfish (*Selene vomer*)
Pompano (*Trachinotus carolinus*)

V.

Surgeonfishes (Teuthididae)
Blue tang (*Teuthis coeruleus*)
Trunkfishes (Ostraciidae)
Cowfish (*Lactophrys tricornis*)
Warreses (Labridae)
Blackfish (*Tautoga onitis*)
Puffers (Tetraodontidae)
Puffer (*Spheroides maculatus*)
Porcupinefishes (Diodontidae)
Porcupine fish (*Diodon hystrix*)
Spiny boxfish (*Chilomycterus schoepfii*)
Angelfishes (Chaetodontidae)
Butterfly fish (*Chaetodon ocellatus*)
Black angelfish (*Pomacanthus arcuatus*)
Blue angelfish (*Angelichthys isabelita*)
Queen angelfish (*Angelichthys ciliaris*)
Triggerfishes (Balistidae)
Queen triggerfish (*Balistes vetula*)
Common triggerfish (*Balistes carolinensis*)

The foregoing list is arranged by families with reference to their relative powers of ejaculation in a rather rough manner, with the exception of the sharks and skates from which only a slight almost imperceptible pulsating flow was obtained as attempts at respiration were made.

Considering the Teleosts, group I represents those which showed the least ability in this direction. The goldfish and seahorse had no success at all although the latter did succeed in blowing a bubble at its tiny mouth showing the pressure to be in an outward direction although it could not raise water to the orifice. One bullhead pumped air through the gill slits and another alternated this with a slight flow from the mouth. The sea catfish operated the operculums violently but failed. The remaining species in this group produced a slight flow but in no case could be considered as squirting water.

The pickerel while showing a stronger flow than any of the above was still much less powerful than those in group III. It seems to mark a fair transition.

Little can be said of the aggregation marked

group III except that they all showed a more powerful ejection of water than those of groups I or II. This was occasionally accompanied by a gulping movement that caused a small quantity of water to well up, but which did not break away from contact with the head. While the action was greater than in the preceding, more variation from species to species was obtained in this group.

Group IV showed a still further advance although the sunfishes and grunts could probably equally well be placed with group II. However, the basses and crevalles showed much more power, especially a red grouper which occasionally discharged a considerable volume clear of the head. In this group even greater variation was seen, some few species not being able to do much more than group II, but the general average was higher.

Group V represents the true squirters, a jet of water instead of a more or less elliptical mass being the result of their efforts, but here the variability in the degree of success was even greater. The families within this group are arranged somewhat according to their ability, the weakest coming first. Many fishes of this group often come to the surface at feeding time at the Aquarium and discharge the water in their mouths visibly.

A glance at the list will show that the families by being arranged according to their approximate average ability to eject water have also been grouped nearly according to their natural affinities. In group I we have all the Isospondyli, Ostariophysi and Catostemi and some Haplomi all of which are more or less related. Group II represents a slight advance in the Haplomi. Group III is composed of Acanthopterygians mostly of the central perciform type with a few specialized offshoots. Group IV also is of this nature but represents fishes showing a greater advance in water-expelling proficiency. The families of group V are all specialized offshoots of the central stem and more or less related one to the other. It is noteworthy that the archer fish belongs to a perciform family, the aggregation that shows the greatest variation in this respect, having members represented in groups III, IV and V.

The experiments clearly showed that fishes in general are able to force water from the mouth and take it in at the gill openings with greater or less success and that it appears to reach its highest development in some of the more specialized bony fishes coming up progressively along the main Acanthopterygian stem from very slight powers in this direction as exhibited by the more primitive fishes. It is necessary to note here that although three non-acanthopterygians failed completely, they have all been observed to eject particles of food from their mouths by some such method when under normal aquarium conditions. It may be that in certain cases some inhibiting factor enters incident to holding the fish.

The means by which fishes are so enabled to reverse their respiratory currents seem to have a general similarity throughout. Normally the current in breathing flows in at the mouth and out at the gill clefts. This is carried on automatically because of the placement of two sets of check valves which ordinarily allow water to flow in one direction only, like those in a simple lift pump. The driving power is given by alternately increasing and decreasing the size of the mouth cavity which is accomplished by appropriate movements of the jaws, operculums, branchiostegal rays, et cetera. When the mouth is opened, the water rushes in the mouth to fill the enlarged cavity but it does not rush in at the gill slits because of the opercular check valves (see 'A' in the figure). When the mouth is closed it is forced out but owing to the check valves just behind[2] the jaw teeth it finds its way out under the operculum (see 'B' in the figure). As the jaw valves only let water in, and the opercular valves only let it out, it follows that an intermittent stream flows in but one direction. How then are they able to reverse the current? By keeping the mouth shut and raising the gill covers high enough the flap edges which form the valves are not able to reach the body and the water rushes in around them. Then they appear to be able to hold the operculums down so tightly that at least very little water can escape there, so that by opening the mouth so wide that the jaw valves do not meet and compressing the various parts of the head it flows out past them. Possibly as an alternative some species may have muscular control over the jaw valves. When held in the position of the experiments with the mouth and gill cavities filled with water it was simply necessary for the fish to hold the gill slits tight and compress the head violently to eject water upward, which they were often observed to do (see 'C' in the figure). Mechanically at least, nearly all the fishes experimented with should be able to do this judging from the general anatomy of the parts concerned. The only hypothesis that I can give at this time as to why certain species do not is that the musculature involved, the *adductor operculi* et cetera seem not to be sufficiently strong or properly co-ordinated nervously in the forms that failed to act in this

[2] Some fishes lack these valves and are therefore forced to shut the mouth tightly to obtain this effect.

WALKING FISH (*PERIOPHTHALMUS KOELREUTERI*)

It has been demonstrated that the eyes of these fishes are equally efficient both in and out of the water: a very unusual characteristic among members of their class. From a drawing by Kockkoek in "Natural History of Animals."

manner. It would almost seem that spiny fin rays are an accompaniment of this development for all those that have marked ability are acanthopterygians. The true squirters all have small mouths (and gill openings) which for simple mechanical reasons makes their efforts in this direction more readily effective than in large-mouthed fishes.

THE WALKING FISH

IN its Oriental home along the shores of the Indian Ocean, the Walking Fish literally goes through life with "a hop, a skip and a jump."

Over the mud flats it casts about between tide marks, in search of salt water crustaceans and other animals of convenient size to feast upon.

Unlike most fishes, it can breathe out of water, damp air being almost as adequate to its needs as immersion.

The Walking Fish is not discommoded by a sojourn of five or six hours among the roots of the mango trees, on which, as the accompanying illustration shows, it is in the habit of "roosting."

The arm-like development of the pectoral fins makes climbing a relatively simple matter, and incidentally gives us an evolutional hint of the development of the amphibian from the fish. From the remarkably motile eyes, the fish derives its technical name of *Periophthalmus*—meaning, eyes that can move about. It is also called the Jumping Fish and the Mud-Skipper.

This strange fish, which is of the goby family, is so constructed that the tail which is highly vascular, serves as a respiratory organ and the animal spends a greater part of its life with the fore end of its body exposed to the air, and only the tail under water. The gill cover is very large and its external opening but a small hole, instead of the wide, slit-like opening common to fishes, a provision which permits of the protracted retention of moisture in the gills.

The Walking Fish naturally extracts a great deal more enjoyment out of life than a sluggish fish could do, and even more than some amphibians, which, though provided with lungs and four feet, lead a far less active existence.

—*I. M. M.*

TAILLESS PEARL ROACH

By C. M. Breder, Jr.

IN THE course of a year two or three thousand European pearl roach (*Scardineus erythrophthalmus*) are usually brought to the Aquarium. These are taken by employes from the small lake in Central Park at the foot of 59th Street where the species has been established for years, and are used mainly for feeding large predaceous fishes, such as the muskallunge (*Esox masquinongy*) that figuratively turn their noses up at dead food. Only the larger or especially choice individuals are reserved for exhibition.

In the large numbers that thus annually come under our observation from a restricted area, comparatively few abnormalities have been noted. An occasional specimen shows the so-called pug-headed condition (achondroplastic) in which the face is much foreshortened or an individual with a twisted spine sometimes turns up, and once an example was examined which lacked the pelvic fins but in which the girdle was otherwise normal. Even less frequently are healed wounds or mutilations found, but this is as would be expected, for wounded fish usually fall easy prey to their

A TAILLESS PEARL ROACH

A fish that has had its caudal appendage removed, probably by a predatory crayfish, and in the due course of time the lesion has been healed by nature.

enemies even if not succumbing to the injury itself.

However, amongst these collections there are generally a few that show mutilation of the tail. In a year this number usually amounts to about ten or a dozen and they all would seem to be from some common cause, for the similarity from one to another is marked, the deformation differing only in quantity. In the milder cases part of the tail fin remains as a few whispy rays from which one may pass by gradual steps to the condition where the entire fin and part of the caudal peduncle are gone. As none have ever been seen with a fresh wound it is inferred that, whatever the cause may be, it occurs in early life when they still are small enough to pass through the meshes of the nets. All that have come to the Aquarium are perfectly healed over and, in the more severe cases, scales nearly completely cover the stump. The only known inhabitants of this small body of water that we can cast incriminating glances at are the crayfish (*Cambarus*) that occur here in considerable numbers. It is easy to conceive that they take many a nip at passing young fish and the inference seems to be that if they do not miss, they either mortally wound the fish or else just catch a piece of its after part which contains no vital organs. Those that are hardy enough, then seem to grow up and adapt themselves to life with the lack of a tail fin. Their numbers and normal size indicate how well they are able to care for themselves.

The outstanding characteristic is an upturning of the last few vertebrae, its degree of flexure depending on the amount of tail lacking. In those specimens which totally lack the appendage there is such a marked upturning that the anal fin is directed backward, occupying almost the position that the tail normally would and serving much after the manner of one. This has been noted in a few other fishes[1] but it is believed that we are the first to have living specimens daily demonstrating how well fishes can get along without their conventional tail. It is noteworthy in this connection that last summer we had an eel (*Anguilla rostrata*) which had lost a considerable portion of its after part but, as might have been expected, there was no upturning of the vertebral column which would of course have been without function in such a species.

The swimming ability of such injured roach seems to be much less impaired than might be imagined, for it must be recalled that not only is the tail fin missing but there is likewise a partial destruction of the 'streamline' form

[1] J. T. Nichols, "The Miami Aquarium." Natural History, Vol. XXI, No. 4, July-August, 1921. A similar condition in the Tarpon (*Tarpon atlanticus*) is mentioned in this paper with an illustration.

NEW YORK HARBOR FROM THE BATTERY
An old print, dating about 1840, showing the Aquarium building at the right.

which, it would seem from this, is probably normally much more accurately shaped for their average speed than is absolutely necessary. For rapid swimming more violent motions are gone through than in normal specimens but an attempt to net one out of a tank would immediately satisfy one concerning the degree of their natatorial prowess. Indeed, in a school of normal fish these are not distinguished with particular ease, so well are they able to hold their own with their more fortunate brothers. Attesting this is the uniform fat and sleek condition that they have been found to possess, which is in no way inferior to their normal companions.

ITEMS OF INTEREST

The Battery a Fashionable Promenade a Century Ago:—An advertisement in the New York Evening Post for July 30, 1824, reads as follows:

CASTLE GARDEN

A BAND of Music, with Rockets may be expected at this Promenade, this and every fair evening during the season.

Yearly tickets can be bought at the City Hotel, at the Washington Hall, Tontine Coffee House, Bank and New York Coffee Houses, Broadway House, Auction Hotel, Bliss & White's, Broadway, A. Moody's, Broad Street, or at the Garden.

Children cannot be admitted in the evening except with their Parents. No smoking allowed on the upper Walk.

Condition of the Supply of Fresh Water.—The murky condition of the fresh water supply at the Aquarium has been a source of concern for at least seven months. It is impossible to distinguish the living occupants of the fresh water tanks except when they happen to swim within a few inches of the glass fronts. There is much grayish matter in suspension which serves completely to obscure the exhibits. Assuming that the large fresh water filters were not working effectively, they were put out of service in turn, cleaned, and supplied with new strainers, but without effect on the murky water.

Visitors frequently ask for an explanation as to the condition of the water. The Department of Water Supply has no remedy to offer and we await the summer season in the hope that diminished flow of streams may lead to some settling and clarifying of the supply that comes from the City's reservoirs. While the fishes have not suffered from this condition, the deplorable fact remains that about half of the exhibits of the Aquarium cannot be seen.

—*C. H. T.*

Elephant Seals of Kerguelen Land.—The following notes relative to elephant seals on islands in the Indian Ocean are from a letter by Mr. T. P. A. Ring of Oslo, Norway, to the director of the New York Aquarium:

"At the present time the elephant seals at Kerguelen Land are pursued relentlessly: it is the third season that the killing has been going on indiscriminately and I believe that the animals have been pursued at the Crozets, Marian and Prince Edward's islands.

Should the Government of France acquiesce in this killing for some time longer the seals will face extinction at those islands. Six vessels are engaged there and a steamer with 8,000 barrels of oil on board has just been lost in latitude 49° S. and longitude 70° E. The crew was picked up by other vessels.

I have written to a friend, an official in the Fisheries Department of France, and it may be possible to give the seals a chance to recover."

Mr. Ring visited Kerguelen Land and in

1923 published an account of the elephant seals in the "Proceedings" of the Zoological Society of London.

The Dogfish (Mustelus canis).—Although the dogfish is the most abundant of the sharks on this coast, and one of the easiest to procure, it has been one of the most difficult to keep alive. Perhaps it is because it is so common that its study has been neglected.

Examination of a number of specimens that died in the Aquarium, and comparison with specimens just captured, showed that those that had been in captivity had an unusual amount of gastric fluid, and enlarged gall bladders. It was assumed that this was caused by the lack of hard, calcareous food.

It had been the custom to feed them on the soft parts of herring, cod and clam, so after the herring had been dressed or the fleshy sides removed to feed other fish, the back bones were chopped in small pieces and fed to the dogfish. The experiment was commenced in July, 1923, and at the present time those on exhibition are in excellent condition. On examination of the viscera it was found to be normal, and at the same time the previously wasted herring bones have been utilized.—*L. L. M.*

Cross Word Puzzling.—A few years ago a school teacher telephoned the Aquarium for assistance in solving a puzzle on which her class had been working unsuccessfully for an hour or two. Nine words of four letters each were given in certain order, placed each on a separate line, the puzzle being to prefix to each word one letter and thereby form another complete word, at the same time spelling the name of a fish. The words were late, ring, zone, over, rink, east, rate, ever and itch. It was scarcely two minutes before she received her answer, which, with a good working knowledge of the alphabet and of the common names of fishes, was readily seen to be *swordfish.*

This type of puzzle was simple as a.b.c. compared with the cross word puzzles now keeping our telephone bells ringing. At first the puzzlers were ashamed to admit their real motives in asking information. "I don't want you to think I'm working puzzles," they would urge; but on finding a perfect willingness to aid them, they let fall the cloak of deception and bravely confessed that they were trying for a prize. As a newspaper quib cleverly sums up the cross word prize situation, "Some people have at last discovered that an education pays." The name of an animal of the cuttle fish tribe, spelled with eight letters, was the calamary; the young of the seal, spelled with three letters, a pup; a school of whales was discovered to be a gam; a fish's name spelled with but two letters, the id (German ide); a Japanese bream, the Tai; a young salmon, the alevin. One of the rare ones that we could not guess was the name of a large size cod fish, spelled with four letters, and which turned out to be kleg —*I. M. M.*

The Fighting Fishes of Siam.—Dr. Hugh M. Smith, for many years U. S. Commissioner of Fisheries, is now Adviser in Fisheries to His Siamese Majesty's Government. In a letter to Miss Mellen dated November 22, 1924, he says, "I am having an interesting time among the fishes of Siam, finding many new forms and making the intimate acquaintance of some of which I had only read before coming here. Of fighting fish, of which we in America know only *Betta*, I have found four different genera."

It is of great interest that Dr. Smith is now in a position to solve the vexed question as to exactly which species are used in the famous Siamese fish fights; and still more interesting that he will soon be able to tell us more about these fascinating pygmy fishes than has ever before been known in the Occident.

The Antarctic Elephant Seal in Captivity.—Mr. R. G. Martin of Margere, New Zealand, sends the following under date of November 11, 1924, to the Director of the New York Zoological Park: "The keeper informed me that after its capture, the elephant seal fasted for nearly ten weeks. Eventually it was persuaded to eat a little fish cut in strips about the size of an ordinary earthworm. From then on its appetite increased until it consumes at present about seven pounds of filleted fish once a day. It is at present going through a 'moult' and the authorities consider that once over this, there will be no further cause for anxiety. I believe it is a young female. At present it is about seven feet in length."

Battery Park.—Battery Park at night; a dream by Whistler, a soft purple black nocturne, yellow lights on the water, reflecting down, down, ripple, ripple, shaky yellow reflections, myriads of them, and a green-purple sky, where the little cold blue stars come out one by one, and cheerful yellow squares of hundreds of windows, high, high, mounting up into the sky, while the ferry-boats hoot

PAINTING BY STEPHEN HAWEIS

One of forty paintings by Mr. Haweis, now on exhibition at the Aquarium.

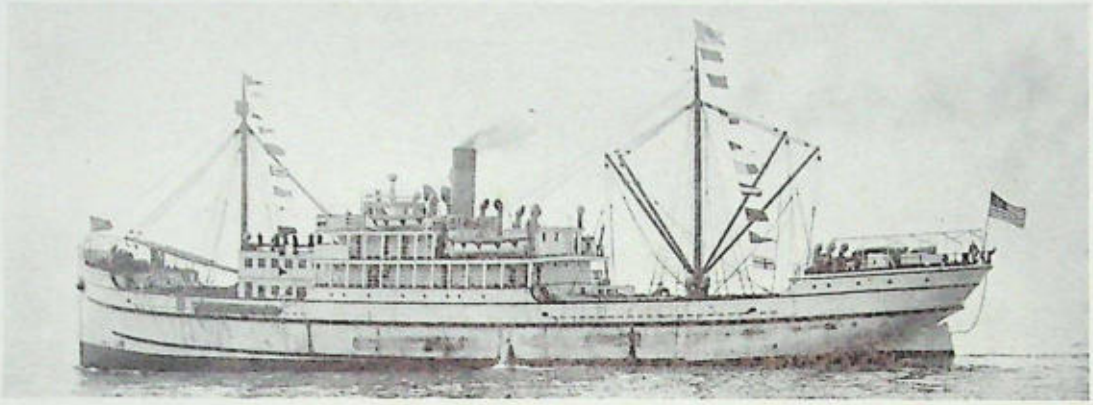
cheerfully one to the other, and an orange glow from the place where you buy hot dogs. Shaky black fingers of winter trees silhouette themselves against the soft sky, and a frosty wind from across the harbor makes you turn your overcoat collar up, and yet you linger on and catch a cold because it is beauty. (From a recent article in *The Home*, a magazine of Sydney, Australia, by Alan Devereux, recording his impressions of New York.)

MR. STEPHEN HAWEIS' PICTURES AT THE AQUARIUM

MOST of the fishes in Mr. Stephen Haweis' pictures live in the sea around Florida, although some of them are found in summer in our own waters. He has not exaggerated their colors, for there is no pigment which can begin to rival the scales of the parrot fish, angel fish, trigger fish, or those of a thousand other varieties. It will be seen at once that he does not attempt to render literal accuracy in the matter of scales and fin rays.

In these pictures he attempts to reveal a truth of impression, a picture of what remains in the mind after having seen fishes swimming among the coral gardens of the south. After ten years of study he has found that the life and movement of fishes can be better interpreted with the convention he has invented than by making accurate outlines which can be searched with a caliper; but he has tried to keep to sufficient accuracy of detail, in most cases, to lose nothing of the character of the fishes he paints. How far he has succeeded in this may be verified in part by visiting the tanks, as there are examples of the spade fish, angel fish and several others in the collection. His pictures attempt to show fishes in motion and to show movement of water and of light and shadow. They are painted in his own way.

It is believed that Mr. Haweis' pictures will give visitors to the Aquarium a new interest in fishes. While they are on temporary exhibition now, it is hoped that they may be purchased and given to the Aquarium to form the nucleus of a permanent collection. —*C. H. T*



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HARRISON WILLIAMS

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THE *ARCTURUS* OCEANOGRAPHIC EXPEDITION

By HENRY FAIRFIELD OSBORN, JR.

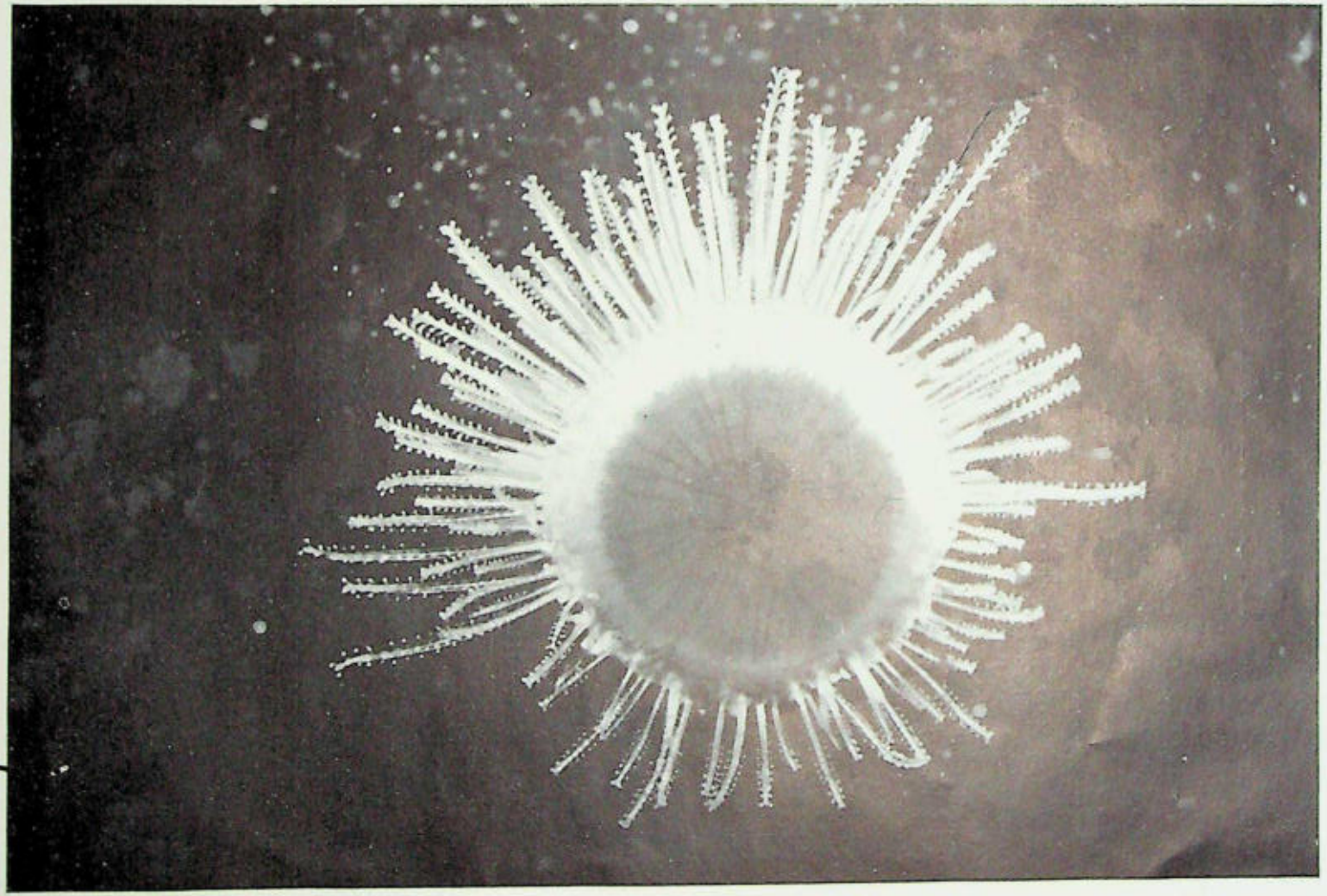
"ARCTURUS," friend of mariners during the passing of the centuries, has become a star of even greater magnitude, through its namesake, the S. Y. *Arcturus*, bearer of the New York Zoological Society's expedition under the leadership of William Beebe, sent out to explore the wonders of two great oceans. It has voyaged to discoveries of such general interest and scientific importance that the vessel and its crew seem under the guidance of a friendly star. But as results could not be entrusted to the stars alone, the Society and its associates, in preparing for their great expedition, made every effort that it should be conceived on broad and original lines, planned with minute care and detail, supported financially with unparalleled generosity and conducted under a leadership so intelligent, energetic and inspiring that success in full measure must inevitably result.

The purpose of the expedition, expressed in general terms, is the study of life in the ocean. Man has visited the snow wastes, the mountain peaks, the deserts, the jungles, the scattered islands of the earth. The ocean still remains a strange world to him—there are approximately 139,000,000 square miles of it. This is the land lying at the bottom of the ocean, more than twice the 57,000,000 square miles above the ocean. This water world is populated with forms of life extensive in variety and number beyond any measure man has placed upon them. Of the innumerable forms of deep-sea life known to exist, comparatively few have been taken by man and subjected to careful observation. Serious oceanographic exploration had only begun about 1870, and since then fewer than two score vessels have been fitted out for deep-sea scientific work.

In selecting the ocean areas to be visited, the Sargasso Sea in the Atlantic and the Humboldt Current in the Pacific, in the general vicinity of the Galapagos Islands, appeared to offer the greatest opportunities for exploration. The Sargasso Sea is a large, loosely defined mass of floating sargassum weed, which is detached from the littoral of Caribbean Seas and adjacent waters, carried northeastward to approximately mid-ocean and there gradually drawn by currents and prevailing winds in a southerly direction to form the great plant mass in mid-ocean. Known to be the habitat of many forms of small marine life, it was more than a presumption that a number of rare and curious forms of large marine life, which used it as a feeding ground, might be observed. The Humboldt Current, in the vicinity of the Galapagos Islands in the Pacific Ocean, approximately six hundred miles west of Ecuador, also offered great possibilities for original scientific observations.

The present expedition owes its origin to the Tropical Research Department of the New York Zoological Society, established nine years ago under the direction of William Beebe, with a station in British Guiana, in the forest jungle of South America. During these nine years the Society, in addition to building up Zoological Park and Aquarium, its game-protective and educational activities at home, has gradually been going farther afield in the study of the animal creation. Six years of work in British Guiana brought results of the broadest interest. Mr. Beebe plotted out for study one-quarter of one square mile of jungle. This plan, original in its nature, succeeded to a degree that even its author could not have foreseen. Sooner or later all the life of the jungle seemed to creep, crawl, walk or fly into this restricted area, to be reported in scientific treatise or popular book for the world's enlightenment.

Following these years of intensive scientific work, an opportunity was suddenly presented through the rare generosity of Mr. Harrison Williams, for Mr. Beebe and his staff to make



A STELLAR GLORY OF THE UNDERSEAS

Jellyfish from the Sargasso Sea, with its dazzling rays forming a corona.

an expedition to the Galapagos Islands. From a popular standpoint the voyage was a decided success—due to its dramatic nature so vividly portrayed in "Galapagos—World's End." From a strictly scientific standpoint the results were of necessity somewhat limited, as the duration of time was short, the expedition being ashore on the islands only for an aggregate of "6,000 minutes." The extraordinary amount of scientific data collected in this brief time, and while voyaging to and from the islands, does credit to the fierce energy with which the party worked.

The Galapagos Expedition, however, served a further valuable purpose. It acted, in a sense, as a "trial run," much being learned of value regarding the ways and means of conducting the present great oceanographic expedition.

The better part of a year was spent in preparation—establishment of a scientific staff, study of data, planning of routes, acquisition of equipment, from dredges to dishpans—finding a suitable ship's crew, commissary, and a thousand and one endless details.

At last the great day of departure arrived, and on February tenth, 1925, the S. Y. *Arcturus*, the largest and most completely equipped vessel ever made available for scientific work at sea, steamed down New York Harbor and nosed out into the ocean. A stop at Newport News for coal, the last touch of land, and the lights of Cape Charles and Cape Henry dropped astern.

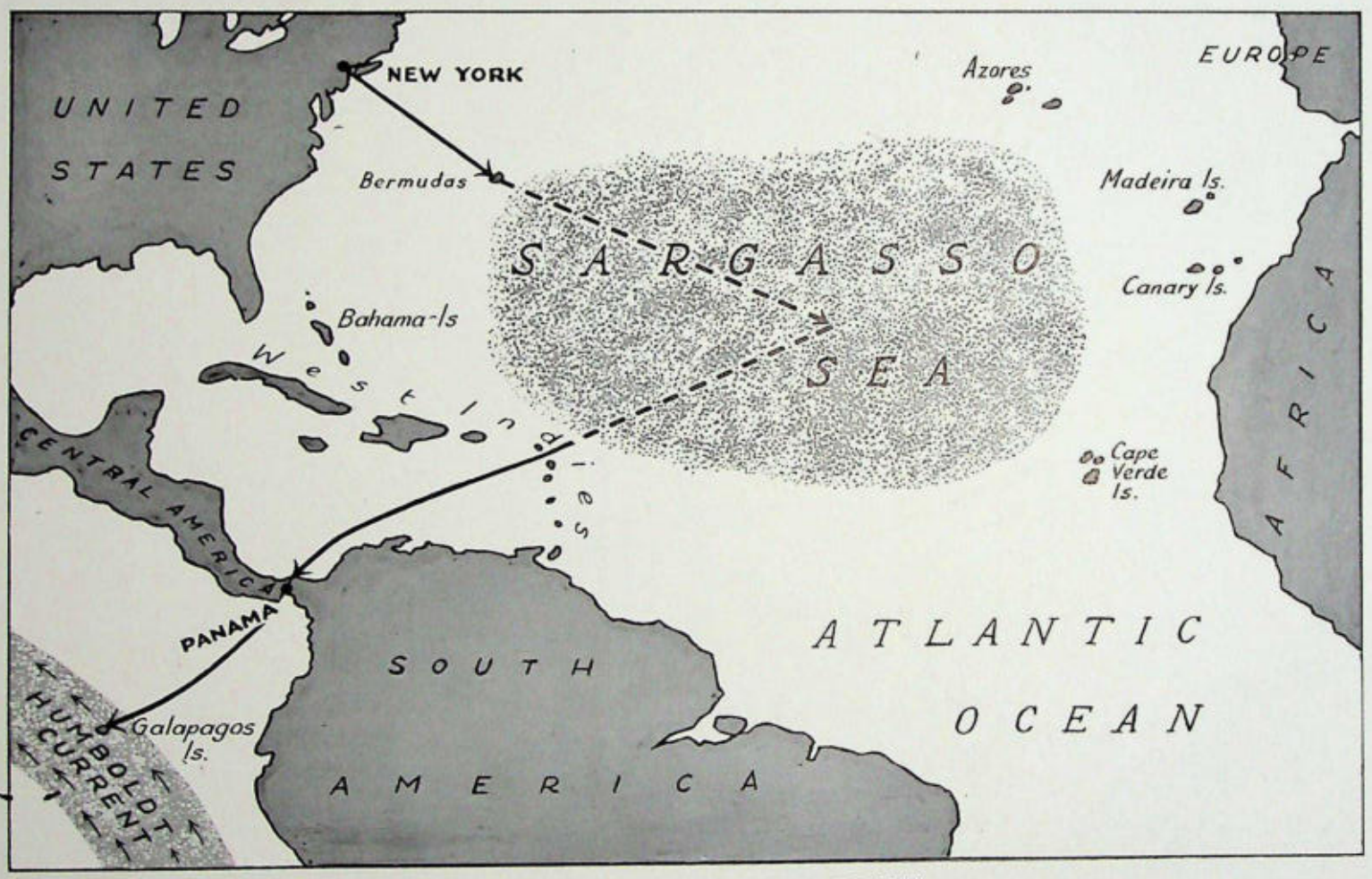
The open sea was ahead. The bow of the *Arcturus* lifted to the swell. The voyage had begun. Days of adjustment to the individual task, long days, for William Beebe, an exacting taskmaster. Equipment adjusted and in place, gear in working order and the Sargasso over the horizon. He writes:

"For nearly a month our ship wallowed in the long surges of mid-Atlantic, while we sought that area that has been described by a veracious French scientist as "une vaste prairie flottante," but it always eluded us. The fact of the matter is that the tricksy current swirling in leisurely fashion between the Gulf Stream and the Equatorial Current performs sleight-of-hand with the Sargassum weed, which indubitably exists in huge quantities; but only at certain propitious seasons do these quantities collect into the floating meadows that have been seen by trustworthy observers. We pursued a will o' the wisp amid February gales that had torn apart and widely scattered the nomad vegetation. Several times our hopes were excited by big parches of yellow-brown weed undulating over the rollers as far as we could see in any direction. But such islands were far apart and never drew together into the vast fields of our anticipations. Again we would encounter lines of weed, streaming across the water in long, thin fingers that beckoned us exasperatingly toward accumulations that failed to materialize. Sometimes these lines continued almost uninterruptedly for four or five miles."

The handicap of the unusual storms which marked February and March in the Atlantic proved too great, and rendered impossible the use of the trawls and dredges to any appreciable extent. Nevertheless a large amount of observation was accomplished in the matter of seasonal conditions in the area, the study of hundreds of nets-full of sargassum that were drawn up, involving the swarming life of the plankton and a great body of observations thereon, the collecting of a series of specimens from many different depths and the preparation of over fifty colored plates. Microscopic work was out of the question; for days it was impossible to work in a chair and all writing and preservation of specimens was done sitting on the floor of the laboratory. Beebe writes, "We were comforted by reading the reports of the *Challenger* and the *Albatross* and learning of their mishaps." Under these conditions the decision was inevitably reached to discontinue the work in the Sargasso Sea for the present, perhaps to return there later on, and to sail at once for the Humboldt Current area in the Pacific.

"We reached Sombrero on March 13th, and as the shaft of the main circulation pump was broken and had to be mended, we lay-to for forty-eight hours. I selected Saba Bank in the lee of the island and in this comparatively smooth water we made six hauls with trawl and dredge. The results showed what we could expect when conditions were at all favorable. Every haul brought up a host of strange creatures, some of the most beautiful being rare coral fish. There were trunk and porcupine fish, small ones with five finger-like adaptations of the pectoral fins, wholly undescribed. Masses of coral, twenty pounds and upward in weight, were drawn up, with gorgonias and sponges of many brilliant colors, and a multitude of starfishes, holothurians, worms and shells.

"For the next half-week we had all we could do examining, studying and preserving. A giant sea-cucumber produced one of the rare Fierasfer fish which is still alive, and which I am studying and will have preserved for a museum group. Our specimens came from 45 to 370



THE PROPOSED COURSE OF THE *ARCTURUS*

Map giving the locations of the Sargasso Sea, Humboldt Current and the Galapagos Archipelago in their related positions to the near-by continents. The line laid down on the map indicates the tentative route of the expedition as first planned.
From a sketch made and loaned to the Society by the New York *Times*.

fathoms, and the dredge would often have several barrels of living creatures."

On March 29th the *Arcturus* passed through the Panama Canal and out into the Pacific. Cortez and his men stood on the threshold of a world the wonder of which they never realized. Jealous as the Atlantic had been of giving up its secrets, the Pacific was doubly bounteous. For a time there was silence. The civilized world at its breakfast table read in scare head-lines "*Arcturus*, lost to world twelve days, vainly sought by radio." A decade or two ago it might have been twelve weeks or months and the "breakfast table" would have been none the wiser. And on April eleventh this, "ship is found, static balked radio." As if a touch of the dramatic were needed to color the wonderful discoveries that even then were being made in the Pacific. For instance, this from Director Beebe:

"The cyclothones and other more common luminous fish which held us breathless in the Atlantic are now passed over without a second glance, and a trawl or two which does not hold a species new to science or at least to the Pacific is deemed a failure.

"Our search for the Humboldt Current itself has been a complete failure for the very interesting reason that at present there is no such current. The warm ones which we found in its place have afforded us more striking results than even the more normal Antarctic current could have done. Astonishing meteorological and geophysical changes have made the exact date of our arrival in the Pacific most propitious for unusual observations. Recent reports from Chili and all along the western South American coast indicate that the normal cold water has been replaced by warm, killing myriads of fish and birds, and resulting in such unheard-of precipitations on the usually arid western Andean slopes as to demolish towns and railways.

"Wherever we went our water thermometers, down to five hundred and a thousand metres, registered high temperatures. We found strange juxtapositions of currents in mid-Pacific seething with a mass of living creatures which I never thought possible. Great logs and palms, bamboos and cocoanuts were drifting westward, inhabited by many kinds of shore creatures. I saw with delight part of my continental theory of the populating of the Galapagos trembling in the balance. Even two hundred miles south of these islands there was no hint of cold currents.

"Suddenly, as if staged for our benefit, came the volcanic eruption of Mounts Whiton and Williams on Albemarle, satisfying our utmost desires in the direction of beauty, grandeur and geological significance. Since their earliest discovery by man there have been no more than a half-dozen similar phenomena.

"Day by day, in this calm sea, so unlike the maelstrom of the Atlantic, we used all our appliances, drawing up brilliant creatures and black, icy ooze from the bottom two thousand fathoms down, and raiding in turn the remarkable fish life of the silvery, the red, the black and the colorless depth zones.

"In the very last haul, one hundred miles south of the Cocos, made before we turned back to Balboa, we secured seven fish from the third zone, all jet black, some blind, some with enormous teeth, and all different and with diverse luminous appendages, sessile, on the end of long fishing-rod-like stalks, or in the mouth itself.

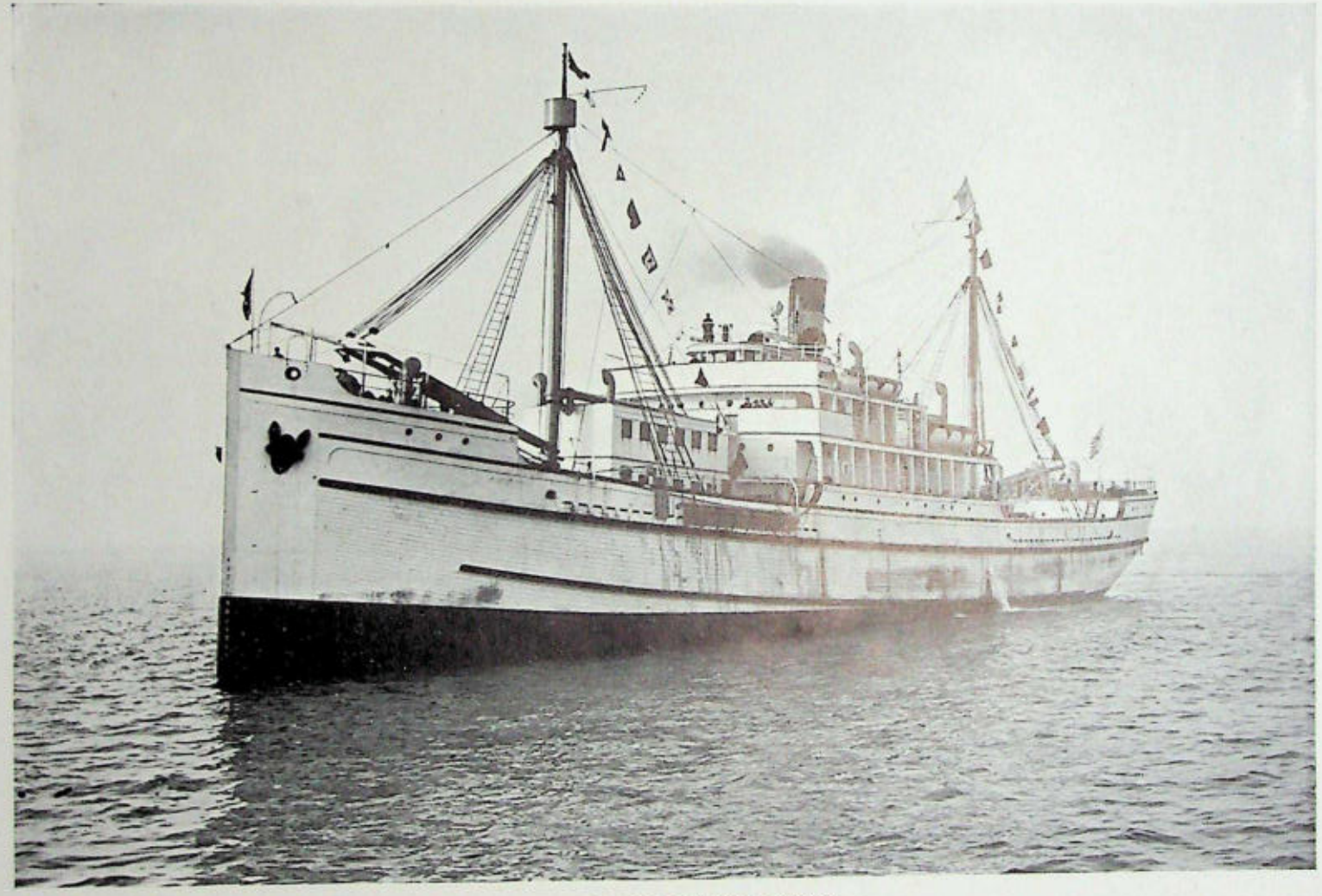
"We visited the Galapagos whenever we saw that it aided our oceanographic researches. We did no dry land work whatever, with the exception of photographing the dance of the albatrosses and capturing two for the Zoological Park, besides making what notes we could of the active volcanos.

"Dr. Gregory found that the study of shallow water fish was absolutely necessary for his work. The development of work with the diving helmet has opened an entirely new field. I find I can descend from fifteen to thirty feet and remain as long as I wish, sitting or walking about, harpooning species of fish which no bait will attract and making notes on the habits of the vast population which are wholly new. I consider this one of the most important operations of the expedition. Gregory is as enthusiastic as I am and as surprised that such a simple method has not been more generally used for serious scientific collecting. We take all possible precautions against large sharks and morays, and where necessary use a wire cage into which the diver can retreat if attacked."

And later on, this informal letter from Beebe:

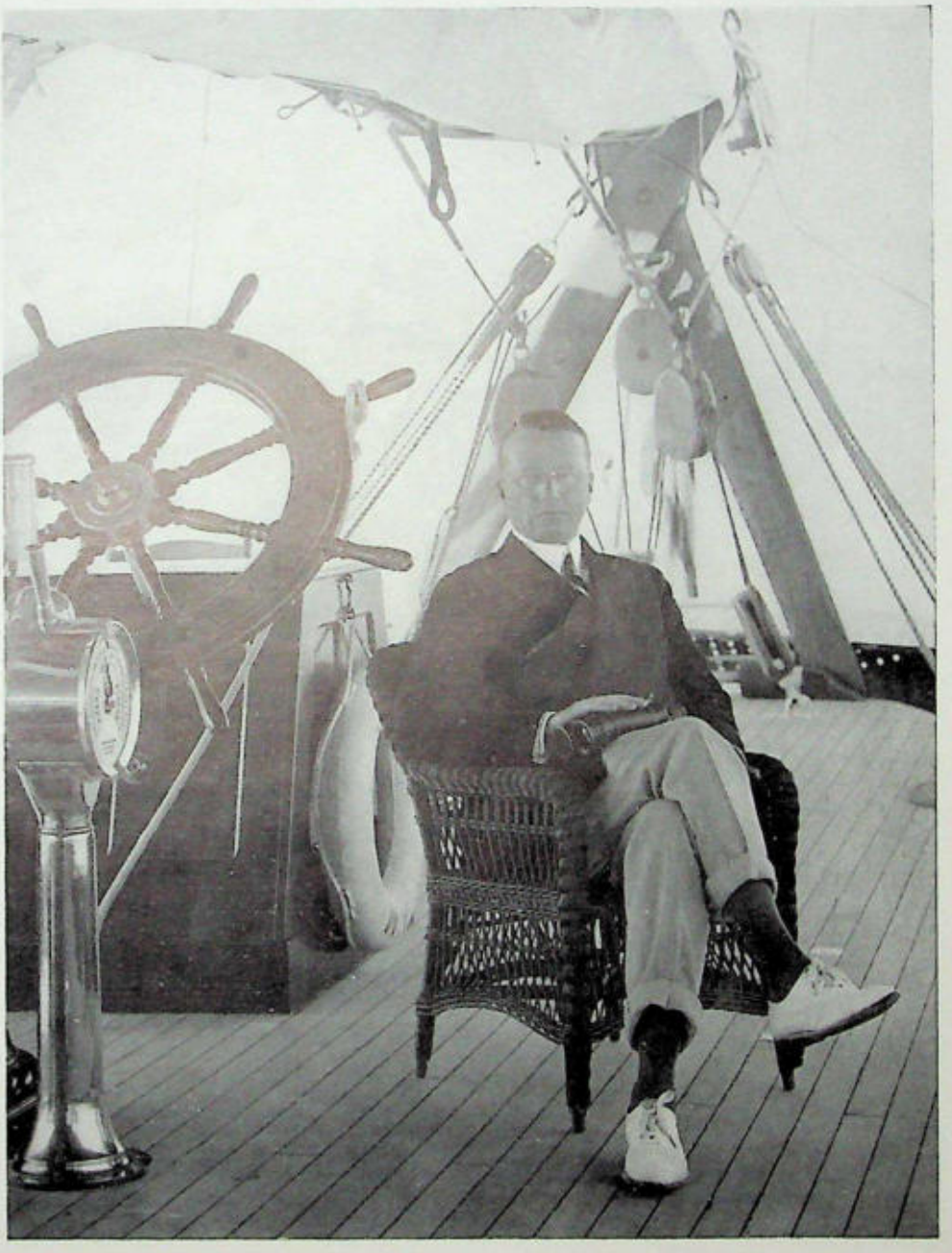
"We are getting fish that hitherto have been found only in the farthest Atlantic or Indian Ocean, and many absolutely new ones. I have planned a campaign this next six weeks which will exceed all our former efforts—at least two big hauls or dredges by the crew during the day and another nightly one by ourselves. This should give us the material for a masterly summing up of the life of this area."

How crude is the statement of purposes as set forth above when compared face to face with reality. For man has yet to learn that bold as his plans may be Nature is yet ever his teacher.

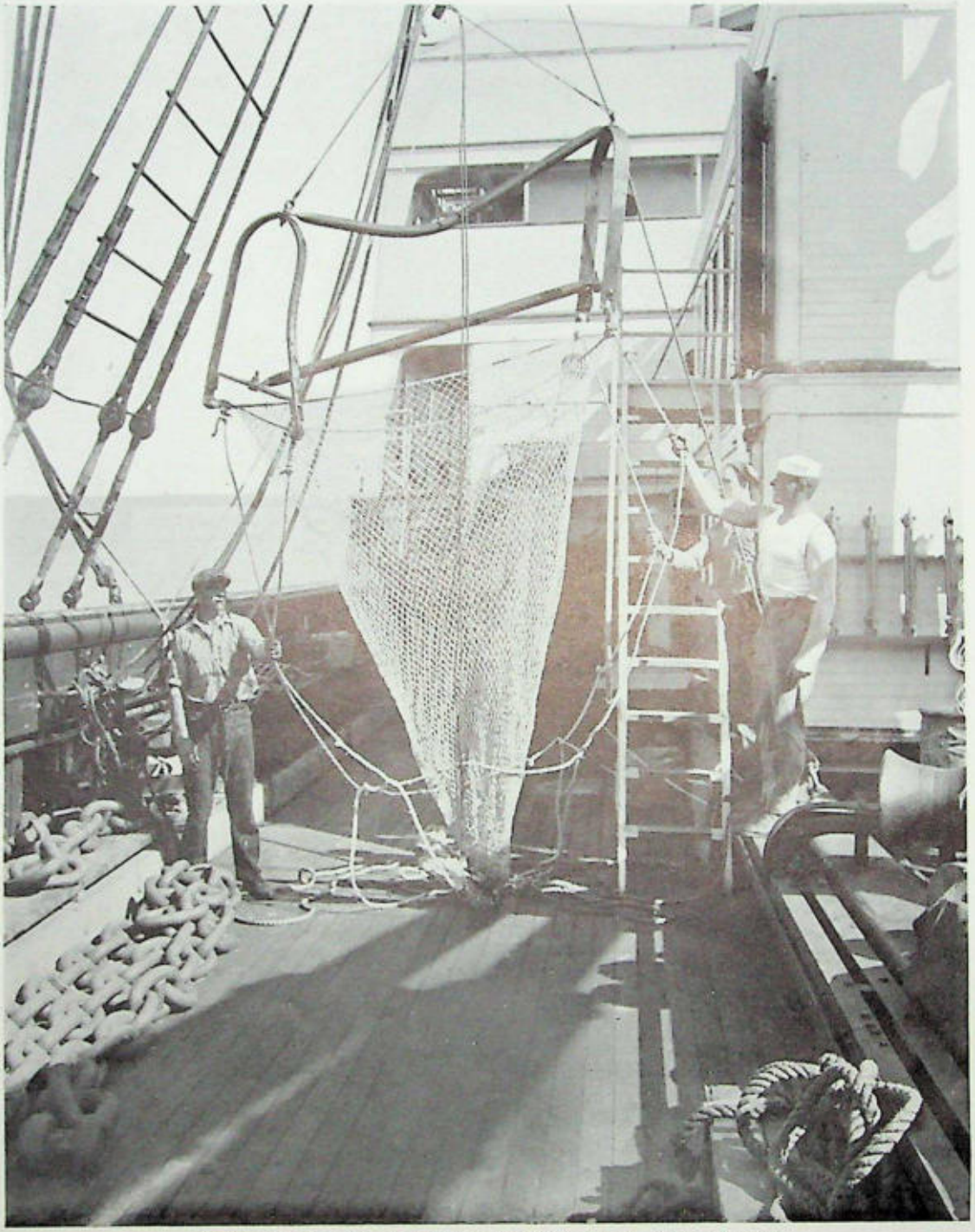


THE *ARCTURUS* OUTWARD BOUND

Although the ship was not designed for purposes such as deep-sea exploration, it has well served the needs of the expedition. The vessel was provided for the Society by one of its most active managers, Mr. Henry D. Whiton.
Photograph by Morris Rosenfeld.



HENRY D. WHITON



A TEN-FOOT DREDGE AFTER CONTACT WITH THE BOTTOM

The wallowing of the vessel in the heavy seas made even surface towing difficult. Several nets were lost and a dredge was bent at right angles. Every respite from mountainous waves was improved by sending over nets, trawls and dredges.

EQUIPPING THE *ARCTURUS*

A brief account of the structural alterations and the intricate mechanical appliances installed to meet the requirements of the scientific staff.

By EDWIN C. BENNETT*
Naval Architect and Consulting Engineer, New York City

THE little-known depths of the oceans of the earth and their myriad inhabitants have always had for man a great fascination and an intense interest, and oceanography probably presents to-day the most fruitful field for discovery and scientific investigation.

Facts and fables have become so interwoven, and stories originating as "fables" have so often ended as "fact" that the minds of many of us are ready to believe the most startling stories of life of the deep that William Beebe and his corps of associates have set out to investigate.

That the New York Zoological Society's Oceanographic Expedition is not barren of results is evidenced by the articles that have appeared from time to time in the public press. Success in oceanography, however, is so dependent upon the adaptability of the vessel carrying the scientific party to the engineering problems intimately connected with its equipment that a description of the *Arcturus* may be of interest to all those who have followed the reports sent in from time to time, telling of the experiences and discoveries both in the Sargasso Sea and in the waters around the Galapagos and Cocos Islands.

The *Arcturus*, designed and constructed in 1918-1919 by the Pacific American Fisheries Co. of South Bellingham, Washington, as a cargo carrying steamer for purely commercial marine transportation, with her high freeboard and her proclivity for rolling, constitutes a handicap both for deep-sea sounding and dredging, and the lifting of specimens from sea level to the deck.

Nevertheless, she is a very substantially built vessel and a good sea boat, capable of weathering almost any sort of gale likely to be met at sea. Strongly and heavily constructed of Oregon pine, the *Arcturus* has an over-all length of 282 feet, a breadth over the planking of 46 feet and a depth from bottom of keel to main deck at side of 28 feet, with a gross tonnage of 2,478 and a net tonnage of 1,474.

The propelling machinery is located about midships of the vessel with two cargo holds forward and two abaft the machinery space, each hold having a cargo hatch in the main deck 14 feet wide and ranging from 17 feet to 22 feet in length.

In design the *Arcturus* is known as a "three-island," one-deck type of vessel, the three islands comprising the forecastle, the bridge and the poop. In the original design the crew, consisting of seamen and firemen, were berthed in the forecastle, but in reconditioning the vessel for scientific purposes the quarters for those members of the crew were transferred to the poop and the original quarters were arranged as workshop and storeroom for scientific apparatus. The bridge enclosure, originally intended to carry either cargo or bunker coal, was divided by building at the after end eight new staterooms with two toilet and lavatory spaces for the accommodation of deck and engineering officers. The officers' cabins were given over for the accommodation of the members of the expedition and the forward end was assigned for use as aquarium rooms and photographic dark room.

In reconditioning the vessel, the plan adopted was to assign the forward half-length of the vessel and all staterooms above the bridge enclosure to the oceanographic expedition, and the after half-length to the operation of the vessel. This partition worked out very happily, and successfully prevented interference between the work of the expedition and the navigation and operation of the vessel.

The conversion of the *Arcturus* to meet the requirements of the expedition necessitated somewhat extensive changes and additions: A large laboratory 36 feet long and 14 feet wide was built between the foremast and the front of the bridge, and fitted up with tables for microscopic and general laboratory work, with shelves at both ends for books, instruments, specimens etc. Four doors permit of ready access to the deck of the ship and electric lights with ceiling lights, insured ample illumination.

for the most minute study.

* Mr. Bennett is also a member of the technical committee of the American Steamship Owners' Association and the technical committee of the American Bureau of Shipping. He designed and superintended much of the work of converting the *Arcturus* to meet the requirements of the staff of the Society's Oceanographic Expedition, and very generously contributed this interesting paper.—*Editor.*

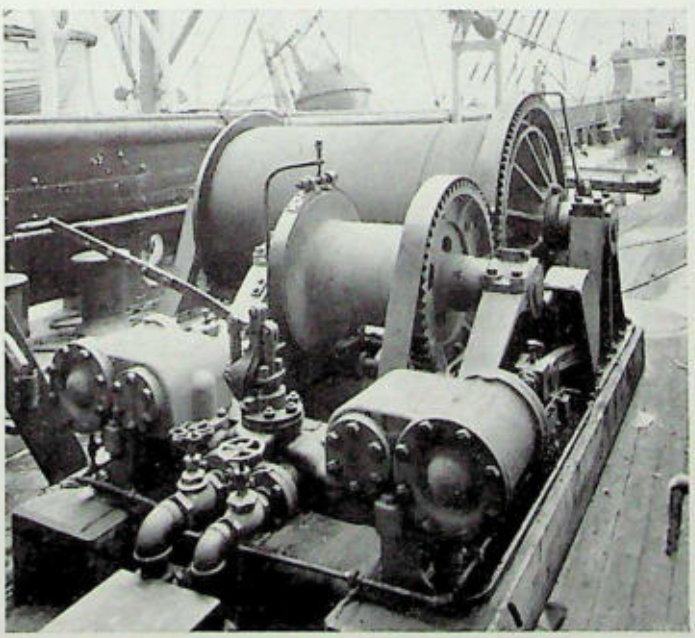
THE DOUBLE BOOM OF THE *ARCTURUS*

On the starboard side is a specially designed boom, thirty feet long. It serves as a suitable place for using the surface-towing nets and when lowered to the level of the water as a landing place for specimens.

Above the laboratory and on the level of the bridge deck a conference room and study was built 31 feet long and 14 feet wide, with a door at the after end for access from the bridge deck and a door at the forward end for access by stairs to the deck of ship. Both the laboratory and the conference room are of very strong construction to withstand wave damage during storms.

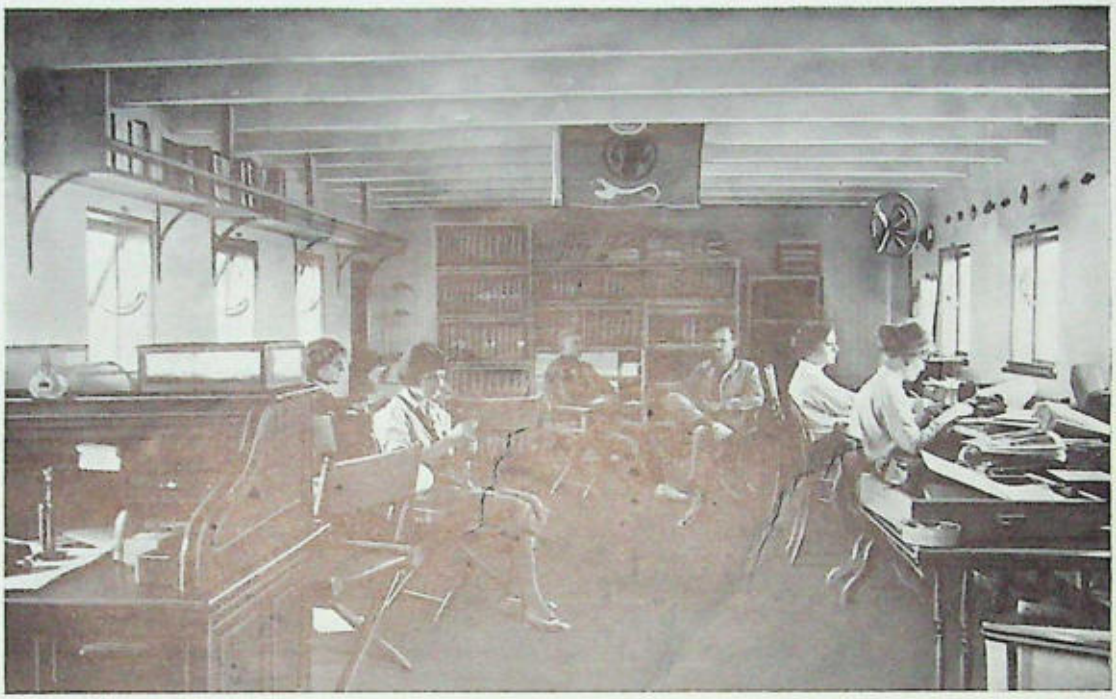
Inside the bridge enclosure a large photographic developing or dark-room was built, the entrance so arranged with light-excluding screens that developing might be accomplished with the entrance door open for ventilation and quick egress and entrance.

Immediately abaft the photographic dark-room a large cold storage room was constructed in addition to that originally built into the ship. These two cold storage spaces, subdivided by insulated walls and doors, are sufficient in size to hold meats,



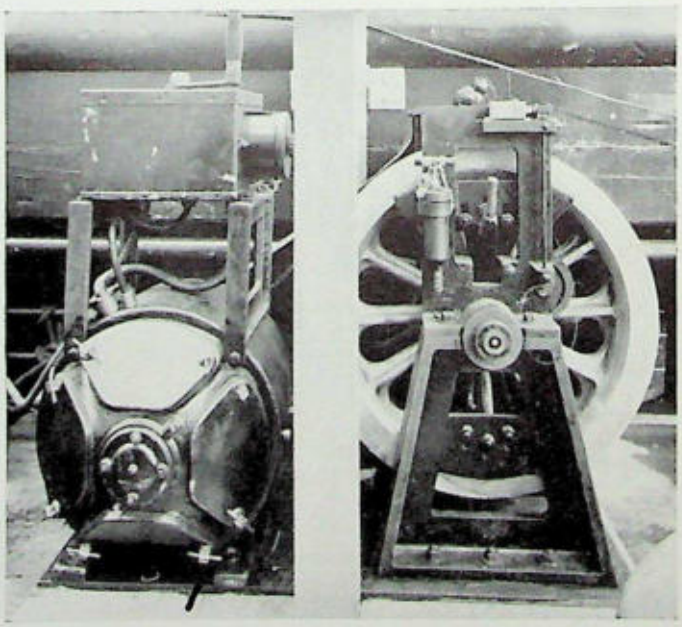
DREDGING ENGINE AND CABLE DRUM

An accurate description of this interesting mechanical equipment is described by Spencer Miller in this Bulletin.
Photograph by Morris Rosenfeld.



THE CONFERENCE ROOM OF THE *ARCTURUS*

A room for conference and general study was built on the level of the bridge deck.



SOUNDING ENGINE

An electrically controlled deep-sea sounding machine of a type similar to that used by the U. S. Coast & Geodetic Survey. Photograph by Morris Rosenfeld.

eggs, butter, fruit and other galley and stewards' stores for a six months' trip, besides providing space for freezing any specimens of deep-sea life the scientific party might desire to preserve.

The No. 2 cargo hold was converted into a coal bunker for additional coal for the ship's boilers. This new coal bunker holds about 700 tons of coal, which, with the ship's original coal capacity of some 877 tons, makes a total coal capacity of 1,577 tons.

In No. 3 and 4 cargo holds, six large steel fresh water tanks were installed, each of 3,500 gallons capacity, which together with the original fresh water tanks make available for use some 43,000 gallons of fresh water. No. 3 hold was also arranged for carrying reserve bunker coal, while hold No. 4 was given over to ship's gear, and the dry stores of boatswains and stewards.

In addition to the vessel's legal equipment of life boats, there are on board two motor boats, thirty feet long, six flat bottom rowing skiffs, some fitted with glass panels in the bottom, row boats and canoes. These boats are all carried on the after weather deck, between the bridge and poop and are handled from deck to water by the booms or derricks on the main mast.

The propelling machinery of the *Arcturus* consists of two vertical, triple expansion, reciprocating engines of 1,500 indicated horse-power, which will drive the twin screws at 130 revolutions per minute, giving the ship a speed of nine knots per hour. Steam is generated in two watertube boilers working at 200 pounds pressure. There is on board the usual complement of feed, air, fire, sanitary and general service pumps, evaporator and distiller for making fresh water, refrigerating machine and electric generator were duplicated to meet the greater demands for cold storage and electric light and power made necessary by the additional requirements of the vessel and as a measure of safety in case of breakdown.

Much of the apparatus used in connection with oceanographic work was designed especially for the *Arcturus* from suggestions and instructions originating from Mr. Beebe. Not the least of these is the bow pulpit—a light but strongly constructed steel platform about six feet long installed forward of the bow and arranged to raise and lower to meet conditions either of the ship's draft or height of bow waves.

Access to this platform or pulpit is by a flexible ladder from the forecastle deck—the pulpit being large enough for two people comfortably. From this pulpit it is Mr. Beebe's intention to collect by hand net specimens of floating sea weeds, etc., or to observe fish life around the bow while under way.

On the starboard side is fitted a specially designed combined swinging platform and boat-boom some thirty feet in length, comprising two booms spaced about thirty inches apart, from which is hung a wooden platform. The outboard end of these swinging booms and platform can be lowered, if desired, to the sea level and thus facilitate carrying on board buckets or similar receptacles for holding specimens secured from the small boats or launches.

At the head of the foremast a steel lookout or crow's nest is fitted so as to command a wide range of observation.

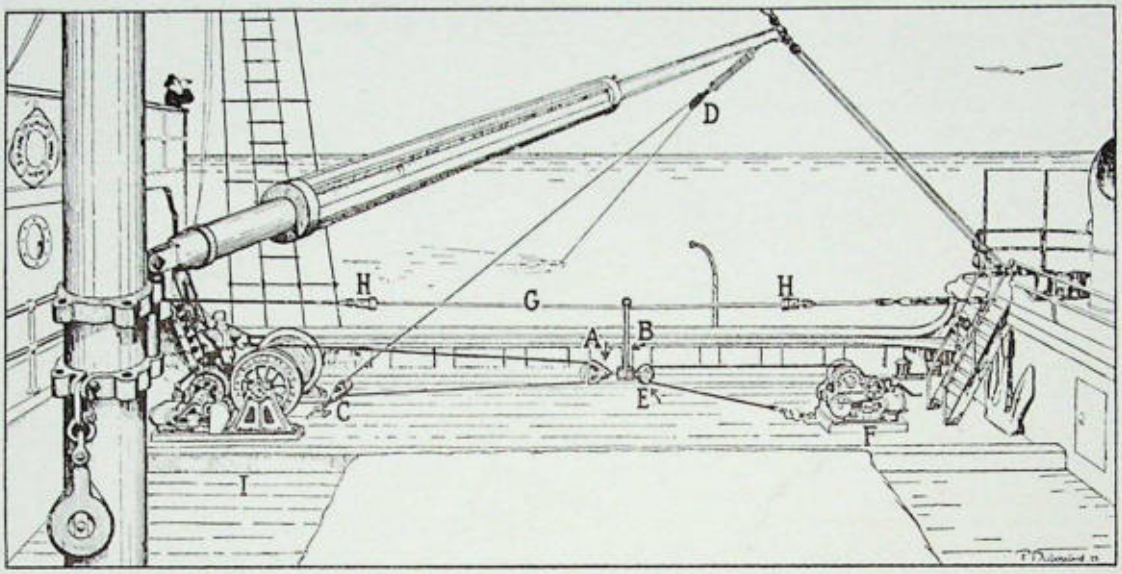
On the port side just forward of the laboratory an electrically controlled deep-sea sounding machine is installed, similar in type to that used by the U. S. Coast and Geodetic Survey, capable of taking soundings, securing samples of the bottom, and the temperatures of the water down to 6,000 fathoms. The sounding wire employed is what is known as piano wire, and at great depths the weight of the sinker and receptacles for sea bottom sample and thermometer, together with the weight of the sounding wire, is so near to the breaking strength of the wire that special precautions had to be provided to take up any jar or shock due to the rolling or surging of the ship. The delicacy of operation and the very small margin between the working load and the breaking strength of wire is such that when sounding to great depths it is necessary to automatically release and discard the iron sinker before reeling in the wire.

The most interesting problem from an engineering point of view is in the arrangement for deep-sea trawling.* No commercial machine could be found on the market that would hold 30,000 feet of half-inch diameter flexible-steel trawling wire and at the same time have combined in its design an automatic relieving device for taking care of any sudden jar to the steel wire when trawling, either from the trawl coming in contact with obstructions on the bottom of the ocean or from the rolling and surging of the vessel itself when under way. It was, therefore, necessary to design and build special machinery to meet the conditions of available deck space on the *Arcturus*, and in this the experience of Spencer Miller of the Lidgerwood Manufacturing Company was found invaluable. The special machines designed for that purpose, from all reports received to date, appear to have successfully met all requirements.

In order to keep in touch with the shore at all times, a very powerful wireless sending and receiving outfit was installed on the upper bridge—the living quarters of the operators being immediately adjacent to the wireless machine—and it is from this apparatus that the majority of the reports so far received have been transmitted.

The intention of this article is to briefly describe only the reconditioning of the *Arcturus* to make her suitable for the work of the Oceanographic Expedition. A description of the scientific apparatus, trawls and trawling equipment, and other deep-sea devices, will undoubtedly be given by Mr. Beebe when he recounts his experiences and describes the interesting specimens collected by the various members of his staff.

* Described fully in the article by Mr. Spencer Miller.



MACHINERY FOR OPERATING TRAWLING APPARATUS

The working of this interesting mechanical device is described on the following pages. From a pen drawing by P. Dubosclard.

DEEP-SEA EXPLORATION

A description of the trawling and dredging equipment of the S. Y. Arcturus

By SPENCER MILLER*

WHEN the Oceanographic Expedition of the New York Zoological Society left New York in February of this year on board the S. Y. *Arcturus*, under the direction of William Beebe, it represented a distinguished group of scientists, artists and photographers in the field of zoological research in this country. The S. Y. *Arcturus* has been transformed into a traveling laboratory with every possible facility for making this exploration the most thorough that had yet been undertaken. To secure representative specimens of deep-sea life it became necessary to include in the equipment of the *Arcturus* a deep-sea anchoring and trawling machine which could collect specimens several miles below the surface of the water. The success or failure of the expedition to secure new and rare specimens of deep-sea life (it will be noted) depended upon the successful functioning of this deep-sea trawling apparatus.

In the past, experience with deep-sea trawling has presented many serious difficulties, principally due to sudden strains which frequently resulted in the loss of costly equipment. The problem was set forth as follows in an article in the Encyclopaedia Britannica, under the caption *Dredge and Dredging* (11th edition, page 571):

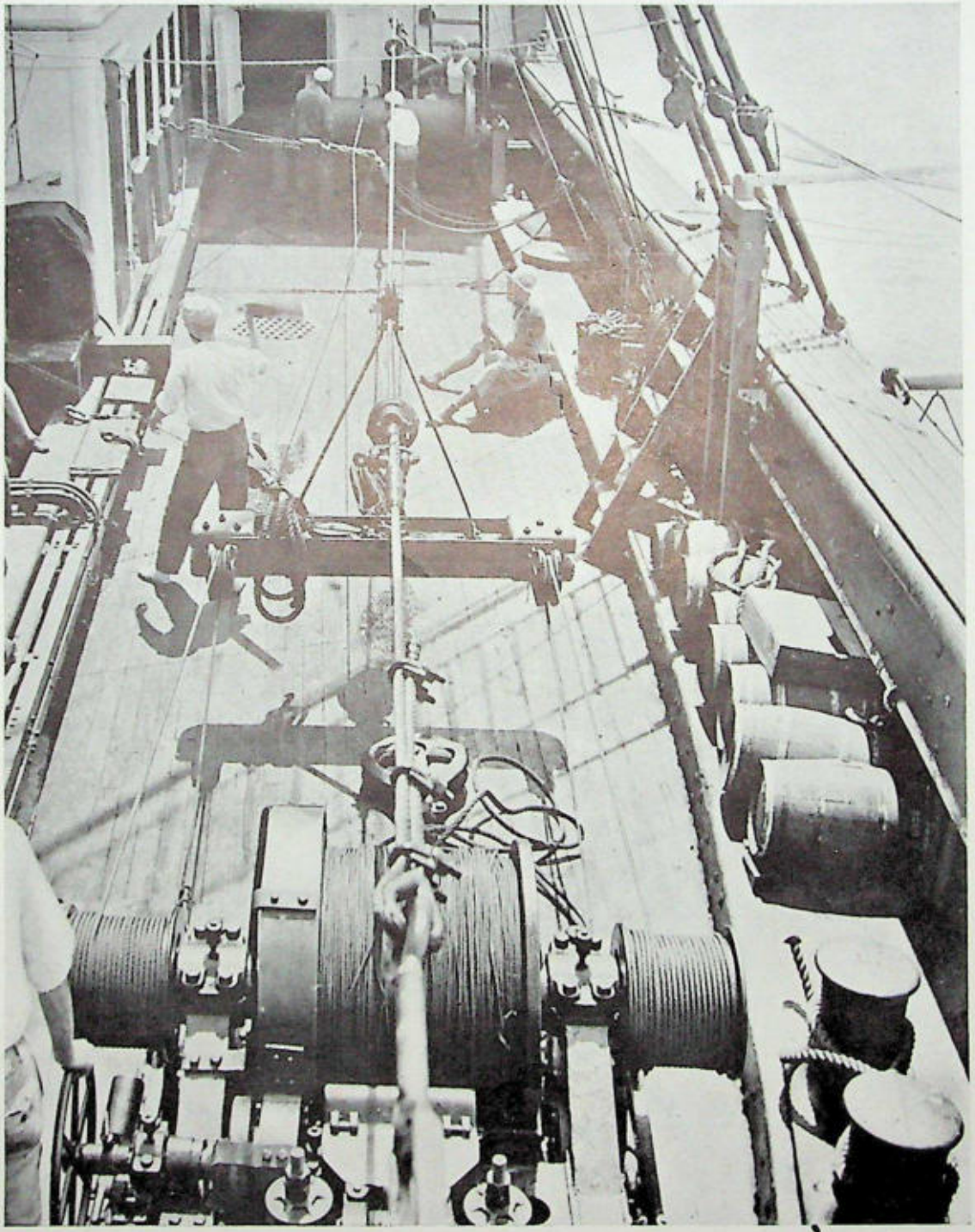
"The possibility of sudden strain (on the dredge or trawling cable) necessitates a constant watching of the dredge rope, as the ship's engines may at any moment be needed to ease the tension by stopping the vessel's way, and the hauling engines by paying out more rope."

It was the full realization of previous difficulties in such deep-sea trawling that prompted the development of a new method to overcome an old difficulty. Accordingly it became the privilege of the writer, who invented an automatic tension engine, to add a cable-reeling winch of novel construction which would carry nearly six miles of half-inch wire cable.

Already this deep-sea trawler has brought up rare and hitherto unknown marine life in that strange part of the Atlantic known as the Sargasso Sea. Under the stresses and strains incidental to trawling in heavy seas, and while the *Arcturus* was steaming as much as three knots an hour this apparatus has completely fulfilled the most exacting expectations.

Mr. Beebe has kept the world informed from time to time by radio of the remarkable per-

* Mr. Miller has devoted much of his professional career to the invention and designing of nautical equipment of extensively varied types. He is a member of the Naval Consulting Board, serving since its organization in 1915, American Society of Mechanical Engineers, Society of Naval Architects and Marine Engineers, the Canadian Institute of Mining Engineers and of many of the more prominent clubs and societies of New York City.—*Editor.*



DEEP-SEA TRAWLING MACHINERY

Specially designed apparatus on starboard deck for paying out the 30,000 feet of flexible steel trawling wire. A description of this intricate device is described by Mr. Miller in this Bulletin.

formance of the novel type of deep-sea anchoring and trawling machine that employs an automatic tension engine and a cable reeling winch of novel construction carrying 30,000 feet of half-inch wire cable, ultimate strength 25,000 pounds. This equipment, which was designed, manufactured and installed by the Lidgerwood Manufacturing Co., in cooperation with the consulting engineering department of Harrison Williams, is somewhat revolutionary in character, and a description may be of interest to those who are following Mr. Beebe's explorations in the Sargasso Sea in the Atlantic and in the waters of the Pacific Ocean about the Galapagos Archipelago and around Cocos Island.

The line drawing of the trawling apparatus is exceedingly instructive, as it shows this deep-sea device in action. The automatic tension engine with double 8¼ x 8-inch cylinders is shown in the foreground. An attendant has his right hand on the regulating wheel by which the operator alters the tension capabilities of the automatic tension engine (F). At the left of the drawing is the steam reeling winch (I), the winch man being seen behind the main reel lifting the pump handle lever for winding in the half-inch cable. Spooling is effected by an extremely simple spooling device which consists of a guide containing two rollers which is pulled one way or the other by a small block tackle. In the middle ground, just in front of the automatic tension engine, is the travelling carriage (B) carrying at the extreme ends two pulley blocks (A-E) for two ropes leading from the two drums on the extended drum shaft of the automatic tension engine. In the sketch, this is shown as a single line for the sake of clarity. The boom reaches outboard on the starboard side, and the line leads on a diagonal from a pulley block secured to the deck just in front of the traveling carriage.

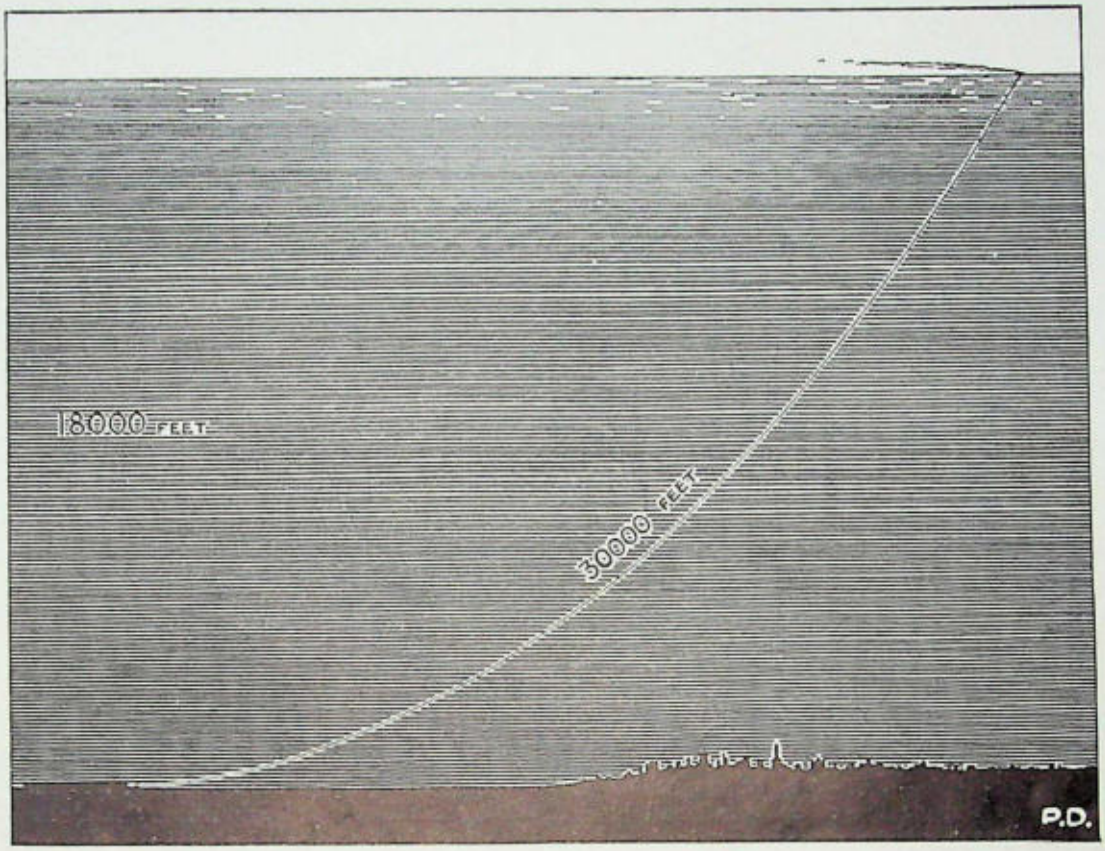
In the preparation of the sketch, it was necessary to exercise some license for the sake of clarity. There was no place from which it was possible to take a broadside photograph of the entire deck arrangement so as to include both winches in a single picture. A new deck-house extending from the bridge to the foremast was omitted in this sketch in order to bring the cable reeling winch into the picture. The boom, too, actually used on the starboard side, is shown on the port side in the sketch.

Cable Reel Winch—The cable reel winch (I) shown at the left of sketch has a total width of 8 feet 10 inches, and total length of about 9 feet. The reel, or drum, is a solid steel barrel 10 inches in diameter. The two steel flanges of the drum are 48 inches in diameter and are spaced 66 inches apart. A gear fixed to one of the flanges is driven by a pinion on the crank-shaft of a standard Lidgerwood winch. There are no friction drums, mechanical brakes nor clutches, and the whole operation of raising, lowering and braking is performed with the single reversing and controlling valve operated by the winchman through a pump-handle lever.

The half-inch line on the reel leads to and passes around a pulley block (A) secured to the traveling carriage (B). From there it leads to pulley block (C) anchored to the deck, thence around the pulley (D) attached to a shock absorbed coil-spring attached to one end of the extended boom, and from thence down into the sea to the net or drag. The automatic tension engine is bolted to the deck abaft the forecastle. Its cable leads from the drum to and around the pulley block (E) attached to the traveling carriage (B), then to a dynamometer anchored to the deck just abaft the automatic tension engine (F). The traveling carriage (B) is free to travel on the main cable (G) between the limit stops H and H, spaced 50 feet apart.

Lowering the Net—The net is attached to the end of the half-inch cable on the deck. It is then hoisted and swung outboard, the operation being performed by the winchman by simply raising his lever and admitting the steam to the winch in the forward direction. The net is then lowered, the winchman simply pushing his lever downwards. The net sinks very slowly in the sea because of the great amount of skin friction of the net itself. Lowering the net is begun by reversing the steam engine, admitting a small amount of steam in the reverse direction, which is accomplished by the winchman by simply pushing down on his lever. To prevent twists and kinks, the half-inch cable must not be paid out at a greater speed than that at which the net will sink. In fact it may take two or three hours for a trawling net to sink by gravity to the great depths that are being explored. As the net descends the weight of the wire rope suspended in the sea increases and the winchman raises his lever and applies steam in the hoisting direction, which acts as a brake to control the speed of lowering.

Penalty for Rapid Paying Out—If the cable is paid out faster than the net sinks, a loop will hang down into the sea, which may twist upon itself. As more line is paid out another loop may form, which may not only twist upon itself but may twist upon the first loop, and so on. All of this, however, could hardly be seen by any one on the deck. Such an accident did occur before the gear was fully mastered, and



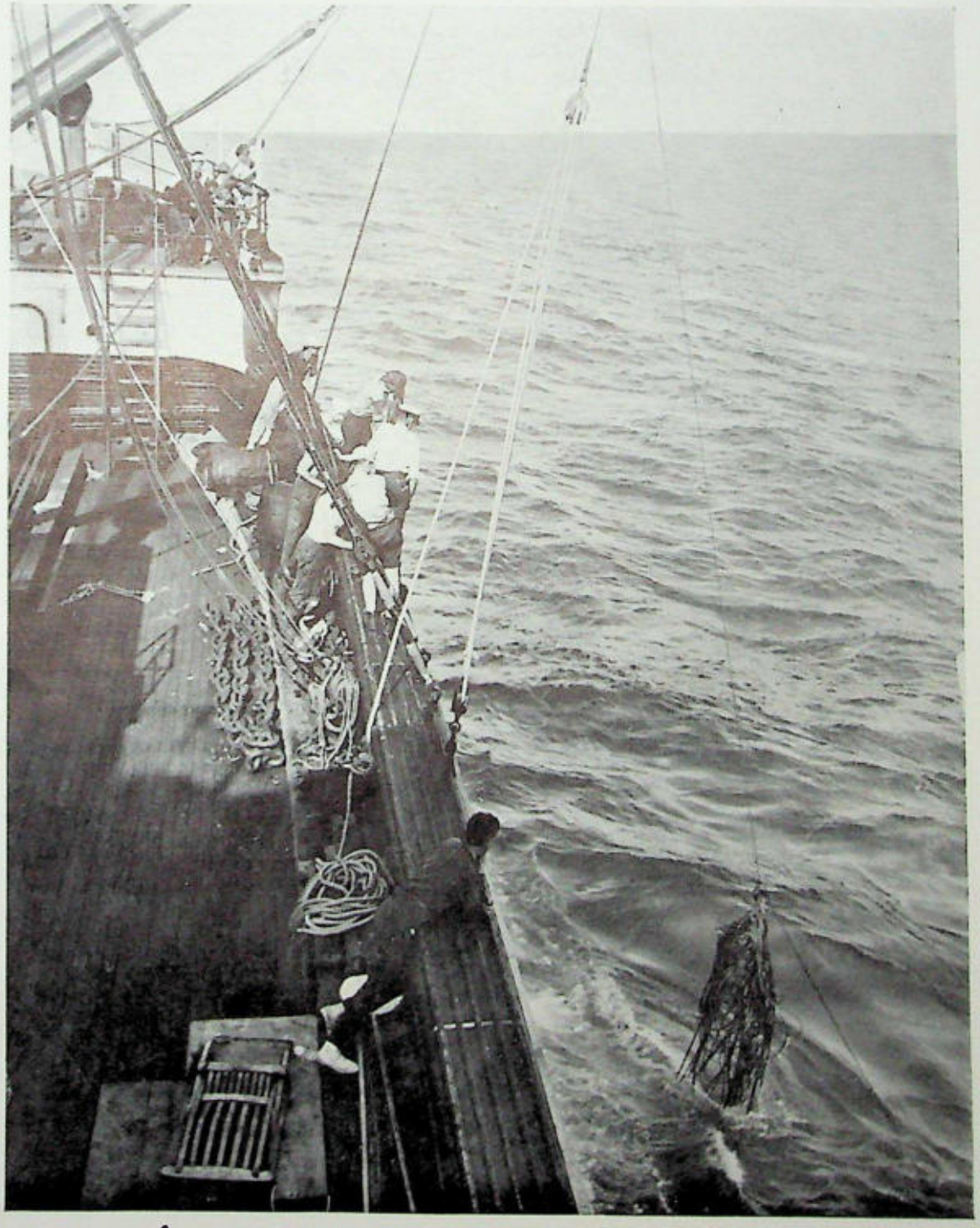
A DREDGING OPERATION

Scale drawing showing the comparative size of the *Arcturus* (upper right corner) in relation to ocean depths of 18,000 feet and the 30,000 feet of line necessary in dredging such a depth. The silhouette at the bottom of the drawing is an idea of the artist to represent the fabled city Atlantis. From a drawing by P. Dubosclard.

was observed while raising the net, when the rope emerged from the sea in an almost hopeless tangle. However, this tangled cable was brought on deck and straightened out. So far as known, this only happened once. The net has been frequently lowered to the bottom of very deep seas and has brought up a great number of most interesting specimens of fish that inhabit the ocean depths.

Dredging Operations—In the scale drawing (above) the depth of the ocean is shown as 18,000 feet. The *Arcturus* is shown in correct scale. Approximately 30,000 feet of half-inch cable has been paid out, which would necessarily drag in a catenary at approximately the angle shown. The *Arcturus* with this arrangement can safely tow nearly three times faster than previous expeditions of the same character. This is made possible by the introduction of the automatic tension engine and its ability to yield in the event of a hang-up.

Operation when a Hang-up Occurs—Assuming that the trawling or dredging operation is going on at a speed of three knots (about 300 feet per minute), the traveling carriage (B) held adjacent to the forward limit stop (H), the automatic tension engine adjusted to automatically yield and pay out at 10,000 pounds. The dynamometer (F), while it has nothing to do with the regulation of the automatic tension engine and was installed for scientific observation, will record the tension at all times, which might in this instance indicate a tension of 9,000 pounds. At any moment the net may foul on a ledge or a bit of wreckage sufficiently to cause a hang-up. With the net held fast and the ship moving three knots, the tension in the line would rapidly increase, and every man on deck would be informed of the hang-up as soon as the tension rose above 10,000 pounds, because the engine would then automatically pay out and the traveling carriage (B) would start to travel aft at approximately the speed of towing, assumed to be three



PENALTY FOR RAPID PAYING-OUT OF CABLE

If the cable is paid out faster than the net sinks, a loop will hang down which may twist upon itself. As this cannot be seen from the deck, a hopeless tangle of the line occurs.

knots, or 300 feet per minute. The traveling carriage (B) moving aft fifty feet, would pay out 100 feet of half-inch cable, automatically, in about twenty seconds of time. The winch man attending the cable reel engine has, in twenty seconds, time enough to rise from his seat, push down on the pump handle lever, and pay out line under perfect control at sufficient speed (about 300 feet per minute) to prevent rupture. At the beginning, the winch man should pay out fast enough to permit the traveling carriage (B) to move forward to the limit stop (H). It will therefore be noted that the operation of paying out the first hundred feet is entirely automatic, but after this the operation of paying out becomes a function of the main cable reel, which is paid out manually. During this twenty-seconds period when the automatic tension engine is paying out its 100 feet, orders may be given to the pilot to swing his ship and the man in the engine-room signaled to slow down. The *Arcturus* would then make a half-swing, steaming slowly in the opposite direction, during which period the winch man would wind in as long as slack existed. If the cable be wound in too fast, the tension might increase beyond 10,000 pounds, the automatic tension engine would yield another 100 feet, which of itself is a warning to the winch man to wind in slower. By this process the net should clear and be hoisted above the bottom of the sea, after which the ship may return to its original course and the net again be lowered and the dredging operations continued. Should any fear exist that the net was damaged, it could be hauled above the sea for examination and repair.

Automatic Tension Engine Acting Alone—The main drum the engine carries 1,500 feet of quarter-inch wire rope, and may be used alone for relative shallow trawling. In this event the cable reel engine and the traveling carriage (B) are not employed. The quarter-inch rope would then lead from the drum of the engine to and around pulley (C) anchored to the deck just forward of the cable reel engine, and thence to and over the pulley (D) attached to the end of the boom, and then dropped into the sea.

It may be of interest to know that when this problem was presented to the Lidgerwood Manufacturing Co. the request was made for an automatic tension towing engine to hold 30,000 feet of half-inch wire cable, but no such towing engine has been developed and it would require several months to produce such a machine. The design shown is therefore a compromise—the only plan that could be had in the time available. The towing engine is a standard machine, while the cable reel engine was special in so far as the reel was concerned.

In former expeditions it was found that in winding a great length of rope under heavy tension there was a great pressure on the drum itself but a far greater pressure on the flanges, tending to spread them apart. With this knowledge in hand, this particular drum, or barrel, was made of a solid steel, ten-inch shaft, which became the drum of the engine, and to which were fixed cast steel flanges heavily braced to take the thrust arising from the crowding of the rope at the ends of the drum, which crowding tendency may be eight or ten times the tension of the line itself.

OCEANOGRAPHICAL INVESTIGATIONS

A brief summary of various researches as set forth in "The Depths of the Ocean."

Written by Sir John Murray, K.C.B., F.R.S., *and* Dr. John Hjort

THE phenomena displayed at the surface of the ocean have been the object of observation from the earliest ages,—waves, currents, winds, tides, and the temperature of the water were matters of great importance and concern to the earliest navigators. It was not however, till about the time of the famous *Challenger* Expedition, nearly 40 years ago, (this book was issued in 1912) that any systematic attempts were made to examine the deeper and more remote regions, or to explore the physical and biological conditions of the ocean as a whole.

From time immemorial soundings were taken by hand with a plummet, always in shallow water near land, but attempts have not been wanting to sound the ocean without the aid of a line.

Briefly reviewed the methods, degrees of progress, ships employed in the exploration of the oceans and the scientists engaged in the work were as follows:

Fifteenth Century.—Cardinal Cusanus invented a bathometer, consisting of a hollow sphere with a heavy weight attached by means of a hook; on touching the bottom the weight was detached and the sphere arose to the surface, the interval of time elapsing from submergance to re-appearance of the sphere indicating depth.

Sixteenth Century.—Puehler improved the Cusanus apparatus, adding a device (clepsydra) to measure the time from the disappearance to re-appearance of the float, in the form of a small clay vase with a small orifice at the bottom, the amount of water entering during the experiment determining the depths. Alberti subsequently replaced the sphere by a light, bent metal tube.

1504.—Juan de la Cosa mapped the first soundings in shallow water in 1504, the soundings were recorded on maps by Gerard Mercator in 1585 and Lucas Janszon Waghenaer in 1586.

1521.—Magellan made probably the first attempt at oceanographical research—although it was not a success, when he attempted to determine the depths

of the Pacific Ocean during his first circumnavigation of the globe (1521). This was the first deep-sea sounding.

1667.—Robert Hooke described in *Philosophical Transactions* an apparatus similar to Puehler's with which experiments were made in the Indian Ocean. As there was some doubt to the exact moment of surface return of the float, he introduced, first a clock-work odometer to register descent, and then two odometers to register both descent and ascent.

1699.—Edmund Halley, Astronomer-Royal—to improve the knowledge of longitude and the variation of the compass, made what could be called a purely scientific voyage, though scientific voyages were really initiated in the time of James Cook in the second half of the eighteenth century.

1728.—Cruquius introduced bathymetrical contours on a chart of the river Merwede.

1737.—Philippe Bauche represented the bottom of the sea by isobathic curves to illustrate that elevations of the sea-floor correspond to the orography of the near-by lands. His conception of submarine mountains was the step towards founding geography on the real form and relief of each region.

1750.—Marsigli and Donati first employed the dredge for obtaining organisms from shallow water.

In the middle of the 18th Century, Dalrymple and Davy made observations on the temperatures of the equatorial current during a voyage to the East Indies.

1770.—Benjamin Franklin published the first map of the Gulf Stream.

1772-1773.—The Fosters—father and son made temperature observations beneath the surface on James Cook's voyages. Dr. Irvine on Lord Mulgrave's Arctic Expedition, employed self-registering thermometers for the first time in determining under surface temperatures. He also obtained water samples from various depths with a water bottle. On the same expedition some of the earliest attempts at deep-sea soundings were made by Capt. Phipps, recording depths of 683 fathoms.

1776.—Charles Blagden studied temperature distribution on the North American coasts.

1799.—O. F. Müller introduced a modification of the dredge which was known as the naturalist's dredge.

1780.—Sassure determined temperatures in the Mediterranean at 300 and 600 fathoms by protected thermometers.

1782.—Six's minimum and maximum thermometer was invented, and subsequently (from 1802-1826) was used by Krusenstern, Kotzebue, Sir John Ross and Sir Edward Sabine, Parry and Dumont d'Urville.

1800.—Péron experimented with slow-conducting water bottles in 1800—which were also employed by Scoresby in 1811 in soundings off Greenland, and by Kotzebue and Lenz in 1823.

1817.—Sir John Ross (1817-1818) by means of an apparatus of his own design called "deep-sea clamms" took soundings in depths of 450, 650, 1000 and 1050 fathoms in Baffin's Bay bringing up from the last mentioned depth a quantity of greenish mud. At 1000 fathoms, a star-fish was entangled in the line slightly above bottom—proving animals present in deep waters. Romme (1817) published a work on winds, tides and currents and similar studies were issued by Risso (1826), Lowe 1843-1860 and Johnson (1862-1866). Gunther brought out important papers (1860-1870) dealing with deep-sea and pelagic fishes, and James Rennell (1832) published an investigation of the Atlantic currents based on observations of sailors up to that time.

1830.—Audouin and Milne-Edwards in 1830 and Michael Sars in 1835 published the results of dredging in shallow waters within limited areas along the coasts of Europe.

1832.—Thouars used the protected thermometer for deep-sea temperatures in 1832, and this instrument also served in experiments conducted by Martins and Bravais in 1839, and by Sir James Ross during his Antarctic expedition in 1839 to 1843. The latter making many density observations of water at various depths.

1839.—Capt. Wilkes—accompanied by Dana—on the U.S. Exploring Expedition (1839-1842) made deep soundings with copper wire, and a few dredgings in shallow water. Sir James Ross, accompanied by Hooker—on the British Antarctic Expedition (1839-1843) engaged in important sounding and dredging work—making the first truly deep-sea soundings in depths exceeding 2000 fathoms. After many unsuccessful attempts to sound in deep water, due to want of proper line, Ross had a line 3600 fathoms in length especially constructed on board. It was fitted with swivels at intervals, strong enough to carry a weight of 75 pounds and lowered from an enormous reel in one of the ship's boats. With this line *the first* abysmal sounding on record was taken at 2425 fathoms on January 3, 1840, lat. 27°, 26″ South, long. 17°, 29″ West, and frequently during the cruise even greater depths were sounded. The dredge also was successfully used in depths down to 400 fathoms yielding an abundance of animal life. Hooker made known some of Ross's results particularly the importance of the role played by diatoms in the seas of the far south.

1840.—Forbes made a great many dredgings in the Aegean Sea. As a result of this work he divided the area inhabited by marine animals into eight zones, in which animal life gradually diminished with increase of depth, until a zero was reached at about 300 fathoms. He supposed that plants, like animals, disappeared at a certain depth, the zero of vegetable life at a less depth than that of animal life.

1843.—Aime introduced reversible outflow thermometers and about 1851 Maury used cylinders of non-conducting material for taking temperatures in deep water.

1844.—Loven studied distribution of marine organisms along the Scandinavian coast (1844), Johannes Muller investigated the pelagic life of the sea by water samples and tow net, giving the first impetus to marine biology (1845), Sir John Franklin (North Polar Expedition) accompanied by Harry Goodsir, made records of dredging results in 300 fathoms (1845). Spratt made dredgings in the Mediterranean at 310 fathoms, and later—brought up shell fragments at 1620 fathoms (1846) and Michael Sars published the results of dredgings on the coast of Norway, giving a list of 19 species from depths over 300 fathoms (1850). He was afterwards assisted by his son, G. O. Sars in this work, and together they issued a list of 92 species from depths between 200 and 300 fathoms, and showed some years later that marine life was abundant down to 450 fathoms. MacAndrew published a list of 750 marine mollusca of the Atlantic coasts of Europe and Africa from dredgings covering 43 degrees of latitude (1856).

1851.—The oceanographical researches of the United States Coast Survey may be said to date back to 1844 when the Director, Bache, issued orders to his officers to preserve deposit-samples brought up by the sounding machine. J. W. Bailey published the results of his examinations of these deposit-samples (1851) followed by other papers on the green sand formations in modern seas (1856). M. F. Maury was for a long period associated with the hydrographical work of the United States and issued several editions of his *Sailing Directions* to supplement the wind and current charts published by the U. S. Hydrographic Office, the last edition appearing in 1859. About this time, Midshipman Brooke conceived the idea of detaching the weight, used in carrying down the sounding lead, when it struck the bottom—the sounding tube, enclosing the deposit-sample, being alone drawn to the surface. This was an advanced improvement over the old method of lowering a heavy weight which had to be drawn again to the surface—as it showed surely the moment when the bottom had been reached. With his sounding apparatus, records of deep-sea soundings rapidly accumulated, enabling Maury to prepare the first bathymetrical map of the North Atlantic, with contour lives drawn in—at various depths from 1000 to 4000 fathoms (1854). The deposit-samples were examined and described by Bailey and by Pourtales. Systematic soundings were commenced by Lee in the U.S.S. *Dolphin* (1851-52) in the North Atlantic and by Berryman in the same ship (1852-53). Berryman in the U.S.S. *Arctic* sounded across the North Atlantic from Newfoundland to Ireland to verify the existence of a submarine ridge—along which it was proposed to lay a telegraphic cable; his deposit samples were described by Bailey. Pourtales and Agassiz made dredgings and soundings off the coast of Florida between Cuba and Florida under the auspices of the U. S. Coast Survey. Pourtales resumed the examinations of deposit-samples after the death of Bailey—the number collected up to 1870 being 9000. Agassiz reported the results of the dredgings, comparing the dredged forms with fossil types.

1857.—Capt. Pullen of H.M.S. *Cyclops* used the first thermometer with bulbs protected against heavy pressures, and shortly thereafter improvements of the six pattern and of Negretti and Zambra's reversing pattern were introduced and have been largely used ever since, improvements and modifications being incorporated from time to time.

Pullen and Dayman in H.M.S. *Cyclops* made a line of soundings along the great circle from Ireland to Newfoundland, using a modification of Midshipman Brooke's sounding machine. Huxley examined and described the deposit-samples naming a viscous substance found in the bottle *Bathybius*. This afterwards was shown by the Challenger observers to be a chemical precipitate. *Dayman* in H.M.S. *Gorgon* sounded the North Atlantic from Newfoundland to the Azores and thence southwest to England (1858). Sir Leopold M'Clintock on the M.S. *Bulldog* surveyed (1860) the route for the telegraphic cable between England and America in the region sounded by Berryman and Day; G. C. Wallich publishing the results of his important observations made during the cruise (1862). In 1860, the necessity of lifting a defective cable in the Mediterranean at a depth of 1200 fathoms disclosed living organisms attached which established beyond all doubt the fact that members of higher groups of animals really lived at great depths in the sea. Otto Torell during one of the Swedish Arctic and North Atlantic expeditions (1861-1864) dredged many animal forms from depths of 1000 to 1400 fathoms. Bocage (1864) described the glass-rope sponge which he found in 500 fathoms off the coast of Portugal; these results were confined by Perceval Wright (1868). Wyville Thomson and W. B. Carpenter, British naturalists commenced a series of short cruises in the North Atlantic and Mediterranean which may be regarded as a preliminary and leading up to the great *Challenger* expedition. On H.M.S. *Lightning* dredgings were made to depths of 650 fathoms, which proved the existence of varied and abundant animal life of all the invertebrate groups; many forms of hitherto unknown species, others identical with tertiary fossils, believed to be extinct or illustrating extinct groups of fauna of more remote periods. Bottom temperatures varied as much as 45° in two adjacent regions (30° F in one to 45° F in the other), a remarkable system of oceanic circulation so distinct that in an hour's sail it was sufficient to pass from waters of extreme heat to those of extreme cold.

1869.—Gwyn Jefferys associated with Carpenter and Thomson continued their investigations in three cruises of H.M.S. *Porcupine* off Ireland, in the Bay of Biscay and to the Faroe Channel, extending the research to the Mediterranean; the latter region being further studied in 1871 aboard H.M.S. *Shearwater*. Leigh Smith at about this time made several voyages to the Arctic regions, and like Scoresby recorded warmer layers of water beneath the colder surface waters of the Arctic Ocean.

1872.—In the interval between December, 1872 and May, 1876 H.M.S. *Challenger* with a staff of scientific observers circumnavigated the world, traversed the great oceans in many directions, made observations in nearly all departments of the physical and biological sciences, and laid down the broad general foundations of the recent science of oceanography. The results of this cruise were published by the British Government in 50 quarto volumes, and became the starting point for all subsequent observations. Contemporaneous with this expedition was that of the U.S.S. *Tuscarora* in the Pacific under Belknap, contributing greatly to our knowledge of temperature distributions and deep-sea deposits. The U.S.S. *Gettysburg* made soundings in the North Atlantic, during the year 1876.

Piano wire was first used on the *Tuscarora* for soundings. Some years previously Lord Kelvin had experimented with same medium aboard his yacht.

1877.—Agassiz in the U. S. Coast Survey Steamer *Blake* explored the Caribbean Sea, Gulf of Mexico and the coasts of Florida publishing a general account of the results in 1888. At the same time the U.S.S. *Albatross* made observations along the Atlantic coast of the United States and in 1891 under Agassiz explored the Pacific region along Panama. Murray and Tizard urged the re-examination of the Faroe Channel and H.M.S. *Triton* and *Knight Errant* (1880-1882) engaged in the work. The discovery of the Wyville Thomson Ridge which separates the warm and cold areas was one of the results of their work. A paper by Murray describing the findings of the four expeditions—recorded 216 species and varieties from the warm area and 217 from the cold; only 48 species were common to

both. The French ships *Travailleur* and *Talisman* explored the eastern Atlantic (1880-1883) and the Italian ships *Washington* and *Vettor Pisani* (1881-1885) engaged in biological and other research work. J. Y. Buchanan (1883) aided in the sounding work of the S.S. *Dacia* belonging to the India-Rubber Gutta-Percha and Telegraph Works Co., surveying a submarine cable route from Cadiz to the Canary Islands, and recorded several oceanic shoals rising steeply from deep water. He joined the same Company's S.S. *Buccaneer* exploring the Gulf of Guinea, with a trained naturalist John Rattray, and recorded many valuable observations—of depths, temperatures, densities and plankton. The U.S.S. *Enterprise* (1883-1886) throughout a cruise embracing all the oceans, brought together an important collection of deposit samples. Murray (1884-1892) investigated the sea-locks on the west coast of Scotland in his S.Y. *Medusa* discovering remnants of Arctic fauna; the physical results were used by Mill in his Memoir on the Clyde Sea Area.

1885.—The Prince of Monaco since 1885 has systematically carried on oceanographical work in the Mediterranean and North Atlantic with his yacht, *Hirondelle*, *Hirondelle II*, *Princesse Alice* and *Princesse Alice II*, founded and endowed a magnificent oceanographical museum at Monaco, an oceanographical Institute in Paris, and published many important Memoirs through the Monaco press. Makaroff (1886-1889) in the Russian S.S. *Vitiaz* voyaged around the world recording observations on temperature and specific gravity, and in 1890 the Russian scientists Lebedinzeff and Andrusoff investigated the physical and biological conditions of the deep waters of the black sea. Victor Hensen—with a staff of scientific men in the German S.S. *National* (1889) studied the plankton of the North Atlantic by improved methods. Natterer in the Austrian S.S. *Pola* made chemical studies of the waters of the Mediterranean and Red Seas and published some interesting results.

1893.—Nansen (1893-1896) in the *Fram* made his remarkable drift across the North Polar Sea, his soundings tending to prove that the Polar position is entirely a deep sea, as Murray had previously indicated. The Danish ship *Ingolf* (1895-1896) investigated the northerly portions of the Atlantic. The *Belgica*—with the Belgian Antarctic Expedition was the first vessel to winter in South polar regions (1897-1899). The German Deep-Sea Expedition on the *Valdivia* studied physical and biological conditions of the Atlantic and Indian Oceans penetrating the Antarctic as far as the ice would permit. Under the editorship of Prof. Carl Chun the results were published in a series of magnificent memoirs. The U.S.S. *Nero* while surveying a cable route between the Sandwich and Philippine Islands (1899) made the deepest sounding hitherto recorded, 5,269 fathoms, near Guam in the Ladrone Islands. Agassiz in the U.S.S. *Albatross* (1899-1900) carried on oceanographical observations in the tropical Pacific, and issued the results in a series of profusely illustrated memoirs. At the same time the Dutch S.S. *Siboga* explored the seas around the East Indies, with results of such importance that they were published in English, German and French by the leader of the expedition, Max Weber.

1901.—During the years 1901-1903, the British on the *Discovery* under Scott, the Germans in the *Gauss* under von Drygalski and the Swedes on the *Antarctic* under Otto Nordenskjold simultaneously explored the South Polar regions; and in 1902-1904 a Scottish Expedition on the *Scotia* led by Bruce likewise visited the same locality for scientific research. Between 1903 and 1911—the German ships *Edi*, *Stephan* and *Planet* made soundings in different ocean basins, the last named vessel (July, 1911) recording the greatest known ocean depth—5347 fathoms (32,088 feet); 406 feet more than six miles. The sounding was made 40 miles off the island of Mindanoa in the Indian Ocean. Agassiz in 1904 again explored the waters of the eastern Pacific in the U.S.S. *Albatross*, the published results constituting a great advance over our knowledge of the Pacific. In addition to the specific expeditions mentioned in the foregoing paragraphs, many British cable and surveying ships over a period of thirty years amassed an immense amount of valuable data regarding ocean depths and temperatures. The principal ships, oceans investigated and the periods of time in which each was engaged are as follows:

H.M.S. *Egeria*	Atlantic, Indian and Pacific	1887 to 189[illegible]
H.M.S. *Waterwitch*	" " " "	1894 to 1901
H.M.S. *Rambler*	" " " "	1888 to 1904
H.M.S. *Penguin*	Indian and Pacific	1890 to 1906
H.M.S. *Stork*	Indian and Atlantic	1888 to 1897
H.M.S. *Investigator*	Indian Ocean	From 1886 to the present time
H.M.S. *Dart*	Pacific Ocean	1888 to 1902
S.S. *Britannia*	Atlantic, Indian and Pacific	1888 to 1907
S.S. *Great Northern*	Atlantic and Indian	1882 to 1897
S.S. *Chiltern*	" " "	1886 to 1897
S.S. *Amber*	" " "	1888 to 1906
S.S. *Scotia*	" " "	1883 to 1898
S.S. *Seine*	" " "	1885 to 1899
S.S. *Electra*	" " "	1887 to 1903
S.S. *John Pender*	" " "	1878 to 1901
S.S. *Duplex*	" " "	1906 to 1907
S.S. *Silvertown*	Atlantic and Pacific	1889 to 1900
S.S. *Retriever*	" " "	1880 to 1907
S.S. *Sherard Osborn*	Indian and Pacific	1888 to 1907
S.S. *Recorder*	" " "	1888 to 1907
S.S. *Dacia*	Atlantic	1883 to 1905
S.S. *Minia*	"	1885 to 1907
S.S. *Norseman*	"	1893 to 1907
S.S. *Buccaneer*	"	1886 to 1906

The results of these searching investigations over a period of thirty years have brought about the establishment of more or less prominent marine laboratories both in Europe and America, but the founding of the Zoological Station at Naples in 1880 by Anton Dohrn marks an era in all that concerns the histology and embryology of marine organisms. Similar marine laboratories have since been founded in many parts of the world for purely scientific research and others for the investigations of economic questions concerning the habits and development of food fishes.

The progress of oceanography depends largely upon the development of mechanical aids, not alone the scientific instruments, but the ship as well. Since the days of the *Challenger* Expedition oceanography has made great strides and there are now available appliances unknown to the pioneers of those days.

New York Zoological Society

OBJECTS OF THE SOCIETY

¶ A PUBLIC ZOOLOGICAL PARK. ¶ A PUBLIC AQUARIUM. ¶ THE PRESERVATION OF OUR NATIVE ANIMALS. ¶ THE PROMOTION OF ZOOLOGY.

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ELWIN R. SANBORN, *Editor*

VOL. XXVIII JULY, 1925 NO. 4

THE ARCTURUS EXPEDITION

This number of the *Bulletin* is devoted to the voyage of the *Arcturus*, under the direction of William Beebe of the Department of Tropical Research.

This enterprise was first rendered possible by Mr. Henry D. Whiton, who offered to furnish a vessel—and this offer materialized in the splendid ship *Arcturus* which he loaned to the Society. Mr. Whiton is a member of the Board of Managers, Class of 1927, one of the Executive Committee and as Chairman of the Arcturus Committee has freely given his time and advice toward the successful promotion of the expedition.

The Arcturus Committee, in addition to Mr. Whiton, includes Harrison Williams, Henry Fairfield Osborn, Jr., William Beebe, Dr. W. K. Gregory and George Palmer Putnam, and the Society tenders this committee its most grateful acknowledgment for their painstaking thought and unselfish effort in the successful development of the plans of the expedition, and a dissemination of the news of the progress of the party and their scientific discoveries. Mr. George Palmer Putnam of the Committee has been particularly successful in promoting the exceptional publicity.

This oceanographic venture is the most elaborate and ambitious scientific expedition as yet undertaken by the New York Zoological Society and has been made possible through the great generosity of a number of its members.

The purpose of the expedition was to obtain specimens of marine life from the surface, from the bottom and from the mid-depths of the Sargasso Sea, which is located in the north Atlantic Ocean about one-third of the distance between America and the African continent.

Later, the expedition was to pass through the Panama Canal to the region of the Galapagos Islands, where a similar series of studies were to be made in the cold Antarctic Humboldt Current.

This program has been successfully carried out.

By a most fortunate accident the *Arcturus* arrived off the Galapagos at the very time when the position of the Humboldt Current had been profoundly disturbed by unknown causes at the same time that two volcanoes on the Galapagos became active.

The result of this shifting of the Humboldt Current, together with the activity of the volcanoes, produced a marked disturbance in oceanic life.

The observations, therefore, taken under these circumstances have a unique value and many forms of marine life new to science have been discovered.

There are published, herewith, a sympathetic article by Henry Fairfield Osborn, Jr., who is a member of the Arcturus Committee of the Society and has kept in close touch with the details of the expedition, an article describing the general apparatus and the reconstruction of the *Arcturus* to meet the requirements of the scientific staff by Edwin C. Bennett, Naval Architect and Consulting Engineer of New York City, and a detailed description of the intricate trawling and dredging machinery by the designer, Spencer Miller, who is a member of the Naval Consulting Board, the American Society of Mechanical Engineers, American Institute of Mining Engineers and the Society of Naval Architects and Marine Engineers.

DR. GREGORY, PROF. HENRY FAIRFIELD OSBORN AND MR. BEEBE

Prof. Osborn has lent his magnetic encouragement to all the enterprises of the Society. He accompanied the present expedition to Norfolk, Virginia, leaving the ship at that port.

The financing of the *Arcturus* Expedition up to date, has been accomplished as follows:

Total contributions and advances to the expedition to June 22, 1925, by Harrison Williams		$107,226.06
Estimated remaining disbursements, including accrued wages of officers and up to arrival of the *Arcturus* at New York City on assumed date of August 10, 1925		34,186.94
Estimated expense of winding-up the expedition, including accrued compensation of scientific personnel		7,500.00
Probable total contributions and advances to the expedition by Harrison Williams		$148,913.00
Total of other contributions to date and the donors:		
Marshall Field	$10,000.00	
Clarence Dillon	10,000.00	
Vincent Astor	10,000.00	
George F. Baker, Jr.	2,000.00	
Arthur T. Newbold	500.00	
Junius S. Morgan	250.00	
Thomas S. Gates	500.00	
American Museum of Natural History	5,000.00	38,250.00
Total estimated costs of the *Arcturus* expedition, including the "2nd Sargasso Sea Cruise"		$187,163.00

Madison Grant.

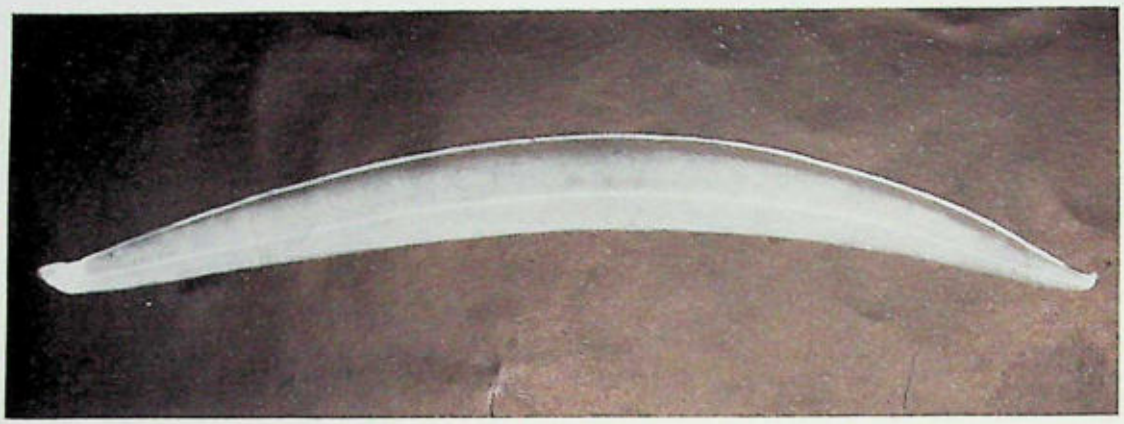
DEPARTMENT OF TROPICAL RESEARCH

THE NEW YORK ZOOLOGICAL SOCIETY "STAFF *Arcturus* EXPEDITION"

William Beebe, *Director;* W. K. Gregory, *Associate in Vertebrates;* L. Segal, *Associate in Special Problems;* C. J. Fish, *Associate in Diatoms and Crustacea;* John Tee-Van, *Assistant in Photography;* E. B. Schoedsack, *Assistant in Cinematography;* William H. Merriam, *Assistant in Field Work;* Isabel Cooper, *Scientific Artist;* Ruth Rose, *Historian and Technicist;* M. D. Fish, *Assistant in Larval Fish Distribution;* Dwight Franklin, *Assistant in Fish Preparation;* Jay F. W. Pearson, *Assistant in Macroplankton;* Serge Chetyrkin, *Preparateur;* D. W. Cady, *Surgeon.*

MOUNT WHITON AND MOUNT WILLIAMS

Volcanoes on Albemarle Island in the Galapagos Archipelago which were in violent activity while the expedition was in those waters, were appropriately named in honor of two of the patrons of the enterprise.



EEL CAUGHT IN MID-OCEAN
It is a species new to science—as transparent as glass.

LOGGING THE *ARCTURUS*

A review of the operations made at various points, including reports from Mr. Beebe, supplemented by radio news, covering the first Sargasso-Galapagos Cruise.

February 11, 1925.—Noon—Passed Ambrose Light.

February 13, 1925.—3:00 A.M. Newport News—Coaling.

February 18, 1925.—6:00 P.M. St. George, Bermuda Islands. Working 20 hours a day to get settled. Encountered two gales causing much shifting of fragile boxes. Much time expended building ledges and fiddles for support of delicate instruments.

February 26, 1925.—Noon—Latitude 26° 37′ North—Longitude 51° 14′ West. Entire Western Sargasso Sea torn apart by storms. Bow pulpit perfect success. First ribbon-like eels caught.

February 28, 1925.—Noon—Latitude 27° 50′ North—Longitude 46° 55′ West. Despite heavy seas made successful haul from two miles depth, obtaining red shrimps, giant-mouthed luminescent fish. Weed widely scattered by storms. Headed northeast for Atlantic Ridge. Must return here in July.

March 4, 1925.—Noon—Latitude 26° 43′ North—Longitude 48° 52′ West. Heavy seas prevent work and launching boats. Sargasso completely scattered by rough water, so that little life is present at this season. Now over Atlantic Ridge which is supposed to be the site of fabled Atlantis. First bottom dredge brought up glass sponges, volcanic rock, and all sorts of weird fishes. Quick work of crew prevented bad accident to trawl.

March 5, 1925.—Noon—Latitude 25° 29′ North—Longitude 51° 16′ West. *Arcturus* west bound for Canal.

March 7, 1925.—Noon—Latitude 23° 43′ North—Longitude 55° 09′ West. Successful deep-sea hauls yield several new species of fish, and a strange fish with scales like hair or feathers. Red octopus tentacle brought up by sounding machine from three mile depth. First Sargassum fish captured has fins like hands; a mass of its eggs is hatching in an aquarium. Rolling through heavy sea bound for Echo Bay.

March 11, 1925.—Noon—Latitude 20° 10′ North—Longitude 60° 27′ West. Despite continued high winds, rains and heavy seas can report success. Two sections made across Sargassum Sea which is torn to shreds at this season. Necessary to return in July to solve problems. Specimens, color drawings and photographs are accumulating. Deep hauls difficult because of heavy seas; deep sea fishes small, but include several new forms.

March 15, 1925.—Noon—Latitude 17° 39′ North—Longitude 63° 15′ West. Ship in heavy seas; secured in one haul five specimens Amphioxus lowest form of backbone animal; never before found at sea. Dredging on Saba Bank. Many strange specimens; one irridescent fish living in giant red sea-cucumber; a brilliant butterfly fish and trigger porcupine fish. Worked three days in shadow of Saba Volcano. Steaming slowly through Caribbean Sea toward Panama.

March 20, 1925.—Noon—Latitude 11° 11′ North—Longitude 77° 05′ West. Captain Howes wired "*Arcturus* voyage Pacific will be minimum of six weeks. Two trips of six weeks, allowing for twenty days each in Humboldt Current."

March 22, 1925. — Noon — Arrive Panama Canal. Filling bunkers with coal. End of the first Sargasso cruise.

March 26, 1925.—First Report of William Beebe, Director.

Colon, Panama Canal Zone, March 26th, 1925.—Our first month's work has assuredly afforded us an acid test of oceanographic work under most trying conditions. Prof. Osborn and Mr. Satterlee will have given you vivid accounts of the heavy weather which the *Arcturus* experienced on the first two short legs of her trip. After leaving Bermuda this continued, and our ideas of the worst month of winter in the central Atlantic in general and the Sargasso Sea in particular will not soon fade from our memories. For week after week we would hope each morning

HYDROGRAPHIC INSTRUMENTS IN USE

Sending down a deep-sea thermometer, which will return with a sample of water and a record of the temperature at a depth of a half-mile.

for a moderately smooth sea, but from the daily wireless reports from other parts of the Atlantic, we must have been receiving the continual heavy swells resulting from the unusual gales which marked February and March in many parts of this ocean.

On only two days was it calm enough to put a boat of any kind overside, and the wallowing and rolling of the vessel made even surface towing very difficult. We lost several nets and one dredge was bent at right angles, but we were comforted when we read the reports of the *Challenger* and *Albatross*, and learned of their continual mishaps. Microscopic work and any delicate drawing or painting were impossible, and only by bringing the ship up into the wind were we able to keep any food at all upon the table. On many nights sleep was out of the question, owing to the necessity of being braced every moment to keep from being thrown out of our berths. For days it was impossible to work in a chair and we did all our writing and the preservation of specimens sitting on the floor of the laboratory. In spite of this the *Arcturus* behaved splendidly, and we managed to get a remarkable amount of work done.

Every respite from mountainous waves was improved by sending over tow-nets, trawls and dredges, and we collected a series of specimens from every depth. Miss Cooper, although suffering part of the time from sea-sickness, has been able to produce fifty colored plates.

The Sargasso itself showed conditions which have never been recorded. There was plenty of weed, and for many days we passed through continual lines of it, one or two hundred feet apart, which, if collected, would have made many acres of solid fields. Whether this season was unusual, or whether this is the ordinary February phase of distribution I do not know, but it is certain that the waves and storms completely destroyed any possibility of extreme focalization. Even the two days of comparatively smooth water were sufficient to cause a noticeable concentration of sargasso.

Despite the high seas we were able to scoop up hundreds of netsful of weed and examine it thoroughly. As we went farther East the weed became fresher and showed signs of vigorous growth, but everywhere there was a decided lack of life. At one time or another we were able to gather a fairly representative lot of the sargassum fauna for a Museum group, but I have found more fish and other organisms in a single head of weed in July which I have grappled from the deck of a steamer bound for British Guiana, than we saw here during an entire week. The solution seems to be that there is a very marked winter season in the Sargasso Sea which has never before been observed, and we struck it at exactly this time. From the number of eggs and larval organisms, the life of the weed is at its yearly minimum, not to develop in any quantity until the quiet seas of May, June and July induce a concentration of the scattered heads of weed into the great fields which a few travellers have seen but not investigated. The government map of distribution for February is wholly wrong. Indeed we found a much wider scattering of weed than is marked for the maximum in August. We observed it in abun-

THE ROPE SCALLOP DREDGE

In the Pacific the expedition drifted into a summer sea, and every variety of dredging paraphernalia was used.

dance on the outer border of the Gulf Stream before we reached Bermuda, while on the mid-Atlantic Ridge twelve hundred miles to the east, and when we sighted Sombrero and the Lesser Antilles, an equally great distance to the west and south, innumerable patches were still passing.

I blamed myself at first for having chosen the wrong part of the Atlantic, and then the thought occurred to me to get in touch with whatever ships might at this time be traversing other parts of the Sargasso Sea. This proved successful, and morning after morning the wireless men would come with reports from various vessels which were steaming through the general area to the north and northeast of us. All, without exception reported similar conditions, heavy weather with widely scattered pieces of weed. When I had finally charted the routes of all previous expeditions in this region, I found that unknowingly I had laid our course through the only hitherto unexplored part of the sea.

Our objects in coming to this sea were to anchor if possible in one spot and study the conditions of life in the weed and in the deeps under it. The moment that reports from these other vessels enabled me to form a comprehensive idea of the conditions existing at this season in the region in general, Dr. Gregory and I held a consultation and he agreed unreservedly with me that it was a waste of time and money to remain longer. The weed was scattered and its fauna at the season of lowest ebb, the continual high seas prevented any deep hauls except with danger to ourselves and our equipment, and when we had secured specimens, examination and study of them was difficult and the use of aquariums impossible. Our coal supply had lasted well and by returning at once we would conserve at least a third of it and probably make it possible to return to this region for a short stop on our way home and complete the objects of this part of the trip. By steaming quickly to the Canal and through to the Pacific, we would find conditions ideal for work during April and May. Hence the sudden change in our plans.

The ocean bottom in the supposed locality of the mysterious continent Atlantis was surveyed two years ago by the United States Navy with the new sonic depth finder which measures depths by the length of time it requires for sound waves to travel to the ocean bottom and return. Dr. Harvey C. Hayes in charge of these measurements, was deeply interested to find an area rising from the ocean bottom which suggested an ocean continent. He found an old coast line with shelving beaches of sand and gravel and other characteristics indicating that what was then the floor of the ocean might once have been at the surface.

We are now shifting coal at Colon, and on Friday will proceed to the Pacific, where I feel certain I shall be able to make as thorough a survey of the Humboldt Current as I had planned to do in New York. Our trip across the Caribbean has been smooth only because we had a strong fair wind and current, a following gigantic swell, which, were we to turn and get into its trough, would roll us to the very scuppers. Mr. Tams, our second mate, who was taken because of his experience on the *Albatross*, says that under the conditions existing in the Sargasso Sea, no expedition, however much more experienced, could have done more in the way of successful hauling than we were able to do.

Fortune has been with us, for in spite of the scanty catch in point of numbers which has marked

Pale blue snails which have lost their shells and developed water-wings for aid in floating on the surface.

our efforts, we have taken some of the most interesting deep-sea fishes. Cyclothones of several species, with many luminescent organs over the whole body, and relatively immense jaws and mouths, Sternoptychus or hatchet fish of remarkable shape and with eyes which look directly upward. The greatest prize was a Stylophthalmus, a small creature, eel-like in general appearance, with a mouth like that of a duck or Ornithorhynchus, and eyes on the ends of long, slender tentacles. Another day we caught the young stages of the same weird creature. A single specimen was taken of what we called the Unicorn Sea Serpent, with luminescent cephalic median horn and tail tip. This may prove to be the larval form of the Fierasfer.

We also have larval flying-fish, and several others so strange that we can fit them into no genera or even sub-families.

As regards the staff I can truly say that I should make no change were I to start the expedition over again. Only even at this comparatively meagre phase of the trip I could have used several more brains and pairs of hands. There has been no idleness and no misdirected effort. The Captain, officers and crew are enthusiastic and have done all they could to help us. Two days ago when the stokers off duty caught two splendid Coryphaena, the fish called dolphins, on hand lines over the stern, every member of the crew crowded our part of the deck while we painted, measured and dissected the big fish.

The machinery has worked well under the most trying conditions conceivable, and the towing engine has saved a dredge more than once. The bow pulpit and the double boom gangway off the port side have justified themselves a score of times. With occasional drenchings we have been able to use them in all but the worst weather, to study flying fishes at close range and to catch all the weed we wished for study. The outside runway and the boats have had no chance as yet. A person would have been washed away from the one, and the boats themselves smashed and sunk had we attempted to use them.

The laboratory is perfectly satisfactory, and the forward hold storage with its unshiplike stairway puts every portion of our gear within easy reach.

My dissatisfaction with the first month of our six months of expedition is not because it has not produced many interesting specimens and discoveries, but that I try to keep up to such a high standard of effective work accomplished on every expedition, that I know everything done thus far will pale into insignificance in comparison with what is before us in calm weather, or in any reasonable swell.

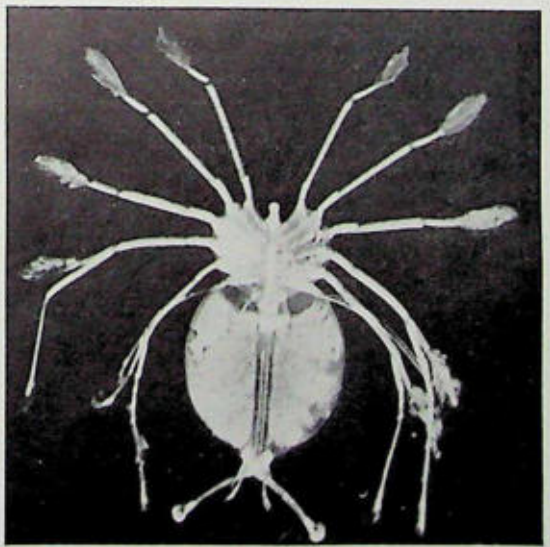
My future plans are necessarily vague as to exact details, but in general are what I planned before leaving New York; to make careful soundings from Panama south and west, avoiding all the tracks of former expeditions, and to select the best possible location in the richest part of the Humboldt Current and remain there until we have accumulated as complete a knowledge as possible of the ocean life from the surface to the bottom.

The one error in regard to the ship was the water supply. In spite of every economy, the fresh water gives out before two-thirds of the coal has been used up. This may make it necessary for us to return for more water, if we fail to encounter rain-storms. In such a contingency I shall see that every day of the return is over a different route, thus yielding new data.

Postscript by W. K. Gregory:

After hearing this report read I feel that in some respects it quite understates the value of the results already obtained. In spite of the unfavorable conditions noted, teamwork in handling the complicated oceanographic gear has been highly developed so that the operations of sounding, dredging, trawling and the rest are now thoroughly understood by those engaged in the work. Again the swarming life of the plankton has been carefully studied and a great body of observations made and recorded.

It is almost impossible to convey an adequate idea of the beauty and interest of the deep-sea and other fishes already secured. Although it will be necessary



A strange ghost crustacean as thin as paper and as transparent as glass.

A new species of deep-sea fish, with an enormously distensible stomach which can contain prey larger than itself.

to return to the Sargasso Sea later in the season, we even now have a fair series of specimens and many color drawings for a striking Sargasso exhibit. Each member of the staff has had leisure and opportunity to work on definite problems and to fit himself for effective cooperation with the rest. All look forward with great confidence toward success.

March 28, 1925.—Noon—Steaming through Panama Canal. Arrived Balboa in afternoon and sailed from there night of March 28, 1925.

March 29, 1925.—Noon—Latitude 7° 15′ North—Longitude 79° 56′ West. Sailed from Balboa, Pacific side of the canal midnight 28th-29th.

March 31, 1925.—Noon—Latitude 3° 23′ North—Longitude 83° 34′ West.

On March 28 we made the transit of the Panama Canal and prepared to investigate the life of that part of the Pacific which, though on the Equator, is traversed in a northerly direction by the cold Antarctic stream known as the Humboldt Current. This is a reversal of conditions brought about by the Gulf Stream, and is responsible for many paradoxical facts, such as the presence of those antarctic creatures, penguins, living and thriving under the intense heat of the equatorial sun.

On the third morning of our Pacific voyage we woke at dawn to an amazing sight. Stretching to the horizon, a narrow line of foam zig-zagged across the placid sea, with spouting whitecaps shooting up through the froth that marked the meeting-place of two great ocean currents, presumably the Mexican and the South Equatorial. These two streams within the sea, wider than any rivers in the world, bore along a vast population, and at their junction the traffic was more seething than at the intersection of any human thoroughfares.

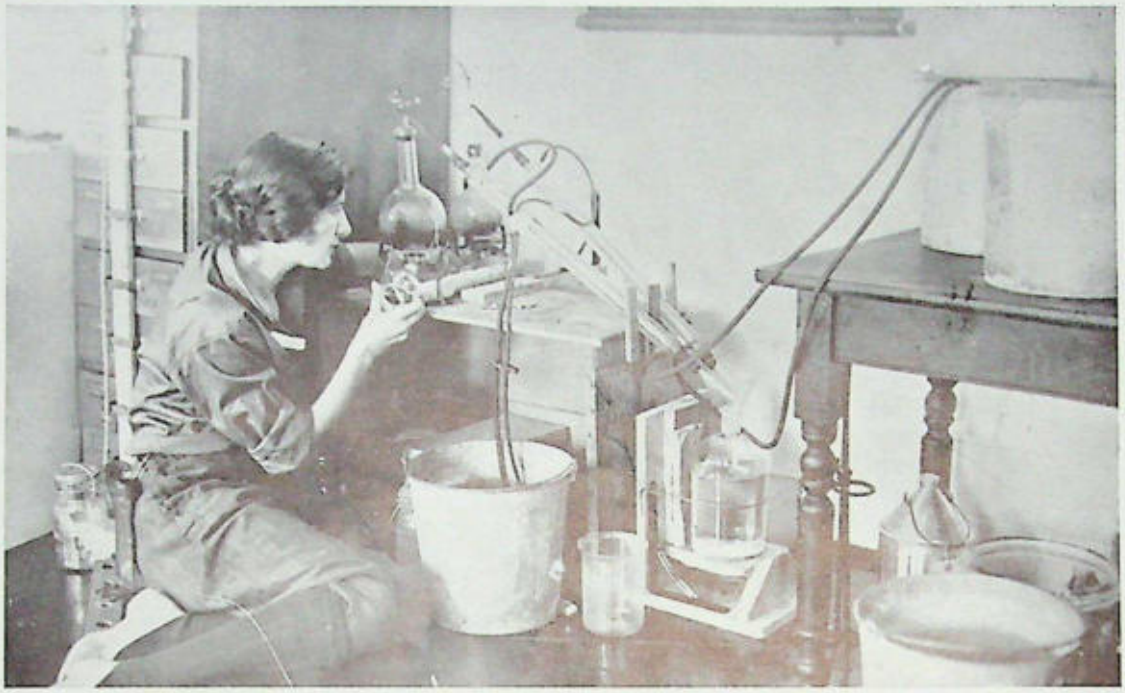
Bits of floating wreckage abounded and each was a focal point for a hundred different sorts of animal. Schools of fish lurked in the shadow cast by plank or log, the smallest ones nearest the centre, where they darted about snatching off the barnacles, worms and crabs that clung to every inch of the sodden wood. Working out toward the periphery of the circle, the predatory fish increased in size, feeding now upon their smaller fellows, until the maximum was reached in the swift-gliding dolphin fish, five or six feet long, whose green and gold scales gleamed dazzlingly as they dashed in and out in cannibalistic raids.

On many such pieces of flotsam perched gannets of two or three species, too gorged with easily obtained food to rise even when the *Arcturus* almost brushed their resting places. Here and there birds rode the small swells, quite unconcerned about the fins of sharks that cruised leisurely around them. Only when the enormous phenomenon of our ship bore straight down upon them could they summon energy to flap their well-fed bodies from under her forging bow.

For two days the *Arcturus* drifted in this fertile territory, while every waking moment was occupied in gathering specimens. In the Atlantic we had been accustomed to drag our tow-nets just under the surface for an hour or two, in order to gather a moderate amount of plankton. Here fifteen minutes of towing was ample to fill the fine silk nets and the bottles tied at the ends of them with such a mass of organisms that the mere matter of sorting them was the work of hours.

Under the term "plankton" is included all those forms of life, mostly small in size, which drift to and fro in the oceans wherever the currents carry them. Many kinds of crustaceans, both adult and larval, the myriad species of jellyfish and tunicates, larval fishes, single-celled animals, certain mollusks—these and others are classed as plankton, since they swim but not strongly enough to go counter to the currents. Where plankton is abundant, there will the fish be plentiful, as the smaller ones feed upon the tiny drifting organisms, and are in turn fed upon by larger fish, the circle being completed when one of the big marauders dies and furnishes food, not only for his former victims, but for the minute creatures that he would have disdained as nourishment.

A mass of life caught in a pail from the wonderful current-rip in mid-Pacific. In this maelstrom were fishes, snails, jellyfishes and a multitude of other creatures.



A CHEMICAL LABORATORY ON THE *ARCTURUS*

Miss Segal distilling water in an apparatus of her own construction, for use in her work in the fluids of deep-sea fishes.

In the Atlantic we had been worried constantly by the fear that the plunging of the ship, as she wallowed in the huge swells, would put an unbearable strain on the trailing nets. Here in the Pacific we had a summer sea, day after day, with hardly a ripple to disturb us as we used our varied paraphernalia. This ranges from small surface nets made of the finest silk to huge cumbersome dredges of rope on heavy iron frames. Between these two come trawls of various sizes and shapes for sweeping the waters between the surface and the great depths or bottom. Our forward deck is completely given over to the machinery necessary to the handling of all the types of net with which we dip into the mysteries of the sea—winches, drums, automatic towing devices, booms, blocks and tackle. An iron framework with a rail waist-high around it can be raised and lowered on the bow, so that one can stand a foot or two above the water and with dipnet or harpoon secure specimens at close range.

This platform, which resembles the pulpit that is used for catching swordfish, was a favorite spot while we lay in the strange current rip.

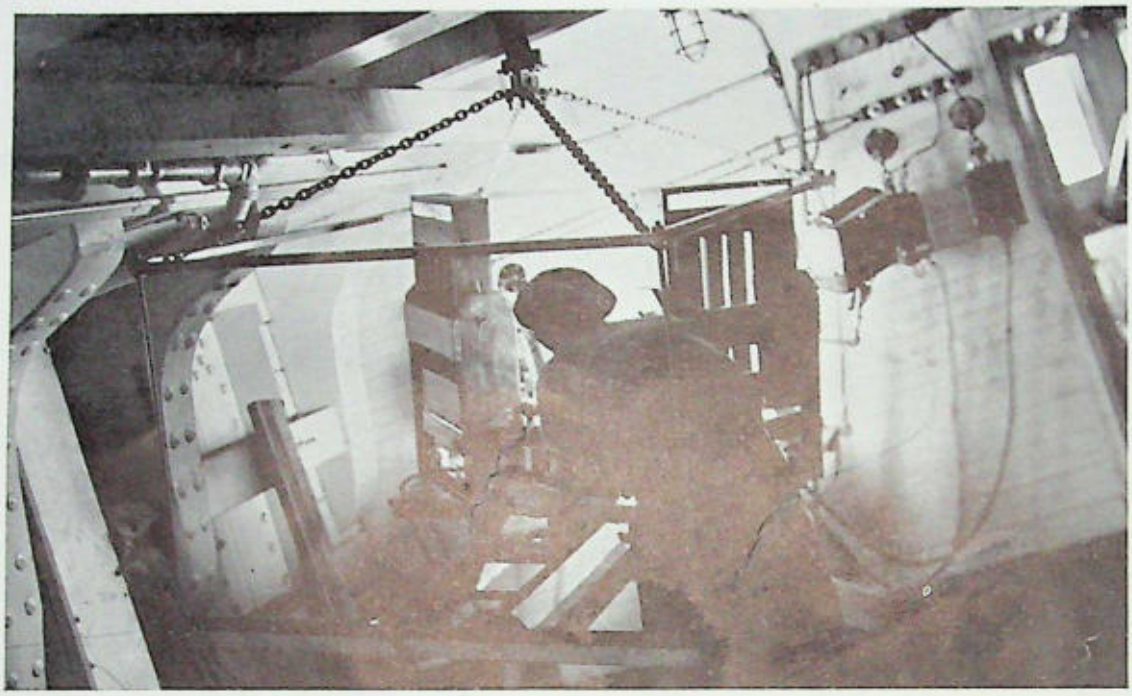
An extraordinary feature of this uncharted zoologist's paradise was the narrowness of its limits and the sharpness with which those limits were defined. A few yards on either side of the line of foam the water was comparatively barren of life, yet the line itself seethed with billions of creatures, clinging to its erratic angles as though magnetized. The plankton was, of course, irresistibly swept there, and as for the larger forms, there is no stronger magnet in life than food.

Sometimes great patches of the water were colored a deep purple by incredible numbers of delicate jelly-fish. A long bamboo stem that we brought aboard bore clusters of pale pink, white and yellow goose-barnacles on every twig, so that the leafless, rotting branch looked at a little distance like a spray of cherry blossoms. Flying fish, glinting blue and silver, skittered on all sides, and in the middle distance a large school of porpoises described their beautiful, easy arcs over invisible barriers, now and then hurling themselves clear of the water for the pure joy of play.

Four large sharks loitered round and round the ship in deliberate fashion, and from the boom we paid out string with pieces of meat for bait. They came as easily to this toll as a donkey following a proffered carrot, and by pulling in the tempting morsel two feet in front of the eager blunt snouts we brought them to the surface directly under our feet, so that we could watch the movements of the brilliant blue pilot-fish that with uncanny prescience anticipated every movement of their huge patrons.

The shark has even more literal hangers-on in the persons of the shark-suckers. The big fish can seldom be lonely, for there is scarcely a shark to be found without at least one of these parasitic attendants, known as Remora. These fish exhibit one of the most marvelous adaptations that we know, the dorsal fin having become metamorphosed into a flat plate with numerous ridges which transform it into a powerful sucking disk. With this they attach themselves to some portion of a shark's shagreen skin, and there they presumably live and die, unless misfortune overtakes their host.

Late in the afternoon a long, feebly writhing body was seen drifting slowly on the surface. The small



LABORATORY OF THE PHOTOGRAPHER

Besides the regular photographic equipment, the question of motion pictures was carefully considered. E. B. Schoedsack, who made the film "Grass," was engaged to handle the cinematographic work of the expedition.

boats were too far away to understand our frantic signals, so all we could do was to hope that it would drift down on the ship. Luck was with us, for while we watched breathlessly our first sea-snake passed so close under the boom that Dwight Franklin scooped it in with a long-handled net.

In the course of two days in the current rip we captured two more specimens of these marine reptiles. They have a wide distribution in tropical waters, and in harbors of the Malay States, it is said, they climb the anchor chains of vessels and bite the seamen sleeping on the decks.

In the evening we lowered a strong arc light over the companion ladder and watched the gradual focusing of creatures attracted by the brilliant glare. The first to arrive were the little halobates, the only kind of marine insect in the world. A relative of the water-striders that are found in fresh-water ponds, this small mariner is born in mid-ocean, spends his life in fearlessly navigating the deep and when he dies sinks for the first time beneath those waters over which he has glided night and day for all his little span. The most extraordinary fact about halobates is the ease with which he can be drowned. Let one drop of water fall upon his back and he is doomed and helpless. Yet myriads of them dart about, hundreds of miles from shore or shelter, surviving the waves and spray of storms by some inexplicable miracle.

One surprise of this current junction was saved for evening. Strange-looking clusters of pale objects that floated by in great abundance proved to be argonauts or paper nautilus, clinging to each other in strings of eight or ten. The delicacy and beauty of their translucent shells make an incongruous frame for the little octopus bodies with writhing arms and huge staring eyes. Only the female is possessed of a shell. She secretes the fragile covering from a special pair of arms for the sole purpose of sheltering her eggs.

Large numbers of squid were attracted by the light, most of them bronzy red in color and ranging from three inches to as many feet in length. Although their swimming speed is great and their ability to dodge instantly in any direction is unlimited, we secured several small ones in the net and harpooned a three-foot one.

We have discovered a new island, which we have named Osborn Island after Prof. Henry Fairfield Osborn, President of the American Museum of Natural History. On the island we visited an albatross rookery and captured two live birds.

We reluctantly left this magical spot, where we had in less than forty-eight hours collected more than forty species of fish and uncounted numbers of invertebrates and consoled ourselves with the vow to return and investigate its wonders further.

April 4, 1925.—Noon—Latitude 00° 10′ South—Longitude 90° 05′ West. South Seymour Island.

April 11, 1925.—Noon—Latitude 00° 17′ North—Longitude 90° 02′ West. Off Albemarle Island in 1039 fathoms.

At 1 o'clock in the morning the second officer roused us to look at a faint, pulsating, rosy glow in the southwest. Bearings located it as on the northern end of Albemarle Island, and at sunrise we weighed anchor and set out to investigate. Our gannet friends, who had found the *Arcturus* a delightful resting-place during all our stay, were

SEA BIRDS ON THE RIGGING OF THE *ARCTURUS*

The gannets found the rigging of the ship a delightful place to rest, and reluctantly gave it up when the *Arcturus* sailed away from the Galapagos.

reluctant to leave us, and at least two dozen bore the nervous strain of our noisy departure and with great fortitude clung to masts and davits and rode out into the Pacific. Several huge devilfish floated slowly past, gracefuly undulating, and flying fish fifteen inches long, with lavendar-pink wings, scaled from under the bows.

At dusk all eyes were eagerly fixed on the southwest, straining for that glowing point. It was there, clearer and nearer and strengthening with every moment of growing darkness. On our previous voyage to this archipelago we had scanned each crater-island hopefully and tried to imagine that fiery sunset streaks and wisps of tattered cloud were the glow and smoke of an eruption. Now we could hardly believe in our good fortune, that a volcano should actually break out while we happened to be near.

Comparatively few eruptions in this archipelago have been witnessed, considering that it is of volcanic origin and that there must have been hundreds of disturbances since it was first discovered. From the circumstances that the Inca Tupac Yupanqui named one of the islands the Island of Fire, we presume that his were the first human eyes to witness an eruption in this barren place. An old Boston sea captain, one Amasa Delano, reported such a phenomenon in 1800 on Albemarle, and a splendid description of an awe-inspiring outburst on Narborough was written by Benjamin Morrell, who saw it in 1825. But there is no record of any one having seen subterranean fires break out on the northern end of Albemarle, the point to which we hurried now.

At dawn we were within ten miles of shore and could make out the individual glowing spots before the sunlight extinguished their bright color. The huge tumbled cloud hung persistently over what seemed to be the central crater, just over the shoulder of the long slope that connected the two northernmost mountains. We named these two Mount Williams and Mount Whiton, after Harrison Williams and Henry D. Whiton, two of the gentlemen whose generosity made possible the voyage of the *Arcturus*.

The long sweeping slope was thickly sprinkled with small vents, which steamed and glowed in imitation of their larger fellow. Volumes of steam poured from freshly ejected piles of rock that even in full sunlight showed sullen red, like new-drawn slag.

As soon as the Captain announced that we were as near shore as safety would permit, three of us set out in a small boat to find some feasible landing. The abrupt banks of old, cold lava that lined the coast turned into frowning cliffs as we drew near, and heavy breakers dashed against them in a way that made us sheer off time and again from certain smash.

At last we found a tiny cove, protected by an arm of lava, where the water was as quiet as a pond. A heron eyed us, unafraid, as we stepped easily ashore under a huge monolith. Tee-Van and I put on our hobnailed boots and set as our goal what we thought was an unambitious mark, one of the biggest, but also one of the nearest, craters, which from the ship we had placed as being possibly two miles from shore. At first we walked over great smooth slabs of gray-green lava, the deposit

LAKE ARCTURUS

A crater lake discovered on Tower Island, Galapagos Archipelago, by Dwight Franklin.

of eruptions of long ago. Across this we went easily enough, almost briskly.

The next terrain was a more recent flow, if such a smooth word can be applied to an incredibly rough, rubbly, friable mass of red-brown lava, strewn acres wide and yards deep, without a smooth inch anywhere, and every spot ready to topple and crumble at a touch.

The land quivered with heat. The equatorial sun beat down, and immeasurable fires below ground poured up. The black skyline of lava on the shoulder of Mount Whiton had a quadruple outline that danced up and down as though some gigantic hand shook a flexible rope. Baked from above and below, we staggered on, missing our footing and falling uncounted times, unable to sit down and rest for the intolerable heat of the rocks.

We no longer talked of the big crater, but bore off to the south, making for the nearest, no matter how small. Of life there was practically none, though I saw one yellow butterfly unbelievably fluttering through the heat waves, and here and there small patches of reedy grass had somehow obtained nourishment since this lava had cooled.

We had brought no food, but our canteens held the only form of nourishment in which we took any interest. To appreciate the flavor of warm water from an aluminum canteen, it should be drunk halfway up the side of an active volcano, with the thermometer approximately 150. Epicures should know of this.

At last we neared our goal, the pitiful little crater which we had scorned when we set out so briskly in the early morning.

But this entire locality was giving forth a stealthy toxin. A dozen times we hurriedly changed direction as things began to turn black before our eyes and a dizzy sickness warned us that we were breathing the insidious fumes. Doggedly we plunged ahead and finally reached the spot where molten lava slowly boiled at the bottom of a narrow fissure. We dared not stay and we were capable of going no further.

We lingered for several days off shore, getting moving pictures and paintings of the eruption in its various phases.

Our volcano did not become any more violent as the days passed, but continued to burn in a steady, determined way; and as our supplies were running low and there were certain things that must be accomplished before we were compelled to return to Panama, we reluctantly steamed southward.

April 15, 1925.—Noon—Latitude 00° 32′ North—Longitude 91° 06′ West. Off Abingdon Island in 431 fathoms.

April 16, 1925.—Noon—Anchored off Tower Island—Galapagos Archipelago. In the quiet waters of Darwin Bay we used the diving helmet for the first time.

Here is a brand-new sensation that should be recommended to every blasé soul. It is like nothing else in the world except a dream, if a dream can be said to be in the world. Instead of the huge, cumbersome suit in which we see divers encased in pictures, this outfit consists solely of a copper helmet.

USING THE DIVING HELMET

The use of this helmet proved to be a valuable aid in studying corals, corallines, fishes and other ocean life near shore in shallow waters.

In a bathing suit or, if you prefer, in your usual clothes, you step over the stern, hoping that the man at the pump is not absent-minded. The descent of the first few rungs of the ladder is accompanied by a sensation in the ears very reminiscent of the Hudson Tube, but that is easily overcome. The use of this device will surely prove invaluable to the study of shore fishes, and I have already made hundreds of notes on their habits which I could have obtained in no other way.

To remain for minutes submerged in a foreign medium is equivalent to being translated to another planet. The gurgling of the air forced down to you is forgotten in the intense absorption of taking in this new world. The refraction of the light makes all objects seem unnaturally large, and apparently you stride over mountain peaks in walking from one rock to another. You become deliberate perforce; your gestures cannot be otherwise than graceful. There is something irresistibly funny in watching, through the glass-bottomed boat, a creature who in his natural element is an angular, awkward animal, but who now is wafted along with legs and arms floating dreamily in a sort of slow-motion rhythmic dance.

The denizens of the submarine world seem to have no fear of the phenomenon that descends among them. In fact, they pay it very little attention unless you provide something attractive in the way of food. I stood in a lava canyon holding a fragment of crab in my hand, and in two seconds was so surrounded by clouds of fish that I could scarcely see through the glass windows of the helmet. All around swam fishes—black and gold, red and blue, blue and yellow—brushing against my fingers as they tugged at the delectable morsel that I held. A few feet away an enormous herd of yellow-tailed surgeon fishes browsed over the rocks, all facing one way and moving slowly together like a herd of grazing cattle. Scattered among these were black and white and orange and purple angel fishes, also pulling at the algae that covered the rough, black rocks. In the dim and cloudy distance moved other shapes, too far away to be seen as other than dark shadows in a milky fog. Underfoot large gobies skipped over stones, and a moray eel writhed into his black cave.

Suddenly a large dark form slid rapidly across my very restricted horizon. It looked alarming. I find that when I am firmly seated in a stanch boat I am quite certain that a shark would practically never attack a man. But sunk in twenty feet of water, encased in a helmet which allows me to look only straight before me, that qualifying "practically" looms large, almost as large as this black, swiftly approaching shadow that rolled on its side and made for me. Just as it sheered off I saw that it was a big, curious sea lion, shooting past, with folded flippers so close that it almost brushed my legs.

Small sharks came to investigate me, but my assistants in the boat kept a vigilant watch for anything large enough to be alarming. This submarine hunting requires a special technique, and it was some time before I learned to allow for the density of the water, which slowed my motions so much, and which hindered the fish not at all.

Every one has had at least one experience which he afterward finds it difficult to believe really happened to him. Repetition fails to dull the edge of novelty in diving. If I were asked to prescribe for the worst case of sophisticated world weariness imaginable I should without hesitation write: "R. One diving helmet."

April 24, 1925.—Noon—Latitude 1° 51′ South—Longitude 89° 51′ West. Off Hood Island in 1,733 fathoms.

April 30, 1925.—Noon—Latitude 01° 47′ North—Longitude 87° 16′ West. Steaming for Canal Zone.

May 2, 1925.—*Arcturus* arrived at Panama.

May 7, 1925.—Report for second quarter by William Beebe, Director.

Colon, Panama Canal Zone, May 7, 1925.—As I look over the first report which I sent to you, I realize that our present outlook on oceanographic work and results seems like that of a university graduate compared with a kindergarten child.

Dr. Gregory and I have confined our efforts wholly to fish and have been able to handle only a fraction of the specimens and problems.

Gregory and Trotter have concentrated on the mechanics of locomotion, both of shallow and deep sea fish, while Segal and I have concerned ourselves more particularly with their viability and habits. Naming has been a constant source of trouble for so many are new species. In the Galapagos zone alone we have increased the number of deep sea fish from twenty-five to over one hundred.

Dr. and Mrs. Fish have done invaluable work in taking the fresh tows and hauls and in a few hours listing, down to genera, the chief components of invertebrate animals. This is usually done months afterward by many specialists, if indeed it is done at all. So before anything is placed in preservative, and while most of the organisms are actually still alive, we know exactly what we have taken in a mass of what looks like a thick scarlet, salmon or greyish jelly of myriads of living, wriggling creatures. The most curious are given to Schoedsack to photograph, or to Cooper, Dickerman or Franklin to paint, another percentage is placed in running salt water aquariums and the rest labelled and preserved.

Dr. Fish attends to the working of the deep sea thermometers, and Mrs. Fish as was her custom in government work at Woods Hole, keeps complete records of the results as a whole.

Tee-Van handles all the general supplies, superintends the oceanographic work under me, and is studying the Tunicates—those strange beings whose place is somewhere between vertebrates and invertebrates.

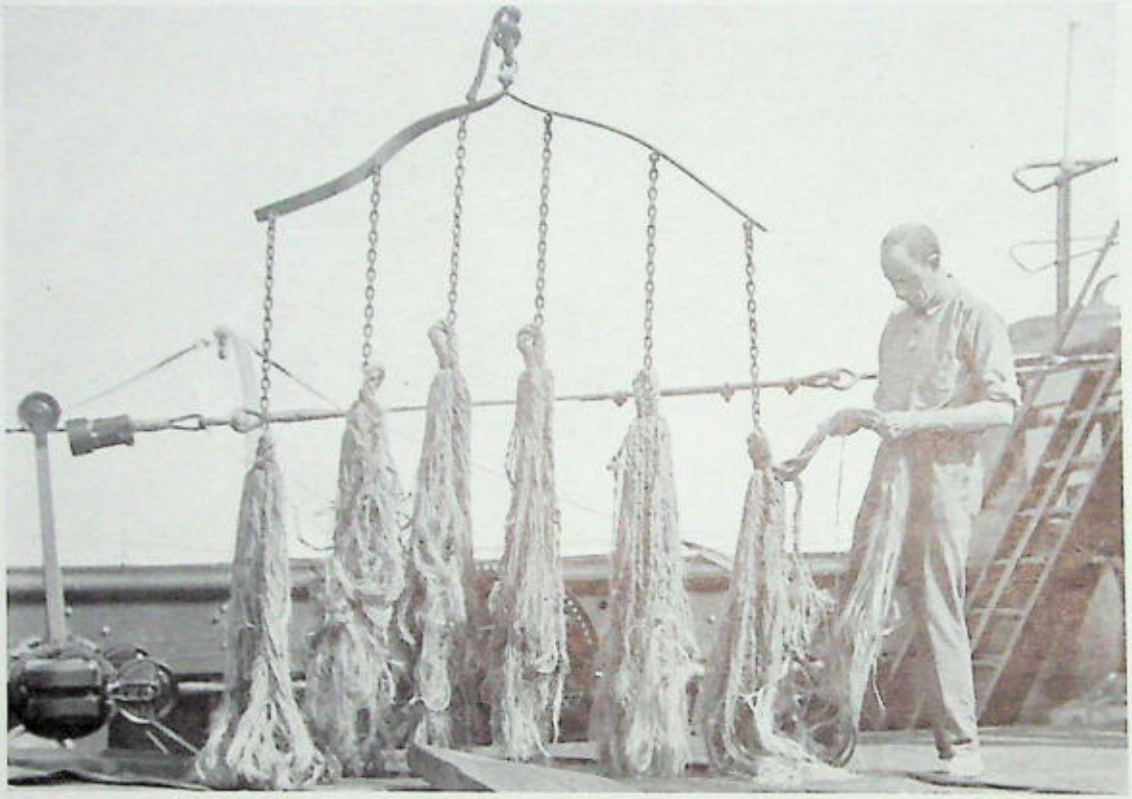
Merriam has entire charge of the deep sea sounding and all repairs on apparatus, besides inventing new fish traps and methods for capturing all forms of life.

Schoedsack has taken ten thousand feet of moving picture film and two hundred still negatives, and has lost no possible opportunity for depicting oceanographic work.

Miss Cooper has completed one hundred and thirty colored plates.

Miss Rose has had complete charge of the intricate system of cataloguing and dissections, the KOH transparent processes, all the live stock and press reports.

Franklin and Chetyrkin have done most excellent work in injecting and preserving all the larger specimens in the most suitable fluids. Franklin has also found time to make eighty drawings of fish and octopi. Chetyrkin has collected most assiduously, has preserved a very beautiful collection of seaweeds and has made some of the most perfect fish skeletons I have ever seen.



ROPE TANGLES

Dwight Franklin working with a device used for sweeping minute specimens from coral banks.

I retained Miss Trotter on the second part of the trip because Dr. Gregory had found she was invaluable to him in his ichthyological work. While her labors will be incorporated with his, she has proved one of the most efficient members of the staff.

Dickerman, whom I brought as a much needed additional muscled, brainy assistant, has developed a most remarkable talent for painting intricately colored small fish, supplementing Miss Cooper's work in an entirely different field and forming a new and very valuable contribution.

Pearson has proved better than I hoped or than Dr. Emerson promised. He is Merriam's right-hand man and spends every extra moment of daylight with his squids and sea-worms. Gregory Bateson, the son of Prof. William Bateson of England, made the trip to Galapagos with us at my invitation, and devoted himself to jelly-fish and related organisms, of which he found and preserved about fifty species.

Dr. Cady has had innumerable patients with small ills and several more serious ailments among the crew to cope with, and has fulfilled his duties satisfactorily in every respect. In spare time he has done anatomical dissection and has taken charge of one of the motor boats.

Of Captain Howes and First Mate McLaughlin, Steward Croker and the deck crew I cannot speak too highly. They have worked with us early and late, as earnestly and heartily as if they were actually scientists themselves.

Acting on my last conversation with Mr. Grant I visited the Galapagos whenever I saw that it aided my oceanographic researches. We did no dry land work whatever, with the exception of photographing the dance of the albatrosses and capturing two for the Zoological Park, besides making what notes we could of the active volcanos.

Dr. Gregory found that the study of shallow water fish was absolutely necessary for his work. The development of work with the diving helmet has opened an entirely new field. I find I can descend from fifteen to thirty feet and remain as long as I wish, sitting or walking about, harpooning species of fish which no bait will attract and making notes on the habits of the vast population which are wholly new. I consider this one of the most important discoveries of the expedition. Gregory is as enthusiastic as I am and as surprised that such a simple method has not been used for serious scientific collecting and especially observation by many people. We take all possible precautions against large sharks and morays, and where necessary use a wire cage into which the diver can retreat if attacked.

No greater contrast can be imagined than that between the experiences of the *Arcturus* in the Atlantic and in the Pacific. In terrestrial comparison, it was like going from the desert into the fertile valley. We had tossed about in the North Atlantic for six weeks, rolling almost unceasingly in great swells that added trying complications to the sufficiently difficult work of handling bulky trawls and dredges. While

HALF-METER PLANKTON NET

Mr. and Mrs. Fish, of the U. S. Bureau of Fisheries, are examining the material gathered in a haul of the net.

we obtained many extraordinary forms of life in the area known as the Sargasso Sea, the number of specimens seemed few compared to the hours of labor involved, and it appeared to be the wrong season for the fauna of this region. We decided to take up the work that we had planned to do in the Pacific, and return to the Atlantic in the Summer, when conditions would be more propitious.

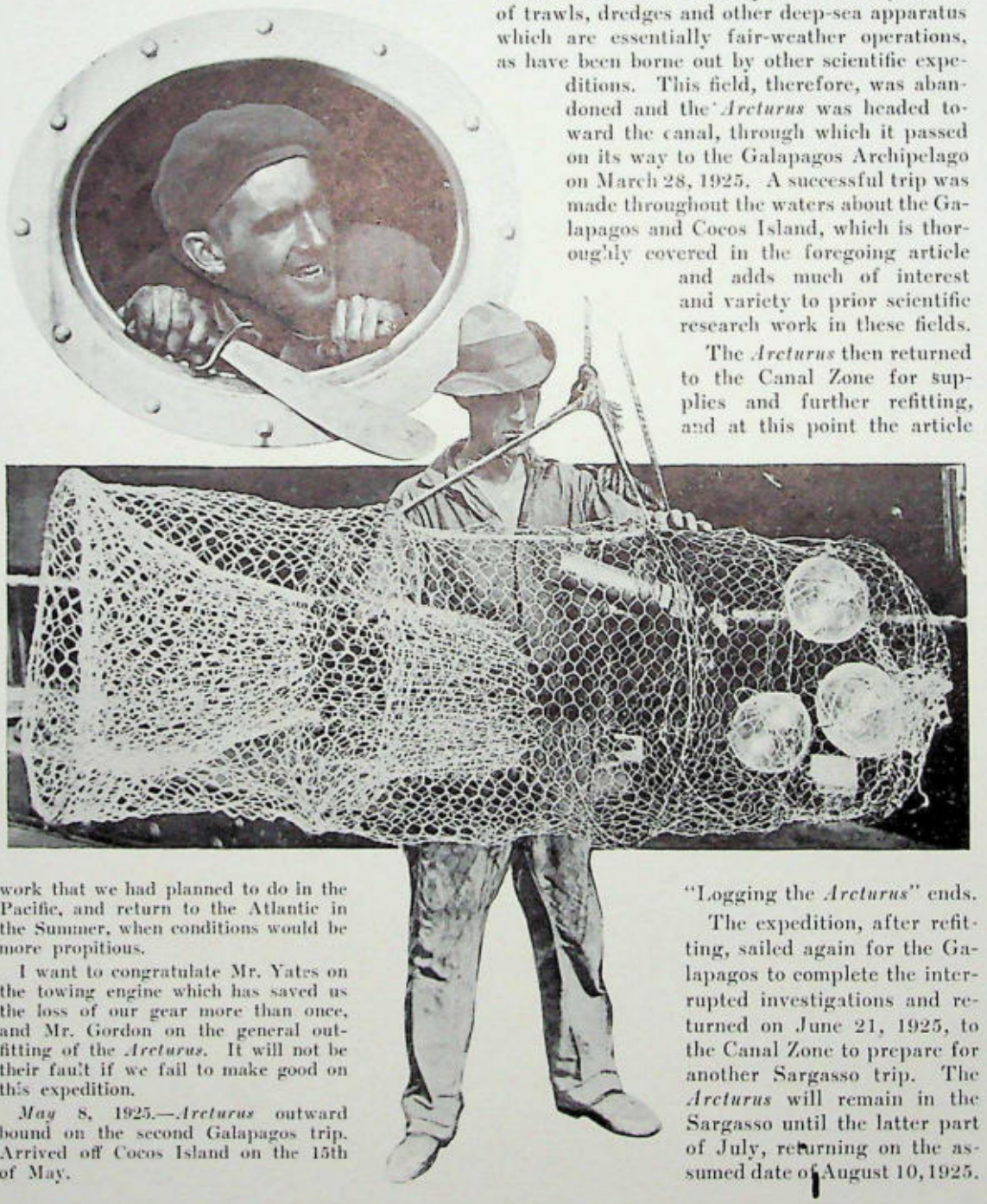
I want to congratulate Mr. Yates on the towing engine which has saved us the loss of our gear more than once, and Mr. Gordon on the general outfitting of the *Arcturus*. It will not be their fault if we fail to make good on this expedition.

May 8, 1925.—*Arcturus* outward bound on the second Galapagos trip. Arrived off Cocos Island on the 15th of May.

This ends the first Sargasso-Galapagos cruise. The expedition after leaving New York made a course for the Sargasso Sea, but encountered such heavy seas and unsuitable weather conditions as to prevent the operation of trawls, dredges and other deep-sea apparatus which are essentially fair-weather operations, as have been borne out by other scientific expeditions. This field, therefore, was abandoned and the *Arcturus* was headed toward the canal, through which it passed on its way to the Galapagos Archipelago on March 28, 1925. A successful trip was made throughout the waters about the Galapagos and Cocos Island, which is thoroughly covered in the foregoing article and adds much of interest and variety to prior scientific research work in these fields.

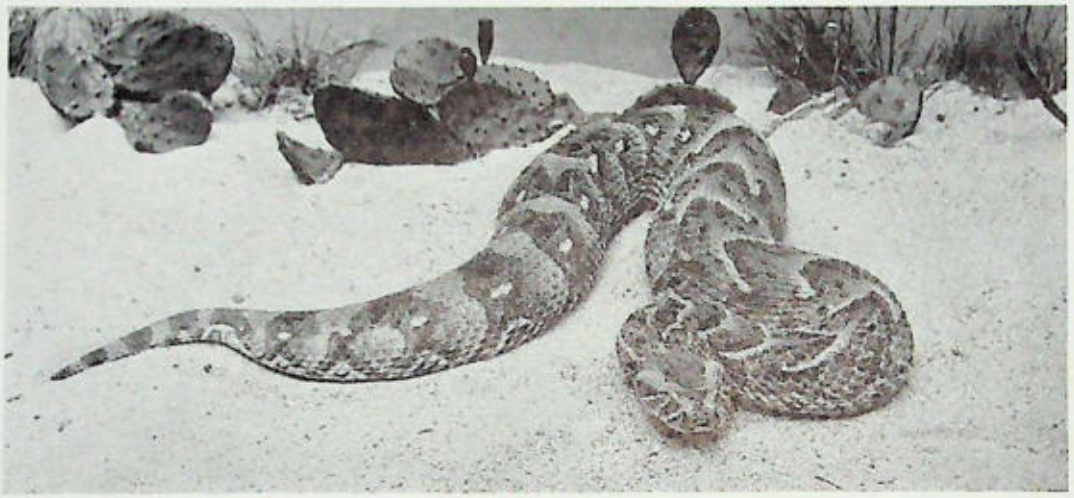
The *Arcturus* then returned to the Canal Zone for supplies and further refitting, and at this point the article "Logging the *Arcturus*" ends.

The expedition, after refitting, sailed again for the Galapagos to complete the interrupted investigations and returned on June 21, 1925, to the Canal Zone to prepare for another Sargasso trip. The *Arcturus* will remain in the Sargasso until the latter part of July, returning on the assumed date of August 10, 1925.



TWO MEMBERS OF THE *ARCTURUS* STAFF

The upper picture is E. B. Schoedsack, the cinematographer. The lower one is W. H. Merriam, Assistant in Field Work, with a submarine fish trap which is equipped with electric lights to attract luminous fishes.



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TEXT ILLUSTRATIONS

ZOOLOGICAL SOCIETY BULLETIN

PUBLISHED *by the* NEW YORK ZOOLOGICAL SOCIETY

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A RESOLUTION

Passed May 21, 1925, *at the* Meeting *of the* Board *of* Managers *of the* New York Zoological Society

Whereas, It is generally recognized that financial support accorded educational and scientific movements is of broad and lasting benefit, and

Whereas, Funds devoted to such purposes must by their nature call for the display of the highest type of generosity, and

Whereas, A rare example of such generosity has been made by a member of this Board, MR. HARRISON WILLIAMS, in the unparalleled support given by him to two great Expeditions, namely, that to the Galapagos Islands in 1923 and the present Arcturus Expedition to the Sargasso Sea and the Humboldt Current, now, therefore, be it

Resolved, That this Board, on behalf of the people of New York City and on behalf of the New York Zoological Society, hereby tenders to MR. HARRISON WILLIAMS its deep and permanent gratitude for the wonderful opportunities made possible to the Society by his rare and unexampled generosity.

ZOOLOGICAL SOCIETY BULLETIN

Published by the New York Zoological Society

VOLUME XXVIII SEPTEMBER, 1925 NUMBER 5

THE RETURN OF THE ARCTURUS

THE ARCTURUS, with Mr. William Beebe and his staff, returned to New York City on the 30th day of July, 1925. This completes the second scientific expedition that this Society has sent out through the generosity of Mr. Harrison Williams, who contributed to it upwards of $150,000, and through his personal efforts secured the balance from his friends.

The thanks and congratulations of the Society are due to Mr. Williams, and to his assistant, Mr. Charles F. Yates, who superintended the extensive financial arrangements involved. Mr. Beebe and the members of his staff are entitled to the highest credit for the successful conduct of the expedition.

By this expedition, and by the Galapagos expedition in 1923, Mr. Williams has exabled the Zoological Society to expand its activities far beyond the care of the Zoological Park and the Aquarium. The Society has always had a national, and in fact international standing, through its successful efforts in the field of wild-life protection all over the globe.

Prior to the two expeditions recently presented by Mr. Williams, the chief scientific work of the Society outside of the United States, was the Tropical Research Station in British Guiana under William Beebe. Mr. Harrison Williams' great interest in science has at last launched the Society on a career of world-wide research which, it is to be hoped, will be carried out over an ever widening area. *M. G.*

THE SECOND HALF OF THE *ARCTURUS* ADVENTURE

By WILLIAM BEEBE *and* RUTH ROSE

THE synthetic log of the *Arcturus* in the last number of the Zoological Society BULLETIN carried the expedition up to the moment of leaving Panama for the second time, headed for the open Pacific. The succeeding events of importance were multitudinous, but for the purpose of a brief résumé may be reduced to four; a ten day sojourn at Cocos Island for the purpose of studying the shore and shallow water fish by means of the diving helmet; another ten day period of research at Station Seventy-four—a point in mid-ocean, sixty miles south of Cocos, about which we drifted, trawled and dredged, studying intensively the various forms of life from the bottom over half a mile down, and up through the column of water covering this point of sea bottom, to the surface.

Our third adventure was the astounding coincidence of arriving at Albemarle in the Galapagos at the same moment when the overflowing lava reached the sea. The fourth and last event to be mentioned here was, Sargasso Revisited, as our grandfathers' authors would put it.

The comparative barrenness of our first Sargasso trip, owing to the constant succession of heavy seas, was more than compensated by even the first week of work in the Pacific, and the results of the Cocos Island and Station Seventy-four undertakings went beyond our utmost expectations.

From the very first net that we put out in the Pacific, material for study poured into the laboratory, and made us so eager to make up for lost time that our hours of work lengthened insensibly. The wealth of the surface life of the Pacific was made manifest to us on the fourth day of the first trip after leaving Panama when we encountered the extraordinary current rip, the meeting-place of two great oceanic currents being defined by a zigzag line of foam that extended to the horizon. Here the accumulation of living creatures was incredible, and while we drifted along its course every waking moment was occupied by the collection and observation of all classes of vertebrates except amphibians, while invertebrates literally in billions often changed the color and consistency of the sea. Big gannets perched on floating wreckage, gorged with the abundance of food about them; dolphin-fish glittered green, gold and blue, as they flung themselves clear of the water in pursuit of

The *Arcturus* anchored in Chatham Bay, Cocos Island. This small islet is half-way between Panama and the Galapagos, and is covered with a mass of tropical vegetation, tall fig-trees and palms, tangled lianas and razor-grass growing rank and dense to a height of eight feet.

skimming flocks of blue and silver flying-fish; great schools of dolphin-mammals rolled and curvetted like pasturing colts in undulating azure fields; yellow and black sea snakes writhed just below the surface, and patches of bright purple water attested the presence of uncounted myriads of jelly-fish. At night a powerful electric light, hung over the gangway, was a magnet which attracted fish of all sizes, paper nautilus, bronze-red squids, crabs, worms, and hosts of tiny, transparent crustaceans. It was here that a huge squid sprang out of the water, apparently reaching with wide-spread tentacles for the line of earnest collectors busy with nets and harpoons. We captured numbers of his smaller fellows but were unprepared with any weapon sizable enough to combat this staring-eyed monster.

The study of the shore fish of Cocos, and the deep-sea hauls of Station Seventy-four revealed the value of combining these sharply contrasted methods of research. The diving helmets proved, beyond doubt, unrivalled means of observing the life of shallow waters. Dr. Gregory and I had vied with each other in our enthusiasm and eagerness for being submerged along the wonderful coast lines of Tower, Hood, and other of these lava bounded islands, and now we revelled in the coral reefs of Chatham Bay, Cocos. Altogether we made over one hundred descents into this world that was so unreal and beautiful that the recording of its crowding impressions is most difficult.

The contrast in the two lines of study was striking. As we recorded in an article to the *Times* (N. Y.) not long ago, in the one case we stepped over the side of a small boat and floated gently down, fifteen, twenty or thirty feet to the bottom, where in these clear waters the visibility was good for forty to one hundred feet in all directions. Here one could choose a comfortable seat and watch the colorful and varied life of coral and lava, select the species or individual that one wished to observe, and very possibly end by capturing it for close examination in the laboratory. The deep-sea work, on the other hand, was a game that must be played blindfolded, a sort of bathybial grab-bag with the added thrill of a Christmas morning anticipation. A trawl put down to a depth of seven hundred fathoms may fetch from the depths amazingly formed creatures, grotesque, beautiful or monstrous; or it may contain nothing at all. Perforce we only grope blindly, aided by a knowledge of the sort of ocean bottom on and over which animals are most likely to be abundant, and guided to some extent by the work of our predecessors in this field, but all the same playing at blindman's buff in which the human animal is always "it."

PLATE I. BUTTERFLY FLYING FISH

Painted by HELEN TEE-VAN

This flying fish, as yet unnamed, was taken on the *Arcturus* in a surface net, in mid Atlantic. The brilliant colors which fade a few hours after death, were recorded by Helen Tee-Van, and the fish represents one of the most gorgeously colored species known. Not only was the pink color of the body changeable, but even the bright spots and splashes on the wing fins—the pectorals and ventrals—came and went, increasing and diminishing in intensity like the fleeting hues of the aurora borealis. The curious black appendages near the mouth indicate that this individual was immature, these mysterious moustaches disappearing in the adult fish.

Unusually fish of this family are blue above the silvery white beneath—the colors of the sky and sea—a protective cloak most necessary to shield the wearers from the ever-present danger of ravenous fish beneath and voracious birds above. At night we had frequent tragic confirmation of the perils awaiting them. Flying fish were always among the first to be attracted to the circular glow of a search-light upon the water, and soon afterwards small, sinister torpedos of squids would appear and launch themselves with projectile force upon the terror-stricken fish. Seldom did they miss, and quicker than the eye could follow they would reach and seize their prey.

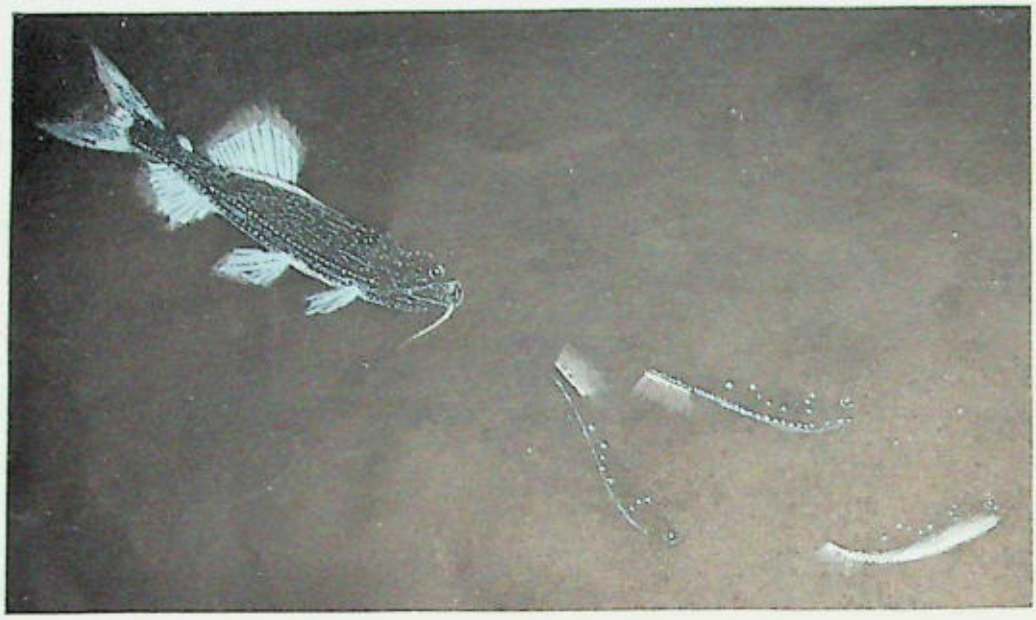
In the marvellous current rip which we discovered in the Pacific, a tiny inch-long flying fish was abundant, whose relatively great spread of wing fins was pure white with two black dots, recalling vividly the white Pieris butterflies of our cabbage fields.

WILLIAM BEEBE.

Upper: PLATE II. THREE LUMINOUS FISH BY DAY

Lower: PLATE IV. SQUID WITH DEFENSIVE SMOKE SCREEN

Painted by HELEN TEE-VAN



Upper: PLATE III. THREE LUMINOUS FISH BY NIGHT

Lower: PLATE V. DEEP-SEA PRAWN WITH ITS LUMINOUS CLOUD

Painted by HELEN TEE-VAN

PLATE VI. BLACK AND SCARLET FATHEADS

Painted by ISABEL COOPER

One of the most constant differences between wild and domestic animals is in the distribution of coloration. Wild creatures have bilateral symmetry, which is a shorthand way of saying that the coloring of the two sides of the body is similar. A bird which has a white bar on one wing has it also on the other, a zebra striped only on one side is inconceivable. Yet, as in almost everything in nature, we now and then run across exceptions, so conspicuous and unexpected that all our carefully built up theories seem in danger of tumbling down.

Early in my experience in diving in the shallow waters of the Galapagos, on the *Arcturus* expedition, I became familiar with stocky fish, one or two feet in length, of a brilliant scarlet color. They were characterized by a conspicuous bump on the forehead which has given to the group the rather unlovely name of fathead. Technically it is known as *Bodianus eclancheri* (Valen.) On another descent into the water I was surprised to see a jet black individual swimming about within a few feet of the window in my copper diving helmet, and a few minutes later a parti-colored fathead drifted into view. Altogether I made notes on about fifty individuals and except for a few solid colored ones, no two were alike. In this they resembled the color variations of domestic goldfish, and the symmetrical spots and markings of cattle, horses and dogs.

There are all sorts of aspects of this subject, other than actual symmetry, such as the change in coloration of the flounder as it shifts from a vertical to a horizontal outlook on life, and the astounding individual variation in the fighting capes of male ruffs.

When we see how successful the fatheads are in competition with other fish, and under the same conditions of environment, we realize that the more usual symmetry of pigmentation may sometimes be less a life and death necessity than a physiological adaptation or equality arrangement. The subject is one of absorbing interest and for years I have gathered facts which may ultimately yield some interesting generalizations.

WILLIAM BEEBE.

Chatham Bay, Cocos, showing the mouth of the small mountain stream at which scores of pirates, whalers and ships of war have watered in the past three hundred years. All the large boulders along the beach have old records of ships and dates cut deeply into them.

Cocos Island is a tiny scrap of densest tropical jungle afloat in the Pacific, five hundred miles from Panama. A focal point for tales of buried treasure, it might well be also a center for poets' dreams of Lotus Land, and nothing more lovely can be imagined than its coast line of lofty, thickly wooded mountains and precipitous cliffs where for every mile there is a foaming-white cascade, that seems to fall, and pause, and fall again as it tumbles to the sea.

The members of the *Arcturus* expedition will never forget the Battle of the Boobies at Cocos. On several evenings of very heavy rain while we were anchored in Chatham Bay, the numberless gannets or boobies evidently considered that the lighted decks presented superior attractions to their deluged homes ashore. Through the blackness of the downpour they converged upon us, with raucous squawks, and crashing heavily aboard, waddled into laboratory, library, cabins—anywhere they found an open door, and proceeded to carry on their quarrels as though the expedition had been

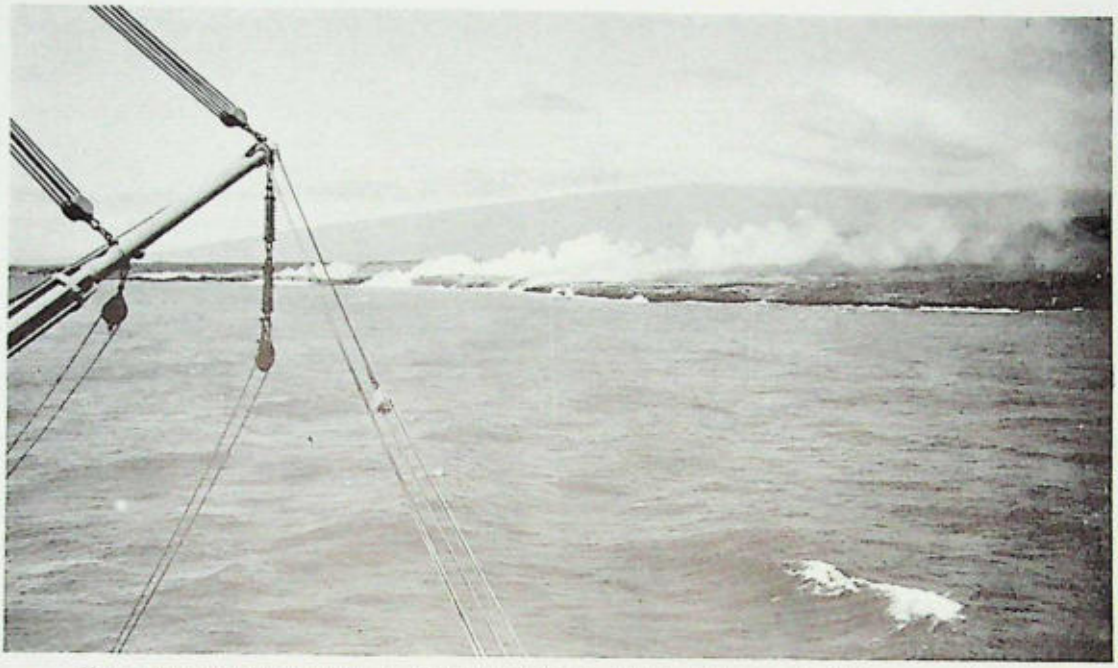
A Double Page of Ocean Wonders.—Luminous fish are not confined to the depths of the ocean. Night after night on the *Arcturus* I captured hundreds of various species of Myctophids —small minnow-like fish—on the very surface. At dawn these would descend below the reach of the light rays, to reascend only at dusk. In Plate II a pair of these small luminous fish are seen pursued by a larger, darker form. This plate shows them by daylight, while the succeeding Plate III across the page reveals their remarkable lighting systems as seen in the dark. The larger fish is known as Astronesthes, the Eater of Stars, a name appropriate both because of the myriad constellations which twinkle from its body, and because its food consists wholly of the star illumined Myctophids. It follows the immense schools of these fish up to the surface at night and down again in the daytime. I examined several dozen Astronesthes and in every case a full-sized uninjured Myctophid was found in its stomach. Two unexpected things about the lights of Astronesthes are the brilliant luminescence of the fins and of the stem of the chin barbel. The tip, contrary to what has been thought of it heretofore, is not luminous, but probably of a tactile nature.

The Myctophids have a complex system of lights, subserving, as far as I could determine, at least three distinct functions. The almost solidly glowing ventral sheet acts both as an attracting focus for small forms of life which are used as food, and momentarily to blind a pursuer, when by a swift turn the fish flashes its broadside upon its assailant. The sparse lateral hieroglyphics are characteristic of each species and probably function in the recognition of members of the same school, while the brilliant scales near the tail are sexual, in that the male has them above and the female beneath. When we know more about the ways of these strange little night lifers of the sea the hundreds of lights upon their bodies will doubtless reveal even more intricate meanings.

The two lower colored plates on the double page, Plates IV and V, illustrate one of the many strange contrasts in the habits of oceanic creatures. Near the surface in daylight we found many species of squids—some only an inch long, others giants up to eight feet. When these creatures are threatened by an enemy their usual method of protection is to throw out a smoke screen of sepia ink which clouds the surrounding water and blinds their assailant. In the subsequent confusion they are usually able to make good their escape.

When we descend below the level which is lighted by the sun—where even ultra-violet rays are no longer present—any defence such as a sepia cloud would be useless. In these black depths new methods have been evolved, one of which I have illustrated in Plate V by a deep-sea prawn. When a fish or other enemy attacks this scarlet crustacean, it shoots out from a series of glands, a billowing luminescent cloud which spreads rapidly in all directions through the water, and so blinds the eye of the onlooker that in the surrounding accentuated darkness the prawn, clad in its invisible scarlet, finds ready sanctuary. Far out at sea and deep down in its depths we thus find the exigencies of life and death of small ocean people controlled by a pillar of smoke and a pillar of fire.

William Beebe.



Molten lava flowing into the sea from the slopes of Mounts Williams and Whiton on northeastern Albemarle. The nine outlets were twenty feet across and one hundred feet above the sea. Fish, octopus and sea-lions were being killed in the boiling sea-water when this photograph was taken.

planned especially to benefit them with a warm and dry arena. The silken swish of wind-driven rain, the thud and shriek of newly-arrived birds, the thrashing of powerful wings as they flapped against the deck-houses or engaged in gladitorial combats, their hisses and screams when approached by us, and the shouts and helpless laughter of the embattled scientists, would have made a phonograph record that no uninitiated listener could have explained. The really distressing feature of these evenings had to do with the inevitable reaction of these birds to fear or excitement. No sooner would they find themselves in these unfamiliar surroundings than they would disgorge the most recently eaten fish, whether as a propitiatory offering to us, or to lighten their weight in readiness for flight or battle it was not difficult to say!

We spent hours picking up the boobies by their wing-tips, whirling them around our heads and spinning them forth into the night, from which the majority of them promptly returned. In the morning there were always dozens of the invaders to be ejected, but nothing seemed to discourage them as long as the storm lasted. A rainy evening and night at Cocos was sure to be spent in a hand-to-wing contest for the possession of the *Arcturus*.

Two red-letter days which followed were when a forty-foot, rarest-of-the-rare whale shark rose unconcernedly alongside the *Arcturus*, lingered until a half dozen of us had fixed color, shape and size in mind, and then slowly sank from view; and again when three of our number harpooned a ton of hard-fighting devil-fish, and we were able to study it at leisure on the deck. It measured exactly eighteen feet in extent, and was the mother of a twenty-eight pound infant which would have been born within a day or two at the most.

The most wonderful experience of all was the acme of the eruption of the Albemarle volcanoes. On Easter Sunday, as I have already narrated, we watched dozens of craters and fumeroles seething and smoking on the slopes of Mounts Whiton and Williams. I attempted, together with John Tee-Van, to reach one of the largest, but only with greatest difficulty and in actual danger of our lives were we able to climb to the nearest and smallest. When, almost overcome by the noxious gases and the heart-breaking struggle over the lava fields, we limped back to the *Arcturus*, we thought we were through with the outbreak, except to revel in its magnificence as long as we were within sight for the next few days.

But a new surprise awaited us. Nine weeks later, also on a Sunday, after leaving Cocos on our second trip, we returned. As we rounded

the northern point of Albemarle, early in the morning, we saw a distant spot of white, too high and too sustained to be explained away as dashing surf. As we drew nearer, it resolved into a series of smoke-columns, apparently rising from the sea itself. All the morning I watched from the crow's-nest until we were abeam of a stupendous spectacle.

During our nine weeks' absence, the lava had crept seaward, cooling rapidly on the surface until it had formed tunnels for the following masses that still boiled upward. Now the lava had reached the shore and in nine great cascades it burst forth from the face of the black cliffs and dropped straight into the sea. There was nothing of the slow, half-solid oozing that we had seen before. Seeming as liquid as water, it gushed out in brilliant streams to cool itself in the breakers. Vast clouds of steam and smoke rolled back over the land, submarine explosions of too rapidly cooled bombs threw great lumps of rock high in air, and white streaks of smoke darted erratically about like the trails of rockets and Roman candles.

Inshore the water was a brilliant green, in sharp contrast to the deep blue of the outer water, and marked as definitely as though it were painted on a floor. Within perhaps a quarter-mile of shore, as near as we dared to go, the temperature of the green water rose to 99 degrees. The moment the ship passed into the blue zone, the thermometer registered 78 degrees.

All day we circled round, passing and repassing, while cameras clicked and brushes and pencils flew. Having lingered to see the indescribable wonder of the scene by night, we unwillingly steamed toward Panama. The next afternoon our steering gear suddenly broke down. If this had happened twenty hours earlier, with the strong wind and current setting on shore, it is very probable that the *Arcturus* would have come to a spectacular and certainly unusual end.

In all our Pacific wanderings we searched untiringly for the Humboldt Current, the study of whose animal life was the chief object of my venturing into this ocean. This cold current flows northward from the Antarctic regions along the west coast of South America as far north as Peru, where it is deflected westward and washes the shores of the Galapagos, thus accounting for the relative coolness of this equatorial archipelago and for the presence there of such organisms as penguins. Two years ago, when on the *Noma*, we found abundant evidence of this current, both in the ten to fifteen degrees lowering in temperature of the water, and in the constant and remarkably strong set to the northwest of the one to two knots of this cold current. On the present

Osborn Island, named for Prof. Henry Fairfield Osborn, lying between Hood and Gardner Islands, the most southern of the Galapagos. The heads of sea-lions are visible in the water.

Top—A huge ray or devil-fish swimming along the surface of the water toward the *Arcturus*. Both wing tips are visible.

Center—A devilfish which we captured off Narborough. It weighed a ton and measured exactly eighteen feet between the tips of the fins.

Right—Ruth Rose in fifteen feet of water, with copper diving helmet and hose, showing the bubbles of her breath slipping out from beneath the helmet. Within a few yards are hundreds of fish, besides sharks and sea-lions.

during my two visits, it was assuredly wholly absent, both on the surface and in the depths. There would seem to be a very direct connection between the present year vagaries of this important current and the unprecedented deluges which have visited the usually rainless coast of Ecuador and Peru. Until I have studied the whole situation further I can make only these definite assertions concerning the time and place of this expedition.

On the 26th of June we steamed out into the Atlantic once more, hoping that at this season the Sargasso Sea might be found. After expedition the scores of lines of temperatures which we took, both surface and deep-sea, failed to reveal any such disturbing influence, and the only currents around the islands were relatively weak and wholly tidal. As to the Humboldt Current elsewhere I can report only on hearsay, several masters having stated that it was weak or quite absent along the South American coast. In all the Galapagos region

spending much of July in cruising about the area where charts locate it, we gave up the search. At this season, according to government reports, the distribution of the weed should be at the maximum in abundance and in area covered. But in the present year at least, as far as the southwestern third of the alleged area of this sea, the water was practically weedless. There is no doubt that, conditions being exactly right, great quantities of weed accumulate and grow in this region. I have seen patches of several acres in extent.

Deep-sea work was carried on constantly during this period of search, and the comparison of Atlantic and Pacific faunas proved full of interest. Off Chesapeake Bay an arrangement was made by wireless, and early one morning we saw the steam yacht *Warrior*, with Mr. Harrison Williams on board, come up over the horizon, swiftly to approach and salute the water-worn, more slowly moving *Arcturus*. Mr. Williams came aboard and watched the workings of the surface and deep-sea work, and had what is always the best point of view, that behind the scenes, with nothing prepared or different from any of the one hundred and seventy-odd days which had gone before.

As we passed on to the north I developed my final plan, to make my last Station, Number One Hundred and Thirteen, a deep-sea one, dredging in the very gorge of the Hudson River, one hundred miles from New York and half a mile below the surface. Of the startling success of this I will tell later. It was up this stately, invisible gorge that the *Arcturus* steamed on her last lap, and between waterfalls over which, in pre-Pleistocene times, perhaps two millions of years ago, the Hudson poured its volume, falling to depths many times greater than those of any waterfall on the earth today. Here I spent four days feeling about in the cold black depths with the fingers of my nets and trawls for the strange blind and luminous creatures which today dwell in the sunken river-bed.

On July 30th, saluted by the whistles and sirens of scores of river craft from motor boats to battle cruisers and ocean liners, the *Arcturus* steamed to her wharf, and the first oceanographic expedition of the New York Zoological Society was ended.

GIFTS TO THE ARCTURUS EXPEDITION

The Society acknowledges with grateful thanks the following gifts to the Arcturus Expedition:

A Sounding Machine, valued at $1,000.
WILLIAM H. TROTTER, Cleeve Gate, Chestnut Hill, Philadelphia.

Motion Picture Negative Stock, 4,000 feet.
GEORGE EASTMAN, Rochester, New York.

Oceanographic Books, including a set of The Valdivia Expedition, valued at $500.
FREDERIC C. WALCOTT.

Flash Lights and Batteries.
NATIONAL CARBON COMPANY.

Powerful Radio Set.
STROMBERG-CARLSON, Telephone Mfg. Co.

WILD-LIFE CONSERVATION

A Large Game Refuge to Be Established on the Upper Mississippi

WITH initial steps under way for the purchase of lands for the creation of the Upper Mississippi River Wild-Life and Fish Refuge, provided for by act of Congress in June, 1924, the dreams of conservationists who fostered the movement will soon be realized. This refuge, along the upper reaches of the Mississippi, is designed as a feeding and resting place for wild fowl and other migratory birds, and as a natural home for fur animals. In addition, it is established for the preservation of fishes, and the native flora.

It is one of the many acres needed for the perpetuation of migratory game birds and other forms of wild life.

The Secretary of Agriculture has been given authority to purchase the lands for the new refuge and administration is through the Bureau of Biological Survey, which maintains many of the other wild-life refuges of the Federal Government. Jurisdiction of the Department of Agriculture within the refuge will extend to wild birds, game animals, fur-bearing animals, trees, wild flowers, and plants, while the Department of Commerce will have jurisdiction with respect to fishes, mussels, and other aquatic animal life. The two departments are authorized to make suitable regulations governing hunting and fishing on the areas acquired.

The bill became a law on approval by the President on June 7, 1924, and authorized appropriations not to exceed $1,500,000 for the acquisition of overflowed lands on either side of the Mississippi in Illinois, Iowa, Wisconsin and Minnesota, for a distance of about 300 miles from Rock Island, Ill. to Wabasha, Minn. The appropriation bill for the Department of Agriculture for the year beginning July 1, 1925, carried $400,000 for beginning the work.

The superintendent of the new refuge has established headquarters at Winona, Minn., and is actively engaged in locating available lands.

MUSK-OX CALF IN THE ZOOLOGICAL PARK
Born September 14, 1925.

The Biological Survey is working to obtain the co-operation of people in the Upper Mississippi Valley in the development and enjoyment of this wild-life refuge. When the lands are obtained and the refuge thoroughly organized it will be one of the greatest establishments of the kind in the possession of the National Government. Here the wild animals, birds, and fishes will under careful conservation have opportunity to increase their numbers, and along with this, the public will be given the enjoyment of the sport of hunting and fishing to the fullest extent consistent with maintaining the wild-life supply within the area in maximum abundance. The region is a beautiful and picturesque place in which great numbers may seek healthful recreation and sport in the out-of-doors.

The areas to be purchased for the refuge are specifically limited to the bottom lands between the river and the bluffs which rise precipitiously on either side from 200 to 400 feet. In this region the Mississippi flows through a valley averaging three to five miles in width to the bluffs. At times of high water a large part of this area is overflowed and not suitable for agriculture. There are many permanent sloughs and bayous, some of them navigable to boats of light draft. Many of them are dry in summer, but the land exposed is not suitable for cultivation. To save the fishes in these cut-off bodies of water, the Bureau of Fisheries sends agents each year to return them to the Mississippi or carry them to other localities for restocking depleted streams. In this way hundreds of millions are rescued every year by Federal and State agencies in one of the great-

est spawning grounds in the United States for such species as bass, pike, sunfish and others.

The pearl-button industry, with an enormous annual output, finds an important part of its raw material in the mussel shells obtained in the waters of this region. It is noteworthy that the spawn of certain shellfish can be disseminated only in the gills of certain fishes, so that the mussel-shell industry in this region depends for its existence upon the conservation of the fishes frequenting these waters. The industry will not only be unhampered by the creation of this reservation but by its establishment will be assured of perpetuity.

The Mississippi Valley is described as the great American highway for our migratory birds, and many of their feeding and resting places are found in the very midst of the new refuge. Quail and ducks have in the past bred here, and during migration the refuge is an ideal place for many species of warblers. The principal fur animals indigenous to these lands are muskrats, minks, raccoons, foxes, and skunks, and in the southern part some few opossums. These animals will be of no small economic importance in the legitimate uses of the refuge.—*U. S. Department of Agriculture.*

TWO MUSK-OX CALVES BORN IN NEW YORK

THE possibilities in colonizing musk-ox herds in northern Canada and Alaska are now seriously engaging the attention of both the Canadian and United States governments. Until very recently no musk-ox calves ever have been born in captivity in North America, and if any births ever occurred in Europe, the records of them are so obscure as to be unknown on this side of the world.

Quite recently a letter appeared in a New York newspaper attacking the Director of the New York Zoological Park for his alleged mismanagement of the Park's herd of five musk-ox, now two and one-half years old. Corsan said: "In their present quarters they never will breed, and are sure to die long before their time."

Six days later (September 7) the musk-ox herd presented the Park with a calf, and on September 14 another came,—the first ever born on the American continent. The one shown in the enclosed photograph was 18 inches high at the shoulders and weighed 16 pounds. While both calves were perfect and healthy animals at birth, they lacked vigor, and their too-young mothers had practically no milk. A nursing bottle, cow's milk, and finally a milch goat were tried, but while Calf No. 2 did its best to make good, the immaturity of the two young mothers was too great a handicap on the offspring. Each calf survived only four days.

The Park herd is in the pink of condition, it has never suffered any from the summer heat of New York, and it is reasonably certain that later on other calves will be born and successfully reared.

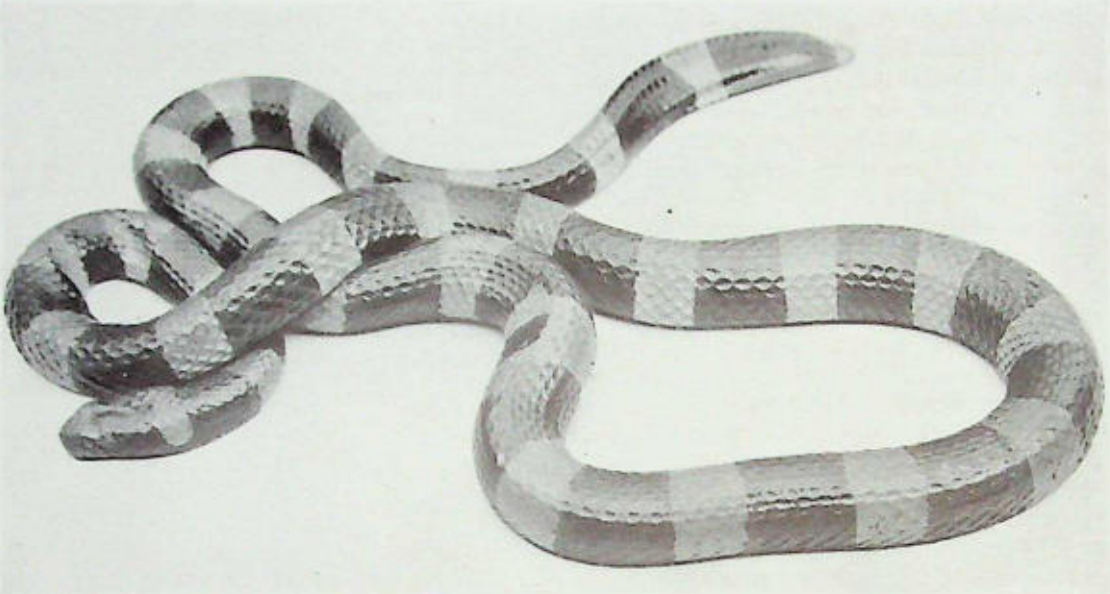
W. T. H.

SOME SEA SNAKES

From the Adventures of James Shervinton, and other tales of the South Seas by Louis Becke

IT is not generally known, except to scientists and those who are acquainted with the subject, that a large percentage of the various species and varieties of sea snakes are highly venomous. These snakes must not be confounded with the very numerous species of sea eels, which, though exceedingly savage and armed with strong needle-pointed teeth, are all non-venomous, though their bite produces high inflammation if not at once properly attended to and cleansed by an antiseptic. The sea snake is a true snake in many respects, having either laminated scales or a thick corduroyed skin resembling rudimentary scales. The head is flat, and the general structure of the body similar to that of the land snake. Whether any of them possess the true poison glands and fangs I do not know, for although I have killed many hundreds of them I never took sufficient interest to make a careful examination; and I was told by a Dutch medical gentleman, long resident on the coast of Dutch New Guiana, and who had made some investigation on the subject, that he had failed to discover any poison sacs or glands in any one of the several snakes he had captured. Yet in some instances he found teeth common to venomous land snakes, but on detailed examination these always proved to be perfectly solid; nevertheless a bite from one of these sea serpents was generally regarded by the natives as fatal; in my own experience I know of two such cases, one at the island of Fotuna in the South Pacific, and the other in Torres Straits.

In Sigavi Harbour, on Fotuna, there is a rock to which vessels occasionally make fast



A TRUE SEA SNAKE, *PLATURUS SHISTORHYNCHUS*

All of these serpents are characterized by the flat rudder-like tail. Contrary to the author's word that "the larger percentage are poisonous" it is believed that all of them are deadly.

their stern moorings. In the boat which I sent away with a line to this rock were several boys, natives of the island, who went with the crew for amusement. One of them, aged about ten, jumped out of the boat, and in his hurry fell on his hands and knees, right on top of a large black and white banded sea snake, which at once bit him savagely on the wrist, causing the blood to flow from a score of tiny punctures. The boy at once swam to shore to be treated by a native; in the evening I heard he was suffering great agony, in the morning the poor little fellow was dead.

The second instance was near Raine Island, in Torres Straits. A stalwart young Kanaka, one of the crew of a pearling lugger, was diving for clam shells on the reef, when a snake about three feet in length suddenly shot up from below within a foot of his face. In his anger and disgust he unthinkingly struck it with his hand, and was quickly bitten on the forefinger. A few hours later he was in a high fever, accompanied with twitchings of the extremities; then tetanus ensued, followed by death in forty-eight hours.

Although these sea snakes are common to all tropical seas, they are most frequent about the Great Barrier Reef of Australia. On any smooth day they may be seen disporting themselves on the surface, or rising suddenly from the depths, erect their heads and some inches of their bodies clear from the water, gaze at the passing vessels, and then swiftly disappear. In nearly all the Pacific Islands the natives hold them in detestation and horror, and when one is seen lying coiled up on a rock sunning itself or crawling over the surface of the reef in search of food, a stone, accompanied by a curse, is always hurled at it. In the Ellice Group, when catching flying-fish at night, one (or more) of these horrid serpents is sometimes swept up in the scoop-net before it can be avoided. They range from six inches to nearly four feet in length, and all have one feature—a blunted tail-end.

Quite recently much further light has been thrown on the subject by Sir James Hector, of the Philosophical Society of Wellington, New Zealand. At one of the Society's meetings, held in April last, Sir James showed several specimens of *hydridae*, some from Australasian Seas, others from the Atlantic. The usual habitat of sea snakes, he said, were the tropical seas generally, but some had been captured in the comparatively cold water of the New Zealand coast, at the Catlins River. These latter were all yellow-banded; those from the islands of the Fijian Group were black-banded. There were, he said, no fewer than seventy species, which, without exception, were fanged and provided with glands secreting a virulent poison. In some

of the mountainous islands of the South Pacific, such as Samoa, Fiji, etc., there were several species of land snakes, all of which were perfectly harmless, and were familiar to many people in Australia and New Zealand, through being brought there in bunches of island bananas—it was singular, he thought, that the sea snakes alone should be so highly venomous. "They were all characterized by the flattened or blunted tail, which they used as a steer oar, and were often found asleep on the surface of the water, lying on their backs. In this state they were easily and safely captured, being powerless to strike." The present writer, who has seen hundreds of these marine snakes daily for many years, during a long residence in the Pacific Islands, cannot remember a single instance where he has seen one of these dangerous creatures asleep on the water, though they may frequently be found lying asleep on the coral reefs, exposing themselves to the rays of a torrid sun. They usually select some knob or rounded boulder, from the top of which, when awake, they can survey the small pools beneath and discern any fish which may be imprisoned therein. In such case they will glide down into the water with astonishing rapidity, seize their prey, and after swallowing it, return to their sun bath. The natives of the Paumotu Archipelago informed me, however that they are most active in seeking their prey at night-time, and are especially fond of flying fish, which, as is well known, is one of the swiftest of all ocean fishes. The sea snakes, however, seize them with the greatest ease, by rising cautiously beneath and fastening their keen teeth in the fish's throat or belly. A snake, not two feet six inches in length, I was assured, can easily swallow a flying fish eight inches or ten inches long.

With regard to their habit of lying asleep on their backs on the surface of the water, it may be that Sir James Hector is alluding to some particular species, but whether that is so or not Sir James's statement must of course be considered authoritative, for there is, I believe, no higher authority on the subject in the world.

MOUNTAIN SHEEP AND ANTELOPE PROTECTION IN MEXICO

In 1922, after a century of uninterrupted slaughter, President Obregon, by presidential decrees, gave ten years of absolute protection to the few surviving mountain sheep and prong-horned antelope then remaining alive in Mexico.

Then, for good and sufficient reasons, the Permanent Wild Life Protection Fund offered to bear the costs and charges of two years of practical enforcement of the law, if the government of Mexico would appoint and duly commission Ben H. Tinker, of Tucson, as Honorary Game Guardian. The appointment was promptly made, and Mr. Tinker entered upon his duties on October 1, 1923. Throughout that hunting season and the next, the sheep and antelopes of northwestern Sonora were adequately protected, and the lambs and fawns observed last year and this year indicate a good beginning of the recovery that was hoped for.

Climatic conditions this year in the Sonoran Desert have been particularly severe, and Mr. Tinker's monthly report of field work for March is of considerable interest. It is as follows:

Tucson, Arizona,
April 1st 1925.

The following is my report for the month of March, 1925:

I found G. A. Ingham and W. Wilfred camped near Cabeza Prieta. They are from Yuma, Arizona. They were prospecting, and are not interested in hunting. This is the only party I encountered in the field during the month. The weather is hot, and all tinajas (tanks) are dry excepting the Papago Tank and Tinajas Atlas. The latter still retains a good supply of water, but the Papago Tank is very low. There is no feed to speak of, excepting a few green shoots of the ajo lily. The galleta grass is dry and brittle, and unfit for feed. Very few wild flowers are appearing,—due to lack of moisture, and no rains. Game is eating choya and bisnaga cactus, and browsing.

The following mountain sheep and antelope were observed:

At Cabeza Prieta, 3 rams and 9 ewes; at Tinajas Atlas, 2 rams and 3 ewes; at Pinacate, 4 rams, 7 ewes and 3 lambs; at Sierra Blanco, 1 ram, 8 ewes and 5 lambs; at Sierra Pinta, 3 ewes and 1 lamb; at Sierra San Francisco, 3 rams, 11 ewes and 6 lambs.

I saw only 3 antelope between Pinacate and Sierra Blanco, and 3 on the Cerro Colorado. Antelope are drifting farther south, toward the lower Altar. Three bands have crossed the border near the north end of the Pintos Mountains, and are now in the vicinity of Mohawk, Arizona.

I used the well that the Cornelia Company drilled just south of Sierra Blanco, for a base camp most of the month, due to the fact that whatever parties then might come in to hunt would use that water; and also because I needed the water for my outfit.

The extremely dry year, and the hot weather starting early, has sure put a crimp in the hunting, and there were no hunters found in our territory during the month of March. Water for camping is widely separated, and with the exception of the Papago Tank is quite a long ways from the game country.

I believe this is the briefest report I have made yet, as there was absolutely nothing doing in the hunting line during the month. My map of operations is enclosed herewith.

Yours truly,

Ben Tinker,
Honorary Game Guardian for Sonora, Mexico.

New York Zoological Society

OBJECTS OF THE SOCIETY

¶ A PUBLIC ZOOLOGICAL PARK. ¶ A PUBLIC AQUARIUM. ¶ THE PRESERVATION OF OUR NATIVE ANIMALS. ¶ THE PROMOTION OF ZOOLOGY.

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ELWIN R. SANBORN, *Editor*

VOL. XXVIII SEPTEMBER, 1925 No. 5

THE ALBERT NATIONAL PARK

A Sanctuary for the Preservation of the Easterly Outpost Colony of the East African Gorillas.

By JAMES G. WHITELEY
Consul of Belgium.

By Royal Decree, dated March 2nd 1925, His Majesty, King Albert, has created, in the Kivu district of the Belgian Congo, a specially protected zone for the preservation of the native fauna and flora of the country in the interests of science. This reservation has been named "The Albert National Park" ("Parc National Albert") in honor of the King who has taken an active personal interest in the matter.

The zone designated for this purpose comprises a region of great scientific interest lying near Lake Kivu and embracing the three volcanos of Mt. Mikeno, Mt. Karissimbi and Mt. Vissoke, rising to a height of nearly 14,000 feet. The lower slopes of these mountains are covered by virgin forest containing rare specimens of flora as well as of fauna. It is in this region that the few remaining specimens of gorilla have found a refuge.

Within this reservation it is forbidden, by the Royal Decree, to capture, kill or hunt any kind of wild animal whatever—including even harmful animals—or to destroy or carry away eggs or nests of wild birds, or to cut down, uproot or carry away any uncultivated plant or tree. Proper provision is made to protect native rights of gathering wood for fuel and other native rights.

The Decree makes special mention of the gorilla and forbids the killing, capturing, hunting or molestation of this animal in any way whatever within the reserve.

The area covered by the Royal Decree is approximately one hundred square miles. As the southern spurs of Mt. Karissimbi and of Mt. Vissoke lie in Ruanda, which is mandated territory, they are not included in the Decree, but the Royal Commissioner of Ruanda will be requested to issue similar regulations covering the southern foot-hills of those volcanos.

In addition to this, the "Parc National Albert" is to be surrounded, on the Congo side, by another reservation, under less severe restrictions, covering about eight hundred square miles, and extending to the shores of Lake Kivu.

This northeastern section of the Belgian Congo is very high and healthy, and it is proposed to establish in the "Parc National Albert" a biological laboratory and suitable buildings where scientists from all over the world may come and make geological and meteorological observations as well as study the fauna and flora of the Congo in their natural conditions.

The full text of the Royal Decree is as follows:

ALBERT, *King of the Belgians,*

To all present and to come, Greeting.

Upon the proposition of Our Minister of Colonies. We have ordered and do order:

Our Minister of Colonies is charged to submit, in Our Name, to the Colonial Council, the draught of a Decree of which the following are the terms:

Article 1. There is created in the Kivu, for scientific purposes, a reserve for fauna and

flora, comprising the mountains Mikeno, Karissimbi and Vissoke, which shall be known as the "Parc National Albert."

Article 2. The boundaries of this reserve on the West, shall not extend beyond the trail of Ntata, Buganda, Bahara, Russura. On the South, they shall follow the frontier of the Congo and of Ruanda from its intersection with the above-mentioned trail to the point where it cuts the trail from Gissisi to Dyombo. On the East they (the boundaries) shall not extend beyond this trail from its intersection with the frontier up to Dyombo, and, on the North, the trail from Dyombo to Ntata.

The Governor General shall fix the exact boundaries of the reserve, taking into consideration the needs of the native population. As far as possible, these boundaries shall run parallel to the aforesaid trails and shall follow the water-courses or the natural features of the land in such a way as to be easily recognizable.

Article 3. In the zone thus bounded, the killing, capture or pursuit of the gorilla, as well as every other act of hunting this animal, is forbidden.

Article 4. In the same zone, reservation being made for the rights and needs of the natives, it is forbidden:

(a) To pursue, hunt, capture or destroy any kind of wild animal whatever, including even harmful animals, except in case of legitimate self-defense;

(b) To take or destroy eggs or nests of wild birds;

(c) To cut down, destroy, up-root or carry away any uncultivated tree or plant.

Article 5. The Governor General is authorized to create a corps of conservators for the Parc National Albert and a corps of special native police.

He may especially, reservation being made for the rights and needs of the natives, forbid, throughout the entire extent of the reserve: circulation, camping and sojourning; introduction of fire-arms, traps or dogs; transportation, possession or exportation, of skins or other remains of wild animals, of eggs or nests of wild birds; digging holes, boring, embanking or other works which modify the aspect of the ground or of the vegetation; without authorization in writing given by a conservator or by his delegate.

The interdiction of circulation does not apply to functionaries in the exercise of their duties.

Article 6. The Governor General and the conservators of the Parc National Albert may, for a scientific purpose or to assure the better conservation of the fauna and flora, revoke, in part or in whole, for the benefit of persons definitely indicated, for a limited period and under certain conditions, the interdictions set forth in the preceding articles.

Article 7. Without prejudice to the penalties provided by the decree concerning hunting or by other decrees and ordinances, infractions of the present decree shall be punished by from 1 to 2 months maximum of penal servitude and by a fine of 2,000 francs, or by one of these penalties only.

Article 8. For the purpose of covering the cost of the establishment, care and maintenance of the reserve, there is created a fund, known as "Fonds du Parc National Albert," which may receive all gifts, bequests, etc., and collect all casual receipts.

Done at Brussels, March 2nd 1925.

(*Signed*) ALBERT.

By the KING:
The Minister of Colonies,
(*Signed*) HENRI CARTON.

The elm lets fall its leaves before the frost,
The very oak grows shivering and sere,
The trees are barren when the summer's lost:
But one tree keeps its goodness all the year.

Green pine, unchanging as the days go by,
Thou art thyself beneath whatever sky:
My shelter from all winds, my own strong pine,
'Tis spring, 'tis summer, still, while thou art mine.

—*Augusta Webster.*

AQUARIUM ALTERATIONS

The Park Department, City of New York, on September 5, 1925, awarded contracts for the completion of the work on the alterations of the New York Aquarium which have been in a state of progress for some time. The various details under construction and the amounts necessary to cover their cost are announced by Chief Engineer Steinacher as follows:

General Construction (not including heating, plumbing or the parapet) awarded to Remo Realty Co., Inc., 645 East Tremont Avenue, Bronx, for $29,876.00

Heating contract was awarded to Henry Bing, 3371 Third Avenue, Bronx, for $1,985.00

Plumbing contract was awarded to S. L. Snyder Co., 260 West 41st Street, New York City, for $1,082.00

Electric work given P. J. Keegan, 1966 Broadway, on open market order, for..$875.00

THE SNAKE CHARMER OF LUXOR

By Sallie Miller

There are many things in Nature that man, with his finite mind and limited knowledge, doesn't know. There are many manifestations in the animal world that at present we can not "account for," or explain. The following clear, coherent and evidently correct story of things seen may well be set forth, even though it is utterly impossible—at present—for us to "account for" the psychologic influence described. Of it Mr. Ditmars says: "I have always believed that the Arabs and Hindus have strange power or influence with snakes, but it is seldom that we see it so clearly and simply described."—*Editor.*

THE SNAKE CHARMER OF LUXOR

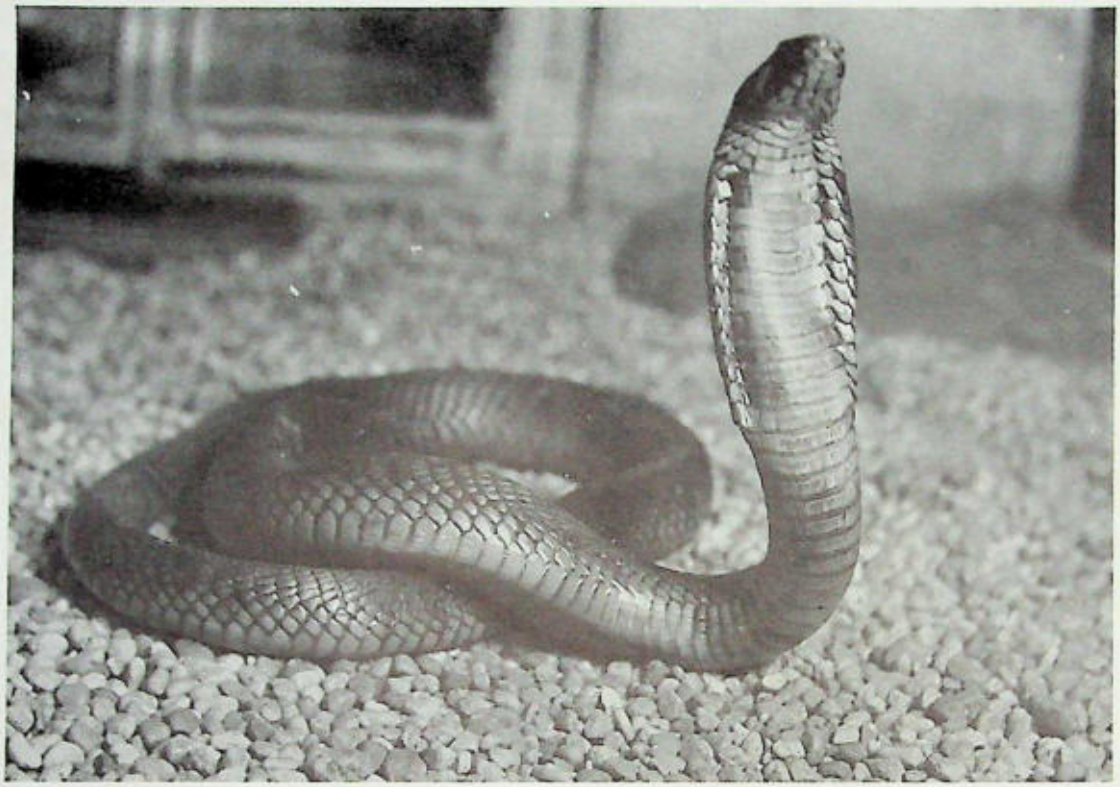
LUXOR is on the east bank of the Nile River in Upper Egypt, which means southern Egypt, for in Egypt one goes up to the south and down to the north, because the land slopes toward the north to the Mediterranean Sea.

At Luxor there lives a man famous throughout the region as a snake charmer. In the winter of 1923, I saw this man, dark of complexion, tall, wearing a black robe which, according to the custom of the country, was loose-flowing.

It had been arranged with our guide that this man should accompany our party from Luxor to Karnak, a few miles distant, where snakes are to be found amid the ruins of the temples. But on the morning of our proposed excursion, no vehicles were obtainable to take us to the place, all having been chartered at an earlier hour by visitors to the Kings' Tombs. So our plans were changed and we did not go where we had planned to go. Instead, we rode on donkeys into the fields to a spot some two miles distant where we dismounted.

When the donkeys had been tethered in the shade of some trees, the snake charmer asked us to choose the direction in which we would like to walk, and I suggested a narrow pathway which branched off from the roadway. With his loose sleeves rolled back to the shoulders, carrying a stout, straight, polished stick which he waved in the air, he preceded us along the pathway, chanting some words in a foreign tongue. Presently, he poked with his stick into some grasses and reaching down pulled out a scorpion, a many-legged, greenish-yellow creature with a body about three inches long. He showed us the sting located in the tail and with his bare finger touched it many times but it did not sting him. "This scorpion," he said, "will kill *any* snake." He then placed it on the vertical side of a nearby wall where it remained motionless. "If I were to come back here tomorrow," he said, "that scorpion would still be here just where I have placed it."

He then took the scorpion and put it into a bottle-shaped bag which he had brought with him, and we proceeded on our walk, he continuing his chant and waving his stick. In a moment he paused, laid his finger against the side of his nose and said, "I smell a snake. But it is not a poisonous one." With his stout stick he pushed aside some tall grass and little bushes and disclosed a hole at the base of a wall. Into this hole he thrust his stick, chanting all the while in tones that had become menacing. Then,



THE EGYPTIAN COBRA, *NAJA HAJE*

This is the supposed asp of Cleopatra. Modern scientific knowledge of this serpent's deadly powers is sufficient evidence that Egypt's queen chose a sure method of dissolution.

withdrawing the stick and thrusting in his arm so far that even his elbow was within the hole, with a sudden jerk he pulled out, tail first, a snake. He held it up by the head for us to look at and told us that it was harmless. Pinching its mouth gently at the corners, as children pinch snap dragon to make it open its mouth, with his thumb he drew back the lower lip and showed us its teeth. Then he coiled the snake up and put it into his bag along with the scorpion. I said to the guide, "Why does he put the snake with the scorpion? He said that the scorpion would kill any snake." The guide replied, "I don't know what he has done to that scorpion but I know that that scorpion will not kill that snake."

I then suggested that we leave the trail and strike out into the fields in a direction at right angles to the path. Here were more old walls and toward them we went. In a few minutes the snake charmer, still chanting, again laid his finger on the side of his nose and said, "I smell a snake. It is a cobra." Again it was at the base of a wall that he pushed aside grasses and disclosed a hole, and again he thrust his stout stick into the hole disclosed. For some minutes he seemed to be agitating it inside. Then drawing it out, he thrust in his arm to the elbow, drew it back a little, thrust it in again and after some seconds, with a quick movement, pulled out by the tail, a cobra, and threw it far from him on to the ground. The cobra at once started to come back at him. When it had almost reached him he lifted it with his stick and threw it back. Once more the cobra advanced and once more the snake charmer threw it back. A third and a fourth time this was repeated and then as the snake again came toward him the snake charmer advanced a step or two toward the cobra. His chant, which had never ceased, now became a thundering menace; terrible imprecations he seemed to be hurling at the snake. His eyes were fixed in a steady stare on the eyes of the cobra and never for an instant were taken from them. Bending forward, shaking his stick and howling his chant, he stepped toward the cobra, and midway in its advance the cobra suddenly stopped, coiled its tail and with its hooded head poised high in air became motionless. It was as if frozen to stone. Motionless it remained and

the snake charmer walked slowly toward it, still keeping his eyes fixed upon the eyes of the cobra. When he had reached it, he laid his hand, palm upward, on the ground in front of the upraised body of the snake and within two or three inches of it. He waited. Slowly, very slowly, the cobra lowered its head. Measured and deliberate was the movement. Lower and lower the head came down till it rested on the upturned palm of the snake charmer's hand. There for perhaps two or three minutes it remained quite motionless, till the snake charmer picked up the cobra by the head, stroked its five feet of body for a few minutes, then coiled it up and put it into his wide-necked bottle-basket. He put his hand down into the basket to arrange the three occupants, and closed the lid. "Have you seen enough?" he asked us. One of the party said "Yes," but I said I'd like to see just one more.

It was not long before he repeated what he had done on the two previous occasions. He laid his finger on his nose and said, "I smell a snake. It is a poisonous one." He poked into a hole, thrust in his arm and pulled out, tail first, a dark colored snake. He told us that it was one of the most poisonous species in Egypt.

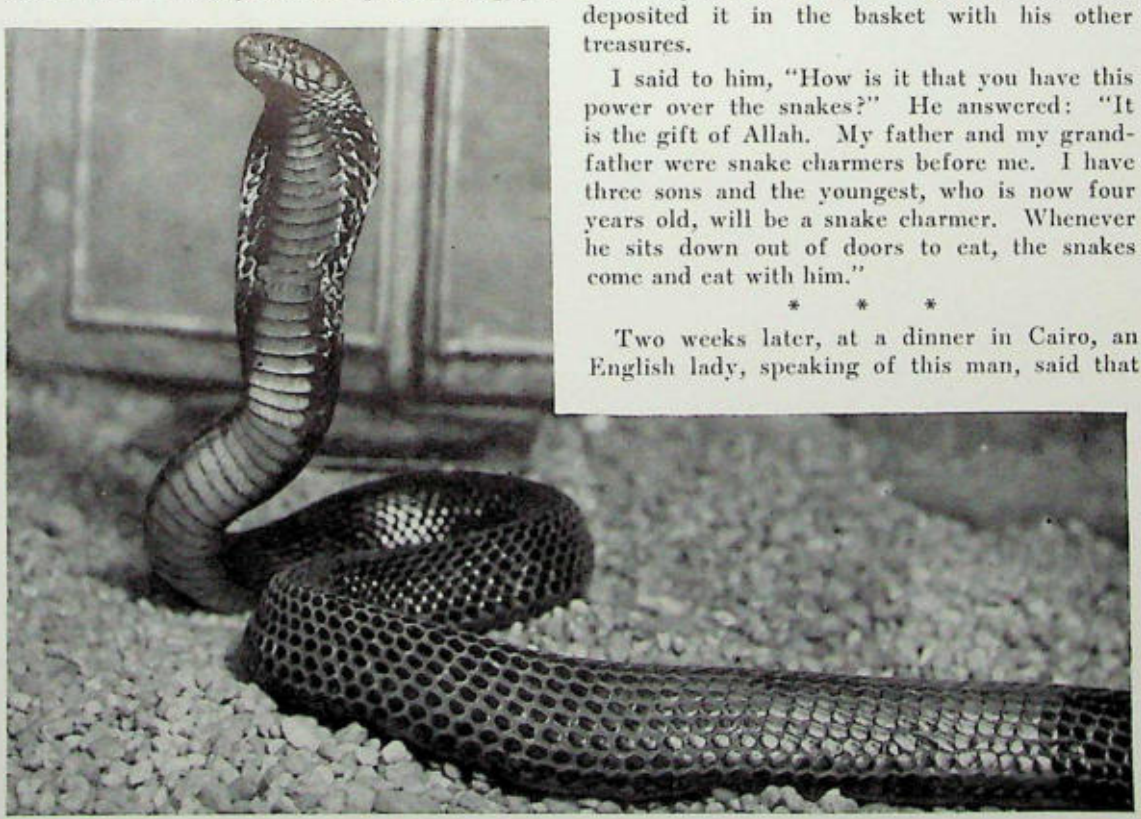
By this time a little crowd of barefoot natives had gathered around—some six or eight of them, perhaps—standing in a group and watching. And at this point the snake charmer did a most cruel thing. Holding the snake by the tail, he threw it into the midst of the group of natives, while he smiled as if at a great joke. Like lightning the barefoot boys vanished. Over stone walls and down embankments they leaped, terror in every face. They leaped before the snake had touched them and they did not return until it was safe in the hands of the snake charmer. One of our party then offered fifty dollars—a large sum in that country—to any one of them who would pick up the snake, but all very firmly declined.

The snake charmer picked it up, and beginning at the tail, stroked it slowly throughout its entire length. He then coiled it about his neck and with its head hanging down his back, he stood with his hands hanging carelessly by his side. The snake, though released from his grasp, made no motion to escape. For some moments the man and the snake remained thus. Then the snake charmer took the reptile from his neck, wound it into a nice little coil and deposited it in the basket with his other treasures.

I said to him, "How is it that you have this power over the snakes?" He answered: "It is the gift of Allah. My father and my grandfather were snake charmers before me. I have three sons and the youngest, who is now four years old, will be a snake charmer. Whenever he sits down out of doors to eat, the snakes come and eat with him."

* * *

Two weeks later, at a dinner in Cairo, an English lady, speaking of this man, said that



THE BLACK COBRA OF AFRICA, *NAJA MELANOLEUCA*

This is a species new to the collections of the Zoological Park, from Tropical Africa.

when she was at Luxor she had seen him do similar things with snakes and that the performance was so extraordinary that she had doubted its sincerity. She had thought that perhaps he had caught the snakes on some previous occasion, tamed them, and in some way succeeded in keeping them in their holes until such times as he wished to perform before visitors. Someone at the table remarked that if he could keep them in their holes to suit his pleasure, that in itself was quite as marvelous as anything that he had done. Disregarding the remark, the speaker went on to say that she had declared that one thing alone would convince her that the man had the power that he appeared to have, and that was, if he could charm snakes in a region with which he was unfamiliar. This man had never been into the Sudan, and as she was one of a party that was planning to go there, it was arranged that the snake charmer should accompany them.

She said that when they reached the Sudan, this man did exactly the same kind of thing with the snakes that he had done at Luxor. She therefore saw that his power was real.

THE POISONOUS SERPENTS

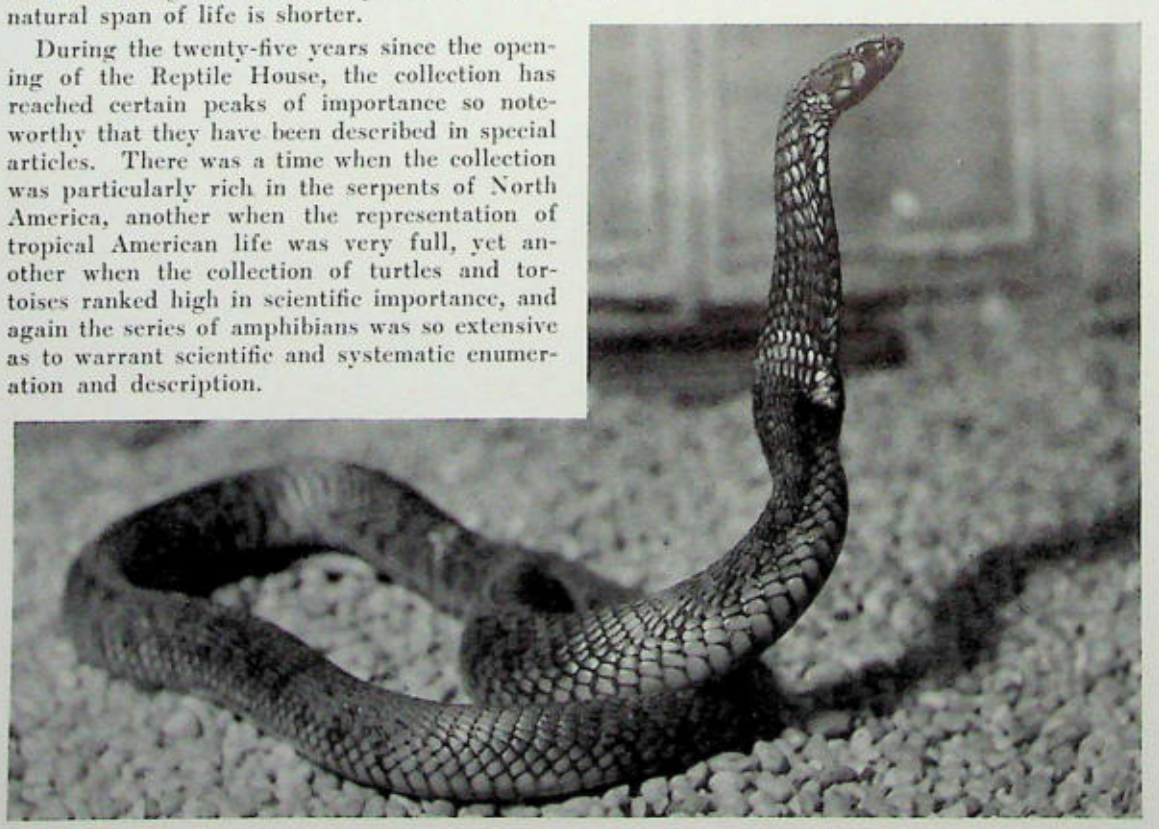
By Raymond L. Ditmars

Illustrations from the Zoological Park Collections

IN extensive collections of living mammals, birds and reptiles, like those in the Zoological Park, a slow process of change is always taking place, which is markedly evident to a visitor who returns after an inspection of several years ago. This is particularly evident among the smaller specimens, whose natural span of life is shorter.

During the twenty-five years since the opening of the Reptile House, the collection has reached certain peaks of importance so noteworthy that they have been described in special articles. There was a time when the collection was particularly rich in the serpents of North America, another when the representation of tropical American life was very full, yet another when the collection of turtles and tortoises ranked high in scientific importance, and again the series of amphibians was so extensive as to warrant scientific and systematic enumeration and description.

These changes, or the building up of certain groups or species from specific areas, result from several causes: Several collectors may temporarily locate in an interesting region, rich in reptile life; letters of inquiry consistently distributed by the curator of the department may stimulate interest in a good collect-



BLACK COBRA OF TROPICAL AFRICA

Under the stress of being photographed, this active snake lifted his head fully two feet from the ground.

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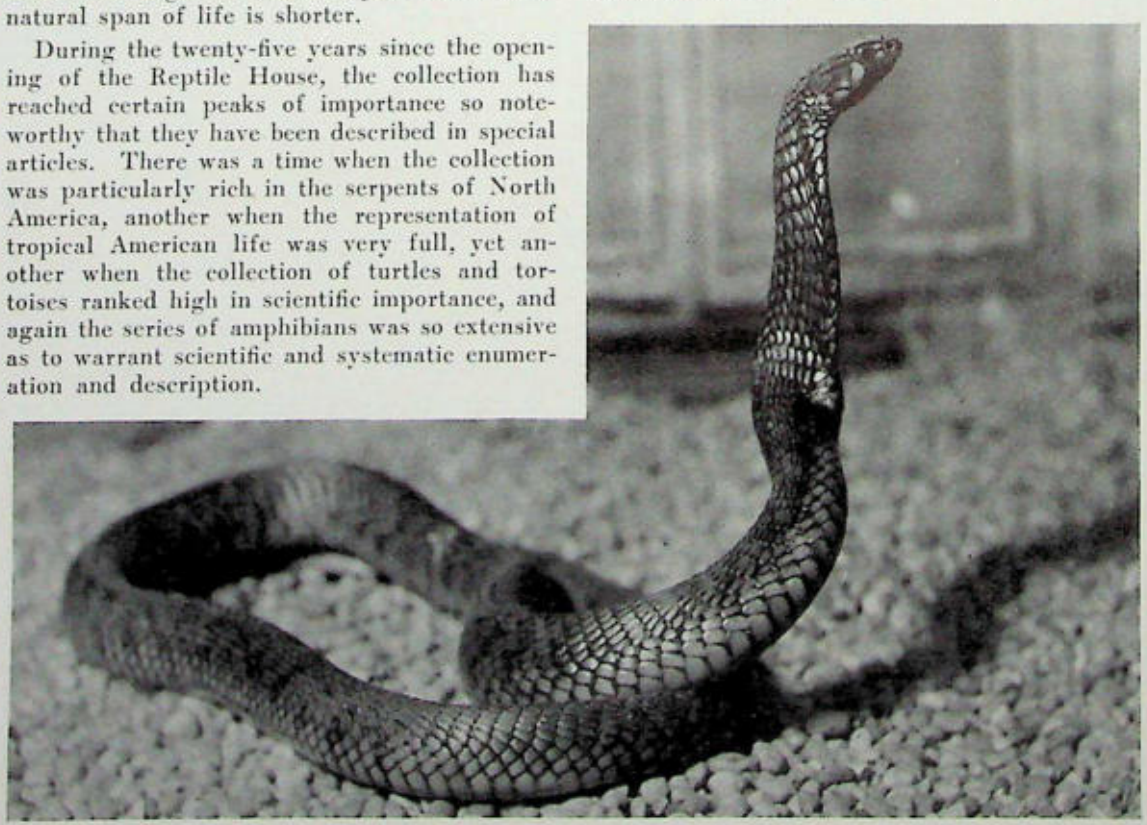

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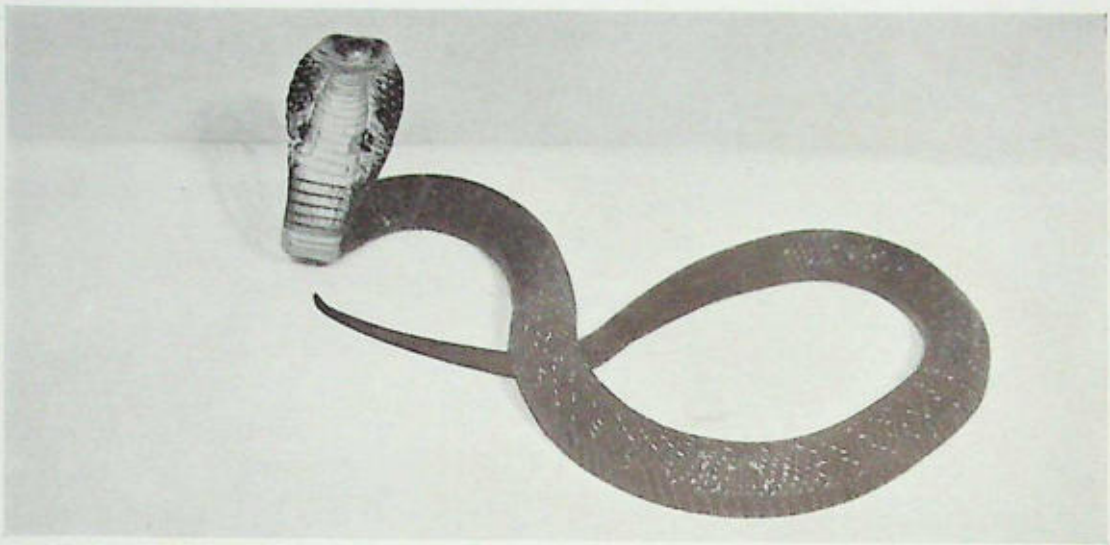
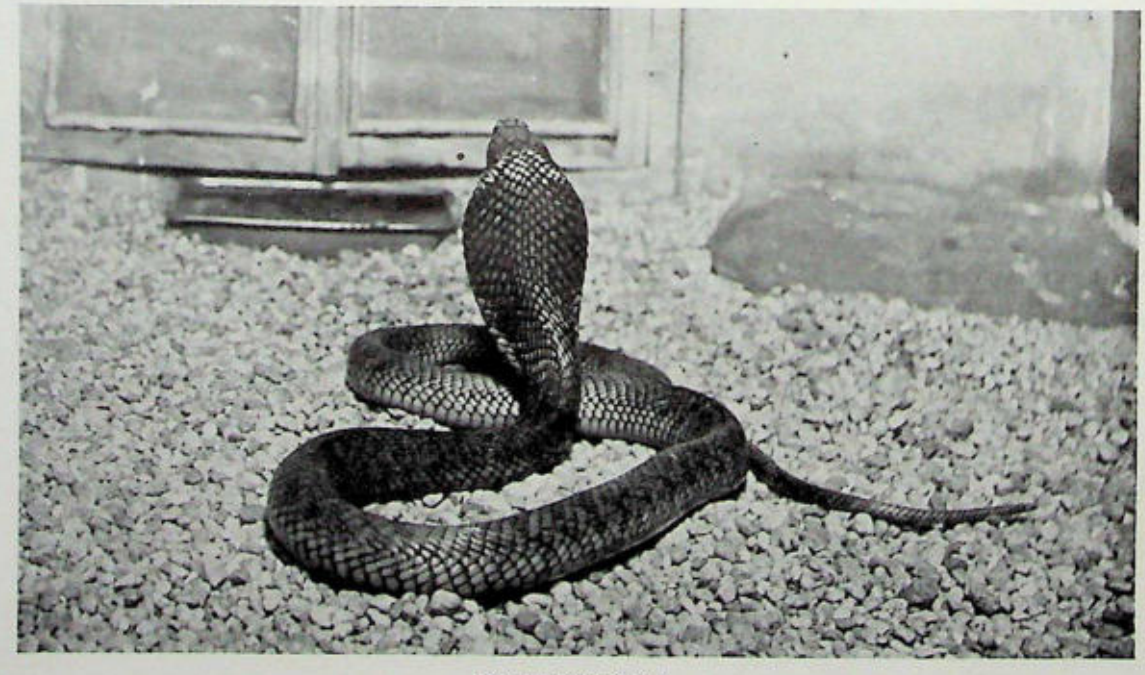


SUMATRAN COBRA

A color phase of *Naja tripudians* found in the East Indies, and the Malay Archipelago.

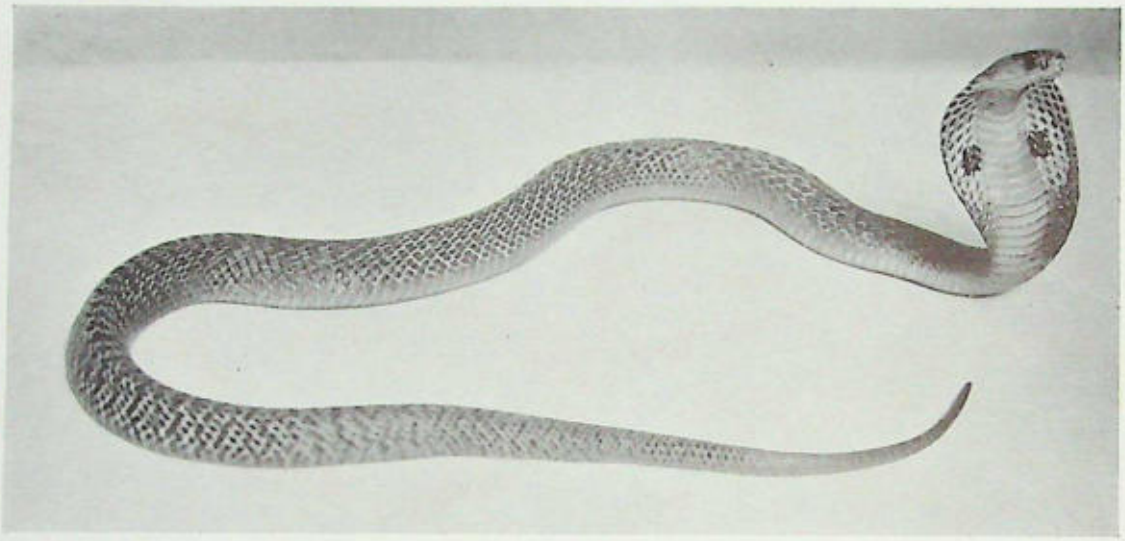
ing area where prospectors or a scientific expedition are at once willing to assist the Society, or an animal dealer may arrive with an interesting shipment. Such methods develop a good foundation upon which an important series eventually may be established.

This process of forming a series of really spectacular interest to visitors, and of scientific importance as well, was started a little over a year ago on the assurance of an African collector, Mr. J. L. Buck, that he would bring to us a collection of more or less well known poisonous serpents from that country. The object was to ultimately exhibit a thoroughly representative collection of the poisonous serpents of the world. These are of great interest



EGYPTIAN COBRA

A back view showing the expanded neck or hood. This species is a dark olive in color and without the striking pattern of the Hooded Cobra, *Naja tripudians*.



HOODED OR SPECTACLED COBRA

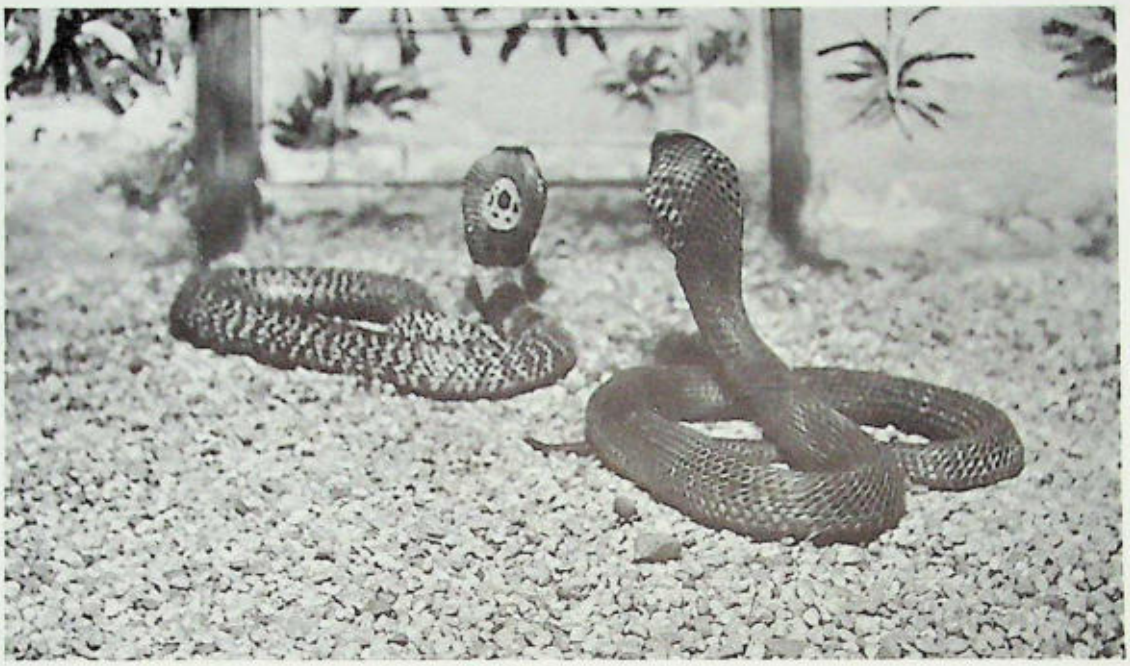
The cobra of India is much better known than any of the other species. It is alleged that this deadly snake causes the deaths of 20,000 people each year in India.

to our visitors, as illustrated by frequent queries, and of great practical value also, in showing how the dangerous reptiles actually look. Some are extremely deceptive upon casual examination, and give a very inadequate conception, from their outward appearance, of their extremely formidable characteristics.

We already had a fair foundation of the Asiatic species, but others were ordered to fill the gaps, and while awaiting the African series, a fine representative group of the North American poisonous reptiles was brought together. When the main African shipment did arrive it was superior to what the writer had

THE EGYPTIAN COBRA

A view of this somber reptile reared for striking. Apparently the hood is never expanded to the extent of that of the Indian Cobra.

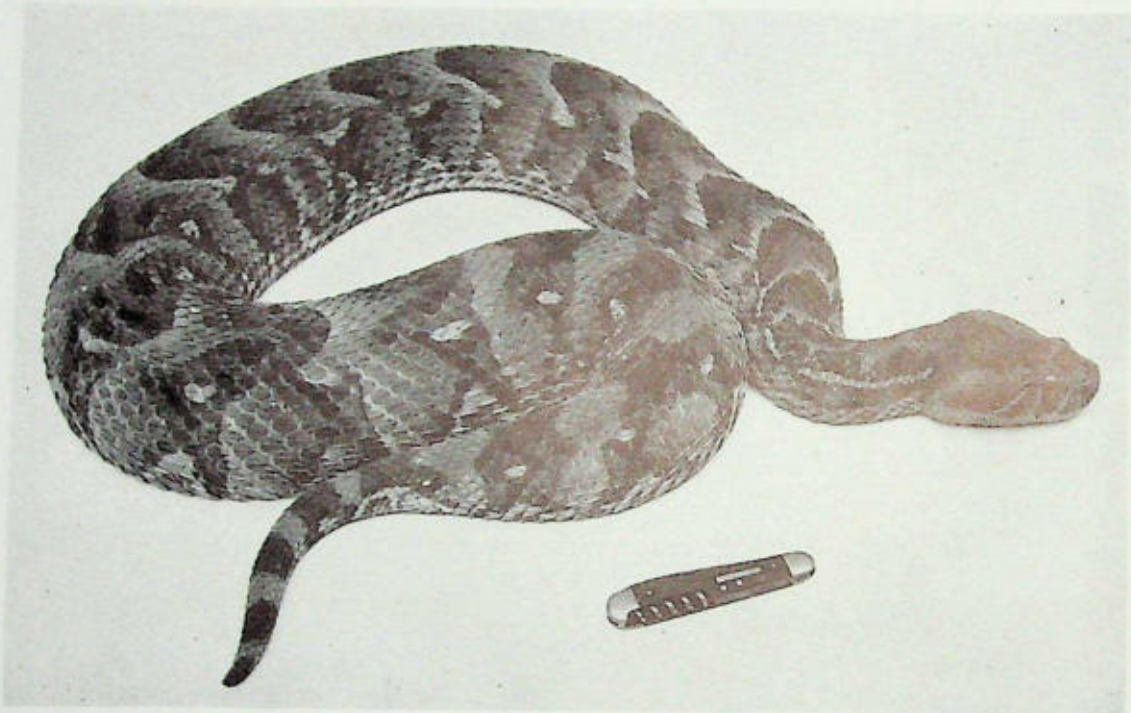


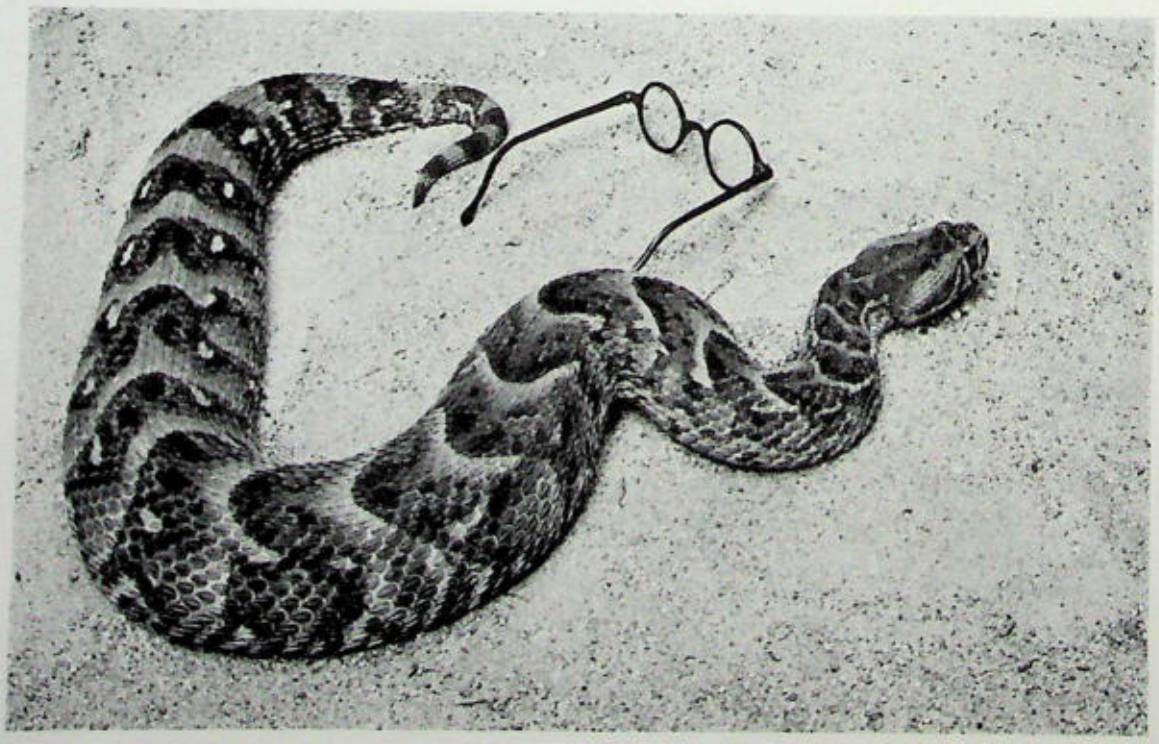
YELLOW AND HOODED COBRAS

The lighter colored snake is the Hooded Cobra, the faintly shown pattern on the partially expanded hood is the spectacle marking which gives its more common name, Spectacled Cobra.

YELLOW AND HOODED COBRAS

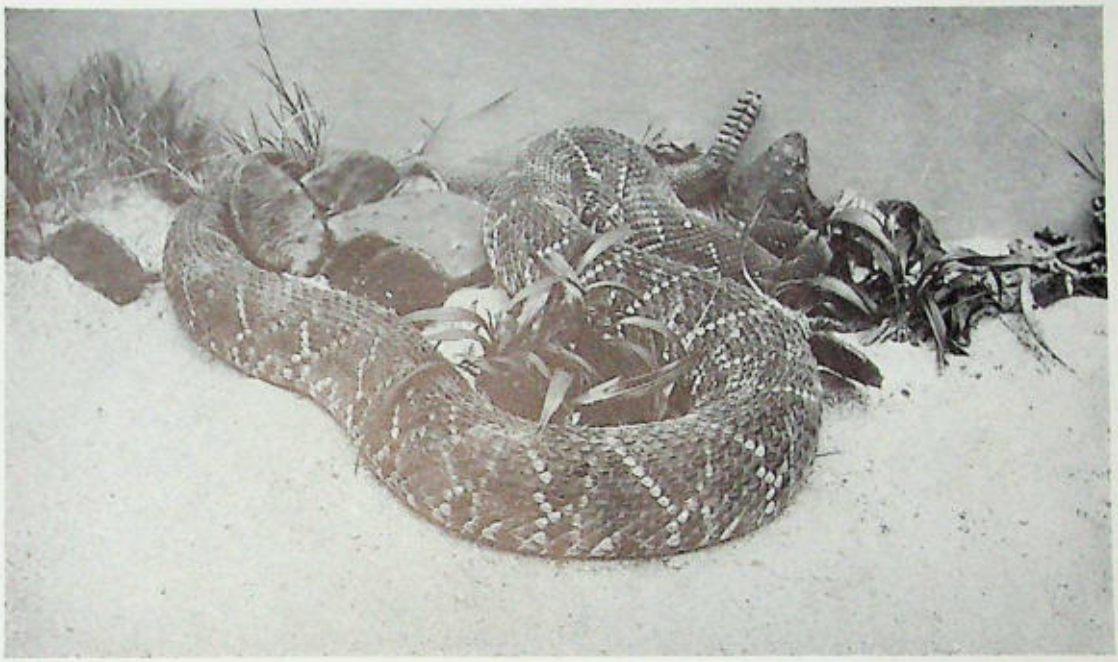
A very fair idea of the reptile's method of striking is shown in the picture. He had reared about 16 or 18 inches from which point he struck forward exactly as one would drop the hand and arm as it rests on the point of the elbow.





AFRICAN PUFF ADDER

Two color phases of the puff adder with accessories to better illustrate the huge size of these deadly though rather sluggish reptiles. The indolence of these snakes makes them rather easy to photograph. They will bite the hand that feeds them if it comes close enough to reach without much effort.



TEXAS DIAMOND RATTLESNAKE

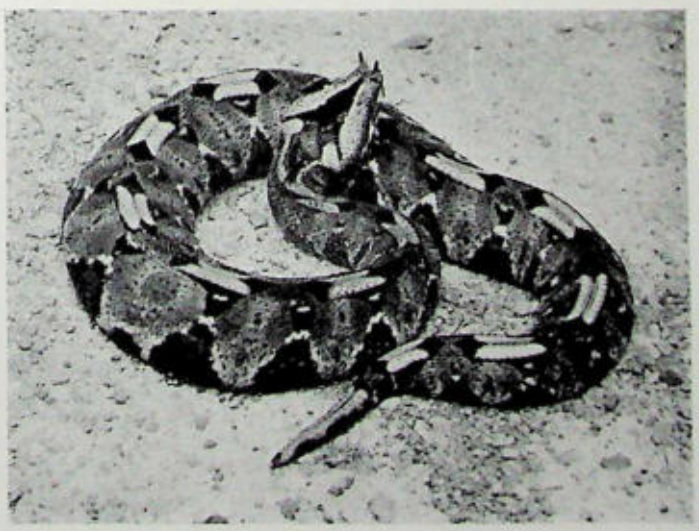
This is *Crotalus atrox* from the southwest, sandy desert country.

anticipated. As sometimes happens in this work, an additional series of north African venomous serpents, consigned to Mr. Ellis S. Joseph, arrived unexpectedly.

As a result of all these efforts we have been surprised to find that for the first time since the opening of the Reptile House more than twenty-five years ago, the poisonous serpents outnumber the non-venomous species in the collection, and that with the exception of the collections in the fraternally associated Zoological Gardens in Philadelphia, we have brought together by far the most important and interesting series of poisonous serpents ever exhibited collectively in the world.

A brief review of the specimens in our Reptile House shows the following species now on exhibition. Six species of North American rattlesnakes, these being the southeastern Diamond-back Rattlesnake, Texas Rattlesnake, eastern Timber Rattlesnake, and the Blacktailed, Prairie and Red Rattlesnake,—these three being western species—also the large golden-green rattler of the tableland of Mexico and the vividly-patterned South American Rattlesnake. Other New World vipers in the collection are the Mexican Two-lined Moccasin, Cotton-mouth Moccasin, Copperhead Snake, Fer-de-lance and Palm viper, besides a series of rear-fanged tree snakes possessing mildly poisonous properties.

The collection of Old World vipers, includes the Horned Viper or "Asp" of the Sahara and



THE RHINOCEROS VIPER

A bed of pansies of the most variegated color could not excel in variety or brilliance the wonderful pattern of this deadly viper.

THE DIAMOND RATTLESNAKE OF MEXICO

Apparently the color of snakes can be varied by the individual. This snake was a beautiful yellowish-green the first day that we photographed and within two days he had become quite dark, with scarcely a trace of the original color. Not so agressive as a Florida Diamond Rattlesnake.

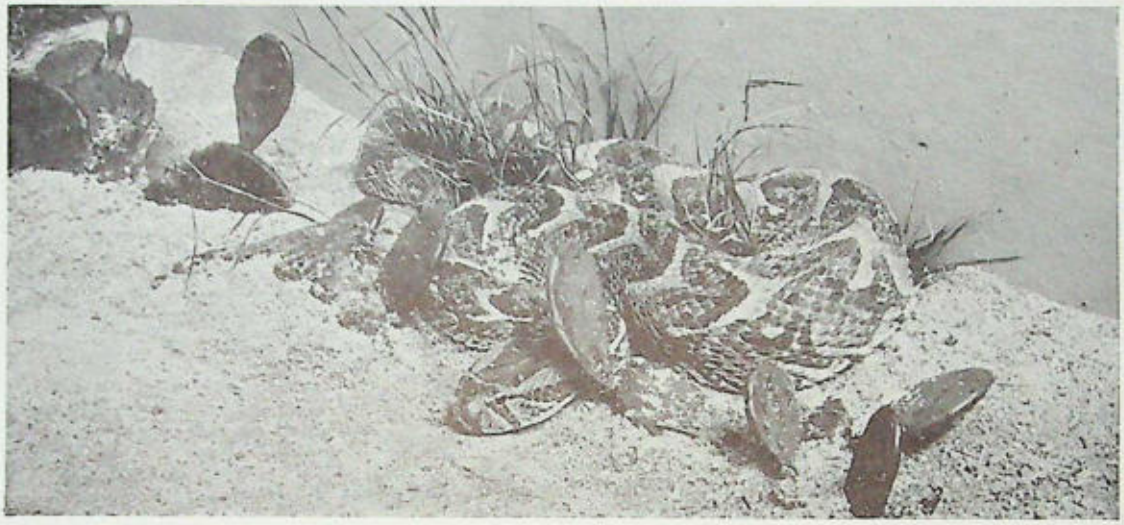
the Hornless Viper of desert regions, the Carpet Snake, and the three giant vipers of equatorial and South Africa, namely, the Rhinoceros Viper, the Gaboon Viper and the Puff Adder.

The collection of cobras is very complete, showing that these curious "hooded" serpents form quite a large group. The exhibits include a King Cobra, thirteen feet long, and three varieties of the Indian Cobra (the Spectacled, Masked and Brown phases), the Philippine Cobra, and five large African species,—the Egyptian, Black-necked, Yellow, Black or Spitting Cobra, and the rarely seen and apparently arboreal West African Cobra (*Naja goldii*). Closely allied to these are nineteen specimens of the quick and deadly Green Mamba, some of them more than eight feet long, and several species of large and savage rear-fanged snakes, with which Africa is plentifully supplied.

THE GABOON VIPER

Scarcely less striking in color combination is this related species of the Rhinoceros Viper. A strange characteristic is the horns on the nose that both species possess.

In a large series like this there are inevitably certain species that rank high in interest from characteristic habits or unique development and these are worthy of special mention. Among the New World species we are exhibiting for the first time two of the giant yellow rattlesnakes from the tableland of Mexico. They are of much interest because of the development of the rattle. The species appears to possess the largest rattle in proportion to its size of



AN EXAMPLE OF PROTECTION
Unless one was a very careful observer, the snake might be passed without being seen.

any member of the rattlesnake genus. This does not mean in number of segments of the warning appendage. The segments are nearly twice as broad as those of the big rattler of Florida and sound a very loud, harsh warning. The species may be described as brilliant golden-green, with faint "diamonds" dusted with a margin of chalky white, along the back. The Mexican Two-lined Moccasin, also for the first time in the collection, lives along the rivers of tropical Mexico and Central America. It is as vividly marked as if painted by an impressionistic artist, and is extremely savage.

Foremost among the poisonous snakes of the Old World is the Mamba. We have long sought to exhibit the species as the name of this dreaded snake is closely woven into tales of South African wilds. The Mamba is excessively slender—whip-like—and attains a length of nine feet. It is one of the most active snakes the writer ever has seen and has particularly dangerous fangs, which are needle-sharp and carried in the extreme forward portion of the upper jaw, directly under the nostrils, so that a mere nip will imbed them. For a cobra type the fangs are proportionately very large. Its bite is probably more deadly than that of a cobra.

Concerning the Mamba's habits, however, the writer believes that a great amount of exaggeration and imagination has been injected into the tales regarding this reptile's aggressiveness and its alleged inclination to pursue man. With nineteen vigorous specimens, all interested in feeding and apparently normal in their actions, we have had ample opportunity to observe the ways of this species; and from years of field work and the noting of wild serpents of various kinds, together with comparisons of their habits in captivity, the writer is convinced that captive specimens exhibit sufficient characteristic habits to enable one to definitely gauge their temperament. I doubt if the Mamba is a particularly savage snake and generally inclined to pursue and attack.

A SAND BED
Here is a bed of sand that conceals a sand viper. It is a perfect example of protection.

ANOTHER EXAMPLE OF CLEVER CONCEALMENT
In such a setting—if the snake did not move—its presence would not be noticed.

Compared with the cobras, it appears to be quiet and rather inoffensive, preferring to lie motionless in the branches of its arboreal retreat and thus escape detection—a very different attitude from the decidedly graceful and aggressive fighting pose immediately assumed by the disturbed cobra.

The Mamba appears in its habitat in great abundance. Among its numbers there may be individuals which, if disturbed at close range in narrow trails or cut off from retreat to a hiding place, that would attack. Its great length, extreme agility and speed would render human escape difficult from a lunge of the slender head, but such cases probably are exceptional. Such instances occur among our common blacksnakes or racers. Usually this fleet species dashes away at the approach of a human, but an occasional specimen will turn and actually come at the intruder. Possibly one in fifty specimens acts like this, yet the reputation of the species in popular lore points to the blacksnake as being a savage fighter and commonly attacking man.

A SAND VIPER
This is the sand viper before he concealed himself. These pictures are authentic, and illustrate a voluntary act of the viper.

We had a lively time while uncrating that big shipment of African poisonous snakes, but our troubles were not with the nineteen mambas. A few of them shot past us with the speed of a thrown lariat, but they were frightened during the opening of the crates, and while they darted towards and past us there was no indication of attack.

Our main troubles were with a remarkable species of long and slender black cobra which appears to be an arboreal type, namely *Naja goldii*. There were a half-dozen specimens, and each individual behaved exactly alike. This is the boldest snake the writer has ever examined and it is fully as quick as the mamba. It comes right at you repeatedly, not in any mere hysterical rush, but with the intention to bite. An instant before the rush, it slightly rears the anterior portion of the body, waves the head and neck laterally in a sinister dancing move-

TEXAS COPPERHEAD SNAKES

The copperheads vary in color, those of the northern habitat being much darker. The copperhead is one of the more fearless of venomous reptiles, apparently knowing its deadly powers.

A MEXICAN MOCCASIN

Compared with the dull colored moccasin of the southern states, this vividly marked species is a striking contrast. And in the speed of his movements and the character of his temper he is even more startling. He struck wildly in every direction—like an angry wasp—mouth wide open and fangs erect.

ment, then glides or rushes straight forward, with open mouth. Suspecting something like this, we were armed with brooms to ward them off, and it was lucky that we took the precaution. The writer is inclined to believe that some of the fatalities in Africa attributed to the black phase of the mamba are caused by this slender and aggressive black cobra. It is, however, a considerably smaller snake than the mamba, scientific records describing the species indicating an average length of slightly more than five feet.

Other formidable members of the African shipment were large examples of the Black Spitting Cobra, *Naja nigricollis*, a spectacular, purplish-black species, its wide-spreading hood marked with livid red of a hue similar to the wing splashings on a tropical butterfly. The entire body scalation glows with a curious soft lustre like the surface of a new gun barrel. This black apparition, slowly rearing and spreading a "hood" as wide as a man's hand, is the personification of deadliness. It is calm, bold and, deliberately facing the intruder, stares towards his face; then without warning the mouth is slightly opened, the head thrown back and two streams of poison are thrown a distance of twelve to fifteen feet. This appears to be deliberately aimed at the eyes.

The African shipment also included the most spectacularly hideous vipers of the world. These are the Rhinoceros Viper and the Gaboon Viper. Barely a yard long, they are as thick of body as a six-foot rattlesnake, with enormously wide heads and fangs of such length that they stab their prey like tiny daggers. Despite its forbidding outlines and protruding nasal horns, the Rhinoceros Viper is beautifully and vividly marked with pale blue, yellow, crimson and olive laid on in bold patterns. The Gaboon Viper, which steadily hisses when disturbed, the body rising and falling like a bellows, is of dull mauve, with a series of bold markings like a row of hour glasses down the back.

The heavy-bodied, slow-gliding vipers form a startling contrast to the flashing body movements of the agile cobras, but in one motion they excel in speed any feat performed by the slender-bodied serpents. That is in the stroke of their long-fanged head. Resting in an open coil, the neck is kept ready in a curve like half of the letter S. They never attack, but if an intruder approaches, the rhythmic hissing, loud enough to be heard a fair distance, at once begins. If the unwary victim fails to take heed and wander to a distance representing a bit under one-half the length of the serpent, there is a movement so quick that the human eye would see little more than a hint of colored haze. But in that instant the head has been launched forward, the poisonous fangs have deeply stabbed and the serpent has returned to the original position of defence.

DR. E. W. NELSON ON THE PRONG-HORNED ANTELOPE.

BULLETIN No. 1346, by Dr. Edward W. Nelson, Chief of the Biological Survey, has been issued, and is now in the hands of its friends. Take it all in all, it is one of the most satisfactory public documents on wild life protection that has ever been issued by the Department of Agriculture; and this is saying much.

For fully twenty years that indescribable mass called "the public" has been worrying a-plenty over the unique and zoologically valuable prong-horned antelope species, dreading and even expecting its complete extinguishment from the fauna of North America. Its physical frailty, its wretchedly poor appetite in captivity, and the ease with which it is snuffed out when wild, intensify the handicaps on its perpetual preservation.

Dr. Nelson's bulletin is an excellent piece of work. It displays thorough investigation, it is admirably supplied with details, figures and maps, and there is a satisfactory exhibit of conclusions. The display of facts invites the reader to do some thinking on his own account.

We are pleasantly surprised by the astonishing number of antelope bands in existence today, and by the thoroughness with which they are scattered over the map of North America. Above all, we are pleased by census returns that show a grand total of 26,604 antelope in the United States, 1,327 in Canada, and 2,305 in Mexico, totaling 30,325 for all America.

But all is not gold that glitters in the pan. The friends of the antelope will be keenly interested in Dr. Nelson's conclusions regarding the future of the species, even though they contain a depressing note. This is what he says:

"*Almost throughout its range the pronghorn is decreasing.* Each succeeding year some of of the smaller herds marked on the accom-

AMERICAN PRONG-HORNED ANTELOPE

A portion of the pronghorn herd in the Wichita National Forest Reserve, Oklahoma. From a photograph by the U. S. Forest Service by courtesy of S. M. Shanklin, Forest Supervisor.

panying maps are *certain to disappear,* and only in the most favorable areas, where they are carefully protected, is there hope for the long survival of these interesting animals. In perpetuating herds of antelope in the different States one of the principal factors will be the interest taken in them by ranchmen, local sportsmen, and other residents. Antelope are on the verge of final extermination in Kansas, where in the early days they were familiar sights from the windows of passing trains.

"There is little hope for the preservation of the large number of small bands containing from three to a dozen or more pronghorns. Under present conditions, when a band is reduced to a very small number, its continued existence is practically impossible unless it has the benefit of exceedingly careful guardianship.

"The decrease of antelope is governed by a number of conditions, among which may be mentioned the inroads of predatory animals, illegal shooting, and the increased occupation of their territory for economic uses and the disturbance brought about by it. There may be improvement as to the first two of these factors, but the last is one which is necessarily beyond control. This means that eventually the surviving antelope will be limited to bands located in some of the more desert and least occupied parts of their former range, such as in northwestern Nevada, or to large, fenced game refuges. There are areas in many of the Western States which are suitable for the maintenance of bands of antelope on the open range if public sentiment will interest itself in them."

Dr. Nelson has devoted considerable labor to the writing of history in connection with the general effort to save the pronghorn from extinction. His records of endeavor show how the federal government, various organizations and many private citizens have wrought at the general task during the past 20 years. The roster of workers and efforts is far too lengthy to set down here, but we are tempted to mention one individual effort as a shining example.

The Arizona Grand Canyon antelope herd owes its existence to the wise initiative, the cheerful persistence, and finally the one-thousand-dollar sacrifice of one man, Dr. E. E. Brownell, of San Francisco. He it was who first proposed the herd that now exists on the Tonto Plateau of the Grand Canyon adjacent to the Hermit Trail. His original proposal

was made to the writer, who doubted the possibilities of its success, and privately shied at it, but honestly put it up to Dr. Nelson for consideration. At once it met a friendly reception, and a prospect of executive treatment. Still in doubt, the writer went to the Grand Canyon to study the possibilities on the ground, with the aid of four qualified local experts.

He came away convinced that the idea was all right, and desirable, and so reported. Dr. Brownell offered to subscribe one-half of the sum estimated as the total cost of foundation, and the Permanent Fund agreed to furnish the other half. Dr. Nelson, the Biological Survey, the Governor of Nevada and the National Park Service did the rest. The herd of 12 now occupies the Hermit Basin, and the story of the capture of forty antelope fawns in Nevada, and their distribution to the upbuilding of *three* federal herds, is both interesting and satisfactory.

Dr. Nelson's valuable bulletin, of 64 pages, may be obtained of the Superintendent of Documents, Government Printing Office, for the modest sum of fifteen cents per copy.

W. T. H.

England to Study Whales.—Four members of a government expedition to the south Pacific to study the breeding of whales and to prevent the extermination of the species, which is now threatened owing to their indiscriminate slaughter, are now on their way to the whaling fields of south Georgia and south Shetland, and will form a scientific staff at the marine station. Other members will follow them next year.

Besides conducting whaling research the expedition will undertake scientific investigations affecting oceanography, meteorology and magnetism.

Wolves in Pennsylvania.—Recent reports of timber wolves in Pennsylvania attacking persons have brought some light on the matter from R. N. Davis, director of the Everhart Museum, who discusses the situation at length in "The Scranton Republican."

He says that the animals classed as timber wolves were in reality only coyotes, which are smaller animals, weighing probably but half as much as the big gray timber hunters. The wolf which attacked a girl at Pleasant Mount would hardly have fallen victim to the twelve-year-old's club if it had been a hundred-pounder. And the wolf shot later at Clark's Summit and displayed in a Scranton gun store was examined by Mr. Davis, and shown to be a coyote.

Army Trains Pigeons.—Possible extensive use of pigeons in directing artillery fire is engaging the attention of the Signal Corps of the army.

Observers in advanced positions release the birds carrying messages telling where the shells are falling, and they are trained to fly back to the lines. This method would be used when other channels of communication, such as radio or telephones, were not available. The Germans utilized pigeons to direct artillery fire on the eastern front during the World War.

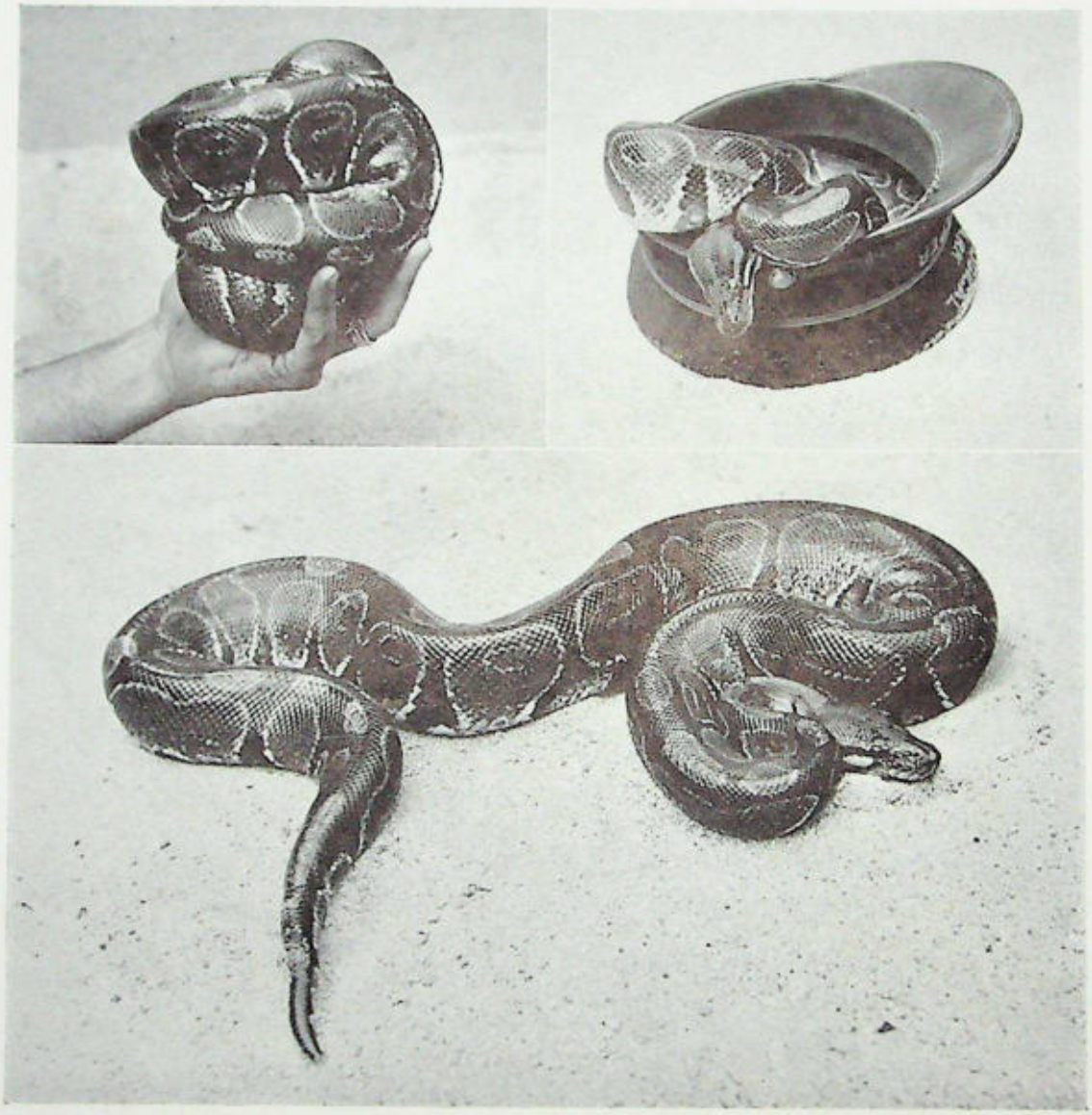
There are now 1,500 pigeons at various posts in the keeping of the Signal Corps, which has a breeding center for them at Camp Vail, N. J. The birds are retained at the various army corps area headquarters, in the insular possessions and in Panama.

It takes from ten days to two weeks, officers say, to train a pigeon to return to its loft and get its bearings. Pigeons do not fly well at night and as a rule are not outstanding in intelligence. Difficulty has been experienced with pigeon fanciers in the army, who wish to make pigeons a major method of communication. Only one bird in ten is considered capable of flying 500 miles in one day.

In the Canal Zone hawks constantly menace pigeons while in flight. To overcome this a whistle is fastened to the tail of a bird, and as it flies the rush of air causes the whistle to sound and frightens away birds of prey.

Tree-Planting for Birds.—The few persons who have paid attention to the planting of trees and shrubs to furnish fruit and seed food for wild song-birds, and other birds as well, are well aware of the fact that the Russian mulberry tree is one of the finest of all trees to plant for the production of fruit for wild birds. The trees mature rapidly, and the fruit continues to ripen throughout a period of from three to four months. In addition to the long sustained supply, the fruit of the Russian mulberry is highly prized by the fruit-eating birds.

Park Commissioner Albert C. Benninger, of the Borough of Queens, has recently placed an order for 10,000 Russian mulberry trees for planting in Forest Park, Richmond Hill. This is the first step toward establishing Forest Park as a bird sanctuary and feeding-place, and the good example thus set is worthy of universal imitation.



THE BALL PYTHON

Here is a snake that can convert his entire length into a form in which there are no waste spaces. He is four feet and three inches in length and seven inches in girth and easily fits into a hat of normal size. If there are any members of the Society with a longing for reptile pets we can cordially recommend the Ball Python. He is shy and timid and given the chance will retire into the smallest space and be perfectly content to be inconspicuous. He can be tossed about from hand to hand and remain tightly and compactly coiled.

Wrens in a mail box.—A pair of house wrens are affording considerable entertainment for the inhabitants of Alpine, N. J. They have taken possession of a mail box belonging to Mrs. R. B. Low and refuse to be ousted. The letter box is at one of the busiest corners in Alpine. Many persons pass by it and mail is placed in it twice a day. But the birds will not abandon it.

Fortunately the box is large enough for both the mail and its tenants. The birds scold loudly at the approach of the postman but do not leave the nest. If one of the birds is in the nest when the mail is put in it remains there quietly until the package is removed and its mate can relieve it. If both the birds are away when the mail obstructs the passage they sit near by and scold until the passage is cleared.

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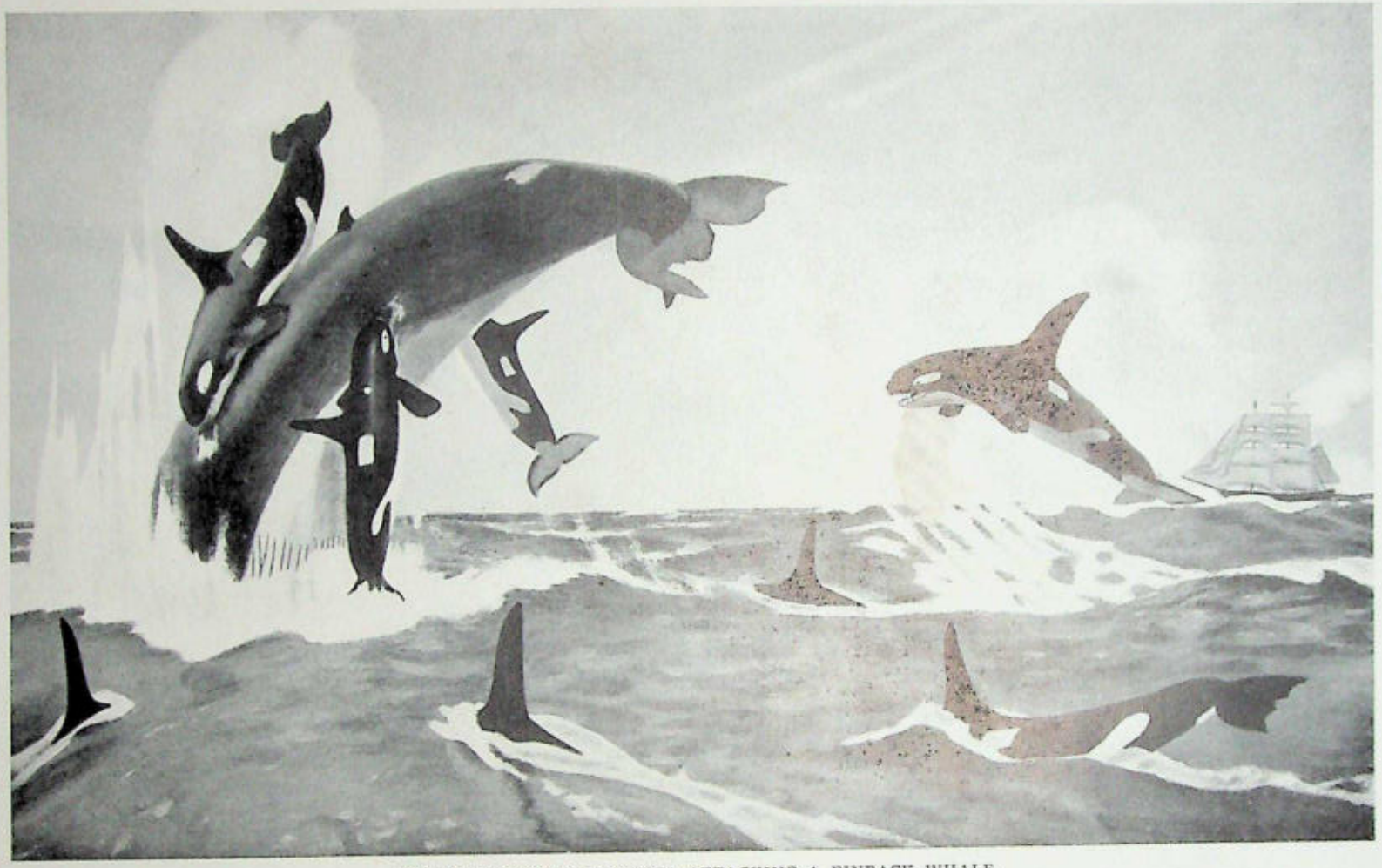


KILLERS (ORCA GLADIATOR) ATTACKING A FINBACK WHALE

From a wash-drawing by Charles Pears published in the *Illustrirte Zeitung*, August 15, 1925.

ZOOLOGICAL SOCIETY BULLETIN

Published by the New York Zoological Society

VOLUME XXVIII NOVEMBER, 1925 NUMBER 6

THE WHALE AND ITS ENEMY

By C. H. TOWNSEND

THE only deadly enemy of the whale is the large and wholly carnivorous member of the porpoise family known as the Killer (*Orca gladiator*), which hunts in packs like the wolf and is enormously destructive to whales and seals.

The frontispiece in this number of the Bulletin has been given the place of honor among this month's pictures because it is with one exception the only illustration known to us of a sea tragedy well understood by whalemen but almost invariably misinterpreted by other sea farers except when such happen to be naturalists having sound knowledge of the ways of killers, swordfish and thresher sharks.

While not bearing the indisputable evidence of a photograph, it is a rarely fine pictorial exhibition of what has been minutely described to us personally by men who had witnessed the terrific onslaught of the killers and were evidently shocked by the spectacle. The whaler's own methods of killing by lance and bomb are merciful in comparison.

These veteran hunters of the whale were deceived by no fables of swordfish and thresher shark as destroyers of the ponderous but peaceful whale. It is true that swordfish have struck ships and perhaps whales also, in their eager rushes at schools of oceanic fishes sheltering in fear under such large objects, but the thresher shark is blameless. Its long tail fin is destructive only among schools of small fishes, while the sword of the former is to be avoided only during its frenzied rushes to shake off the harpooner's spear and line.

The following account of an attack upon a whale by killers, is from an article by Dr. David Starr Jordan in *Natural History* for July, 1925:

"I once saw an attack by killers on a whale off the coast of Lower California. The great animal sprang into the air for almost the length of the body, with one or more killers clinging to its sides, writhing and twisting in its efforts to detach these marine bulldogs. A skilled photographer, Mr. W. W. Richards, had the fortune to see, off Santa Cruz in California, a fracas of the kind. He made of it a picture, probably absolutely unique, which I have reproduced in 'The Days of a Man.' Around the suffering whale, attracted by the blood, are multitudes of greedy shearwaters (*Puffinus*) known as 'whale birds,' clamorous for their share of the spoils."

The full page picture is from the *Illustrirte Zeitung* of August 15, 1925, after a drawing by Charles Pears, a member of the expedition which recently returned from a four years' cruise in Antarctic waters in the ship of the late Polar explorer Scott.

It shows a finback whale attacked by a school of killers, raising itself in agony high out of the water. Its attackers have torn yard-long strips from its skin, ripped the flesh from its lips, pushed into its mouth and torn out its tongue.

The smaller picture is from "The Days of a Man" by Dr. Jordan and is from the photograph by Mr. Richards to which he refers. Being a single snap-shot at a rather long range, the details of the attack on the whale are not shown as graphically as in Mr. Pears' drawing.

The method of attack by the killers is well described by Roy Chapman Andrews in "Whale Hunting with Gun and Camera."

The killer reaches a length of about twenty feet.

According to Captain Scammon, whaler and author of The American Whale Fishery, "Three or four of these voracious animals do not hesi-

KILLERS ATTACKING A WHALE
From a photograph by Richards published in "The Days of Man."

tate to grapple with the largest baleen whales." Quoting Captain Holböll on "Killers in Greenland Waters," Scammon continues: "A school of belugas (white whales) had been pursued by these blood-thirsty animals into a bay in the neighborhood of Godhaven and were literally torn to pieces by them."

Eschricht in "The Northern Species of Orca," states that it had been known to swallow four porpoises in succession and that thirteen of these animals together with fourteen seals had been found in the maw of one of these greedy creatures, which measured only sixteen feet in length.

THE ANCIENT AMPHIOXUS

By Ida M. Mellen

THOSE of our readers who are fresh from college work in biology will probably not proceed beyond the heading of this article. One becomes so recklessly weary of studying amphioxus day after day—in biology, in zoology, in embryology—that we hear of students who, in desperation, have vilified the animal by prefixing a D to its name!

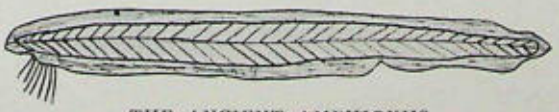
The simple, inoffensive amphioxus preserved in formalin is such splendid material for all of these studies! And it has such a unique place in the world of life, for, despite its diminutive size, it occupies a class all by itself; and it is the lowest of all the vertebrates! Lower even than a fish is amphioxus, whose other names are lancelet and "the headless fish." A strange little creature, at the most three inches in length, that spends its entire life buried by day in the sand with only its head-end and mouth protruding, and swimming actively about by night.

The expression "head-end" is used advisedly. By that we mean the end where the mouth is. The lancelets have no definite head, their name of amphioxus meaning "sharp at both ends"; and you could scarcely tell which is the head-end or the tail-end were it not for those little whisker-like appendages called "cirri" that surround the mouth and help to convey the food to the gullet.

It was in 1778—147 years ago—that the old German naturalist and traveler, Pallas, discovered the lancelet and classified it as a mollusc. Not until 53 years later was the animal again particularly noticed. Then, in 1831, Jonathan Couch captured a specimen which he and everybody after him for a long number of years believed to be a fish and which was later described by Yarrell. Couch also refers to it in his four-volume "History of the Fishes of the British Islands," published in 1858.

You will not find amphioxus in any modern book on fishes. We divide the animals having a spinal cord into two orders—the Craniata and the Acraniata: those having heads and the headless. And under Acraniata—the headless ones—we find our little friends amphioxus, for whom this order was especially created.

Amphioxus is without head or brain, eyes, ears, jaws or teeth, scales, heart, spleen, red blood, limbs, or true fins or kidneys; and though just referred to as having a spinal cord, it has no bones and consequently no vertebrae. The elastic rod running from head-end to tail-end, called in biology the "notochord," is regarded evolutionally as the forerunner of a backbone. Amphioxus has a hidden optic nerve which renders it sensitive to light, and it has other



THE ANCIENT AMPHIOXUS
Dr. Dohrn of the Naples Aquarium likens it to a split sardine.
From a sketch by Ida M. Mellen.

nerves and sense organs and muscles and tissues; also digestive and respiratory and excretory organs. Its colorless blood seems to serve as well as though it were red, and its nephridia answer its simple purposes quite as well as kid-

neys; and altogether it appears to enjoy its little life spent buried vertically in the sand or swimming around by short spurts. Action soon tires it, and it comes to rest, falling on its side when not in motion. Some say it burrows only with the head, others that it can burrow with either head or tail-end; and all observers agree that it burrows with wonderful rapidity. It is said to swim with the mouth uppermost.

Lancelets never have been exhibited at the New York Aquarium, but are on the list of rarities that we shall probably show if our dream of a pigmy fish exhibit should ever come true.

The accompanying drawing is made from a specimen one and seven-eighths inches long, taken in the Mediterranean. Lancelets are found also in the Bay of Naples, the East Indies, the coasts of South America, India and New Zealand, in Chinese, Australian and Malayan waters, and from southern England north to Norway; and three of the sixteen known species are North American—the West Indian Lancelet of Florida and the Carolina coast, the California Lancelet, and the European Lancelet found in Chesapeake Bay.

The eggs of these diminutive animals are laid and then fertilized, the same as most fish eggs, and hatch in the astonishingly short period of eight hours.

Only the Chinese have made the "headless fish" the basis of an industry. In a narrow strait between the Mainland and Amoy Island, 200 boats ply between August and April, dredging 300 tons of amphioxi a day or six and a half millions of the little creatures, the total catch being reckoned at no less than one billion a season.

We can show you what the "headless fish" looks like, but we are unable to tell you what it tastes like.

THE TRUNKFISH

From a pen-drawing made by W. S. Bronson of a specimen five-eighths of an inch long.

THE TRUNKFISH

Local Occurrence of Young Specimens

By C. M. Breder, Jr.

THE trunkfish, *Lactophrys trigonus* (Linnaeus), an inhabitant of tropical seas, is known to us locally only as a summer straggler. In its native haunts it attains a length of about one foot but those which reach our shores are generally much smaller, the majority being tiny specimens of not over three-quarters of an inch. At this size they do not resemble the adults very closely and as an examination of the literature failed to reveal a good figure of any trunkfish of this size we induced Mr. W. S. Bronson to prepare the side and front views here shown. That he has succeeded admirably in not only excellently delineating the form but also in catching its spirit will be evident to those that are familiar with this grotesque fish in its immature state.

As the young fish are almost spheroidal in outline, their gyrations as induced by their all but invisible fins are erratic and decidedly unfish-like as their encasement in a rigid test precludes any movement of the body at all, thus placing every locomotor effort on the appendages.

On attaining a larger size they become more angulated, the tail grows proportionally larger, and they loose the rounded appearance characteristic of their youth. Our young specimens confined with the seahorses are generally passed unnoticed by the less observing visitors, usually being mistaken for some foreign object being drifted about the tank by a vagrant current.

THE LINCOLN PARK AQUARIUM: CHICAGO
Designed for fresh water fishes. From a photograph by F. M. Woodruff.

OTHER AQUARIUMS

Aquarium, Lisbon, Portugal.—The Vasco da Gama Aquarium at Lisbon was opened in 1898 on the occasion of the celebration of the Fourth Centenary of the voyage of Vasco da Gama to India and is owned and controlled by the Portuguese government. The building contains also the Marine Biological Station of the Fishery Bureau, for research in the field of marine biology and oceanography connected with the fisheries.

According to a letter received recently from Dr. A. Ramalho, the director, the Aquarium has fifty-six tanks and one pool for sea water and forty tanks and seven pools for fresh water. The exhibits at present are fifty species of fishes, twenty of invertebrates, ten of amphibians and three of reptiles (turtles).

The building is open daily to the public. While a small admission fee is charged to visitors, it is free to school classes accompanied by teachers.

The attendance in 1924 was 46,874. The regular employes of the Aquarium number fourteen persons and the annual cost of maintenance is about $6,300. The building is being enlarged for the purpose of adding a fisheries museum.

—*C. H. T.*

Chicago Aquarium.—The only city in the world that now boasts two aquariums is Rio de Janeiro, but Chicago promises to make a similar boast within the next few years.

The present aquarium was opened in May,

THE AQUARIUM, LISBON, PORTUGAL
The Vasco da Gama Aquarium and Marine Biological Station.

THE LINCOLN PARK AQUARIUM: CHICAGO
Basement view of the fresh-water aquaria for tropical toy fishes.

1923, the building being 75 x 100 feet, and cost $250,000 to build. It maintains only fresh water exhibits, showing 78 varieties of fishes, besides many reptiles, amphibians and invertebrates. There are 106 exhibition tanks in all, including 58 balanced aquaria, and its exhibits of fishes of minute size are wonderfully attractive.

It is rumored that the proposed second aquarium for Chicago will cost $2,000,000, and be over 300 feet long. We understand that it will exhibit both fresh and salt water animals—*I. M. M.*

Leipzig Aquarium.—The aquarium in Europe is generally a feature of a zoological garden, and that of Leipzig is no exception to this rule. Three hundred fifty thousand persons visit the Leipzig Zoo and Aquarium each year, one mark purchasing admission to both.

A fresh water fish-hatching exhibit occupies two rooms of the Aquarium building, besides which fishes, mammals, reptiles, amphibians and invertebrates are shown in sixty-seven aquaria, the water being heated or refrigerated as need be. Thirty-three tanks are devoted to terraria, such exhibits meeting with great appreciation in Germany and other European countries, where a deep interest exists in little animals that can be kept in the home.—*I. M. M.*

THE AQUARIUM, LEIPZIG, GERMANY
Aquariums are usually connected with zoos in Germany and are greatly appreciated.

Scripps Institution Aquarium.—It was not until after the publication of our Annual Report for 1924 that we learned of the aquarium of the Scripps Institution

for Biological Research at La Jolla, California, which is large enough to have been included in the "Table of Information Regarding the Aquariums of the World. It exhibits more fishes than the Boston, Honolulu or New Orleans aquariums.

Dr. T. Wayland Vaughan, the Director, has filled out a questionnaire in order that particular data concerning this aquarium may be included in the next printing of the "Table."

This aquarium at La Jolla (pronounced La Hoya) has 19 exhibition tanks with a capacity of from 60 to 261 gallons each, and, except one tank, is devoted exclusively to salt water, exhibiting at the last census 1,300 fishes and 50 invertebrates. It was opened in 1916 by the University of California, and is open free every day in the year, but its visitors number only about 8,000 persons annually.

California is the only state in the Union having two aquariums.—*I. M. M.*

MARINE TURTLE ASLEEP ON THE BEACH

From a photograph published in the National Geographic Magazine by Dr. Alexander Wetmore of the Smithsonian National Institution. Reproduced by permission.

MARINE TURTLES SLEEP ON HAWAIIAN SANDS

Two Long-standing Errors Corrected

By Ida M. Mellen

OUR old aquarist, Mr. Washington I. De Nyse, who never forgot an interesting incident, told me that once Ella Wheeler Wilcox visited the Aquarium and threatened to have everybody there arrested because no provision was made to permit of sea turtles leaving the water.

Her "ignorance" was indulgently smiled upon and she was enlightened with the information that marine turtles never leave the water except the female when she deposits her eggs by night in tropical sands. Subsequently a label was hung over the turtle pool reading:

"Sea Turtles never leave the water except when the female deposits eggs. This pool was formerly fitted with a sloping platform but it was never used by the turtles, some of which have lived here eighteen years."

Accommodations for leaving the water had never been taken advantage of and were finally removed. Director Townsend has visited not less than fifty islands in the tropics and has participated in the capture of female turtles at night while they were engaged in digging holes for their eggs; and he never saw a marine turtle leave the water except for females during the breeding season.

Moreover, when questions regarding the proper transportation of sea turtles to northern markets from Florida arose in court, testimony was given to the effect that marine turtles always died when transported on their plastrons and it seemed therefore unquestionable that the

weight of the heavy carapace upon the lungs was fatal, and transporting them in that position constituted cruelty to animals. When turned upside down the turtles always survived the journey.

Now comes Dr. Alexander Wetmore, Assistant Secretary of the Smithsonian Institution in Washington, with an Hawaiian Islands article in the July 1925 *National Geographic Magazine*, in which he presents a photograph of "A Green Turtle Asleep on a Sandy Beach: Lisiansky Island," with the further notation: "These grotesque creatures browse in submarine fields of algæ until hunger is satisfied, and then crawl heavily out to sprawl in the sand, safe from enemies in the sea. On one occasion, the author, while walking 300 yards along the beach on Lisiansky Island, counted 80 of these creatures from fifteen inches to four feet in length. Others, feeding a few yards offshore, were hidden by ripples on the water and so escaped the casual census. Their only enemies seem to be sharks."

The supremely comfortable attitude of the animal depicted in the photograph belies the thought that the weight of the carapace presses painfully (to say nothing of fatally) upon the lungs, although of course it must be remembered that in hauling out on land they probably spend only a few hours or half a day, which is different from spending three or more days in that position on shipboard.

The point is, however, that the turtle is taking a nap, and not laying eggs!

Naturally we wrote to Dr. Wetmore for more details, and asked him if the turtles were perhaps females awaiting the fall of night to lay their eggs. His reply is conclusive:

"Dear Miss Mellen:—In reply to your letter of August 25, I may say that in the Hawaiian Islands at least it is the usual practice for marine turtles to crawl out on beaches to rest. The picture to which you refer was taken on Lisianski Island where these turtles were very common and where I frequently saw from 25 to 50 or more on the beaches at one time. These included males and females, from animals 18" long to those that were fully grown. Though some of the females that we killed contained eggs ready to be laid, there was no question that these creatures came out regularly, apparently for the sole purpose of sleeping in the sun.

"This practice was not confined to islands with sandy beaches alone, since I found a few turtles pursuing the same course on Necker Island, where they simply hauled out on shelving rock ledges where there was no covering of sand.

"Whether your captive turtles would haul out in a similar manner is, of course, something that can be proved only by experiment. I fail to see where such action can harm them in any way since during my work in 1923, to which I have alluded, I found these animals on the beaches on practically all of the islands visited, and found them there daily. They were so common in fact that we captured them frequently for food. Very truly yours,

A. Wetmore."

And so it is that in zoology we need to stand ready at all times to renounce our most confirmed beliefs for opposite ones!

In another letter, Dr. Wetmore says, "Marine turtles asleep on beaches were so much a part of daily life and observation in the islands of the Pacific, that I never questioned but that it was the usual habit for these creatures the world over."

In answer to a question as to whether the turtles ever haul out on inhabited islands, or only upon those that are uninhabited, Dr. Wetmore says:

"Turtles do not crawl out regularly on the sands of inhabited islands, since they are subject to so much persecution that any indiscreet enough to commit such an act would end up on someone's table in short order. On the desert islands we found that in spite of their apparent stolidity they were somewhat disturbed by the presence of men, as after our party had patrolled the beaches for a few days turtles usually forsook the immediate vicinity of our camps and resorted to more remote sections where our people were less in evidence. This was done in spite of the fact that only occasionally did we molest them. Their avoidance of inhabited islands is thus merely a matter of experience and caution."

But the question still remains, Why do marine turtles rest comfortably on their plastrons on sand and rock and die when left in that position on board ship? Dr. Wetmore suggests the possibility that the deck's vibration upon their plastrons affects them adversely.

The Alaska whale fishery did a tremendous business this summer. More than 500 whales were harpooned, the largest 86 feet long and weighing close to 100 tons.

Many thousands of barrels of oil were marketed to eastern manufacturers for use in soap, leather and steel factories, and an enormous quantity of fertilizer was processed.

New York Zoological Society

OBJECTS OF THE SOCIETY

¶ A PUBLIC ZOOLOGICAL PARK. ¶ A PUBLIC AQUARIUM. ¶ THE PRESERVATION OF OUR NATIVE ANIMALS. ¶ THE PROMOTION OF ZOOLOGY.

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ELWIN R. SANBORN, *Editor*

VOL. XXVIII NOVEMBER, 1925 No. 6

"PEACE" IN THE AQUARIUM

JEAN SEIVWRIGHT, *The Sun* (N. Y.)

The Aquarium is an ideal retreat for those whose nerves are on edge. Once its threshold is crossed you leave behind all the throbbing noises of the city and the glaring light of vivid sunlight. Frequenters of the waterfront have long known its lure. School children and visitors who are doing the sights have also felt its thrall, but comparatively few of those who spend their hours in the towering buildings that make the skyline of New York realize what a solace it holds for nerves that are unstrung.

Such peace there is in the Aquarium—despite the fact that as a rule there are over 5,000 living animals beneath its roof—that the silence grips you as you enter, and you tread softly as you would in some venerable cathedral. Voices are hushed as you start your journey about the building and get acquainted with the fishes. There is a calmness about these silent creatures that is soon reflected in your own mental state as you watch them swim at ease in their tanks or rest with unblinking eyes among the sands or rocks that so cunningly simulate their native habitat.

As the quietness of the Aquarium and the beauty of its inhabitants enthrall you, you realize that once more you are at peace.

Your first casual visit to the Aquarium will doubtless be followed by others when you discover its restfulness, and it is almost certain you will the moment you enter. Perhaps, too, you may find a new interest in your life, for lack of which your soul has held a singular restlessness.

While the silence is particularly soothing to those with nerves aquiver, the influence of beauty is also far reaching. Of course, the man or woman whose acquaintance with fish has been exclusively with those sad, dull eyed creatures that rest on the tiled counters of a fish market, may smile at the suggestion of beautiful fish. But beauty exists, especially among the fish from Southern waters. Inspiration for a ravishing gown or a wonderful scheme of decoration may be gleaned from watching some of the specimens. Silver and blue, with touches of lemon or rose, that gleam like the flushing dawn, indicate the colors that may be found in those tropical fish. Among the goldfish are certain varieties whose gorgeous tails flutter in the water like bridal draperies.

WORK ON THE AQUARIUM BUILDING

There is now hope for an early completion of the long-delayed construction work at the Aquarium. Plastering, plumbing and electric wiring all being in progress, the new third story may be available for occupation sometime in January. The exterior walls of the building will not be treated with the proposed uniform, gray finish until spring.

The exhibits of the Aquarium have been kept up to the standard set by the space available and are as extensive and varied as at any time in the history of the institution. The exhibits are to be further increased. Upon the completion of the work contracted for by the City, the Zoological Society will commence the construction of additional tanks that will provide much more exhibition space than is now available.

The attendance has been as large as usual and will probably not fall below the average of two millions. —*C. H. T.*

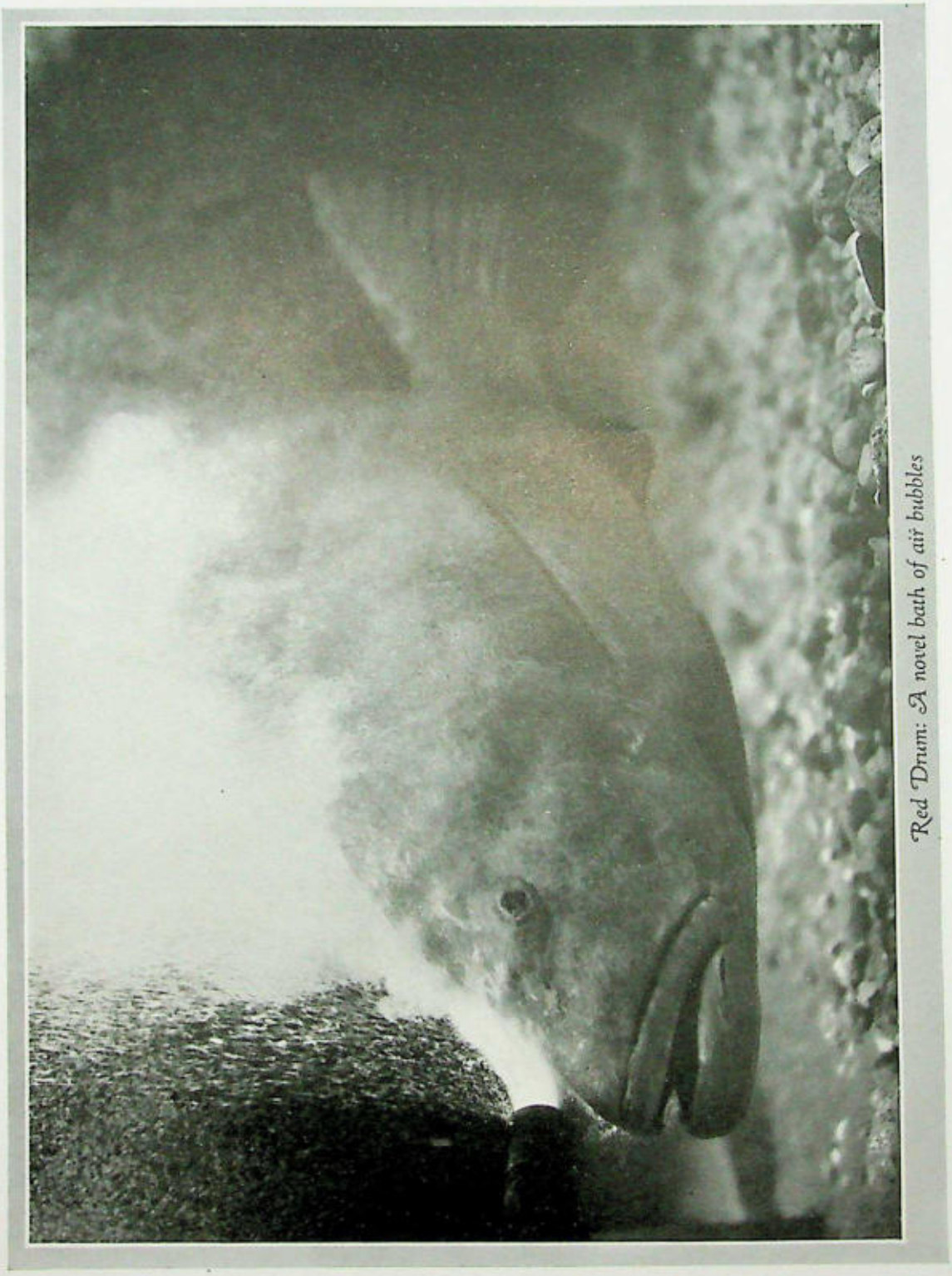
The New York AQUARIUM : : : : :

Some new Rockwork & new Fishes ~ ~ ~ ~

~ ~ ~ ~ ~ ~ *From recent Photographs*

: : : : : : : *Taken at the Aquarium by* Elwin R. Sanborn

Sea-Horses



Red Drum: A novel bath of air bubbles

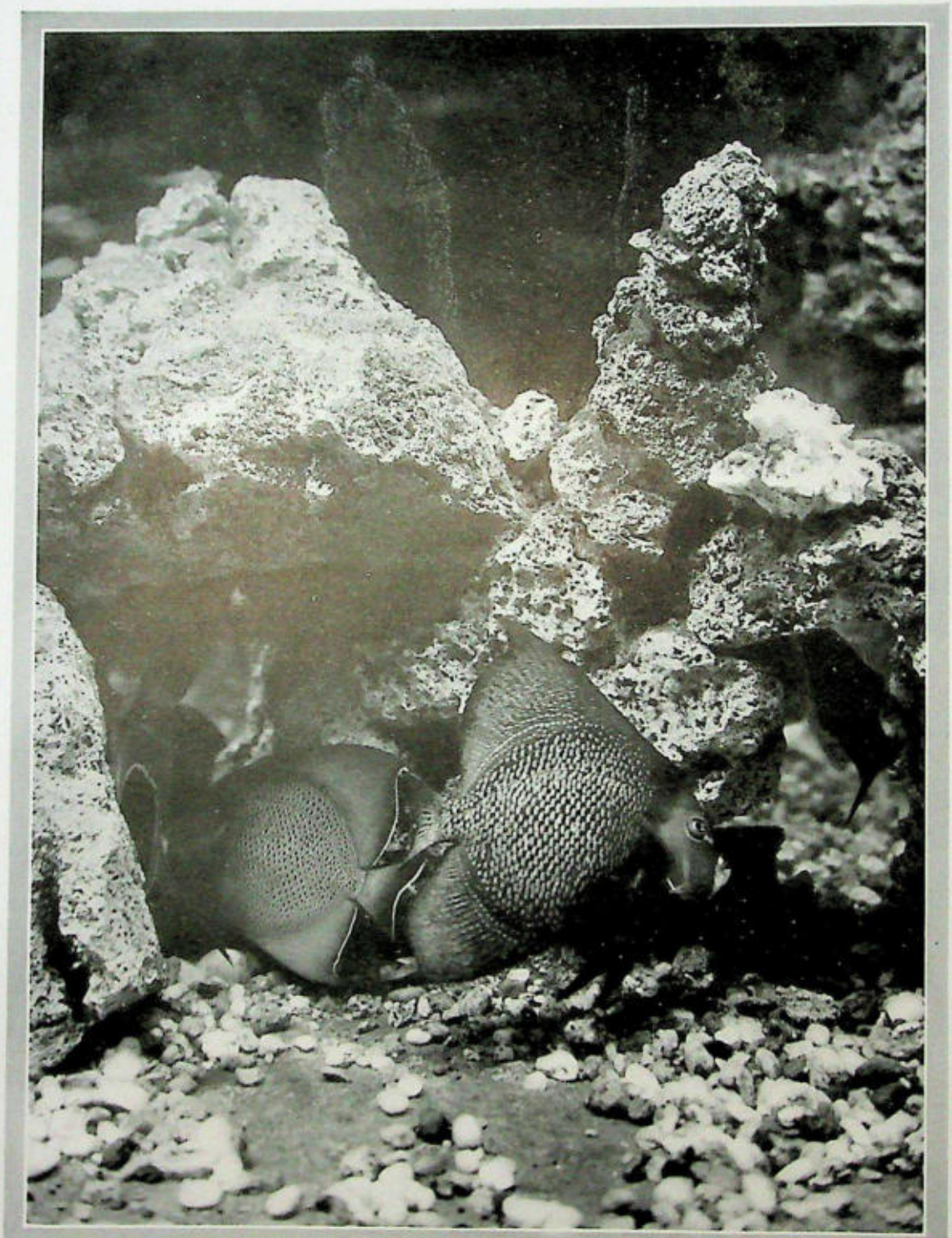
White Perch

Some fishes from Tropic waters

Mississippi Catfish

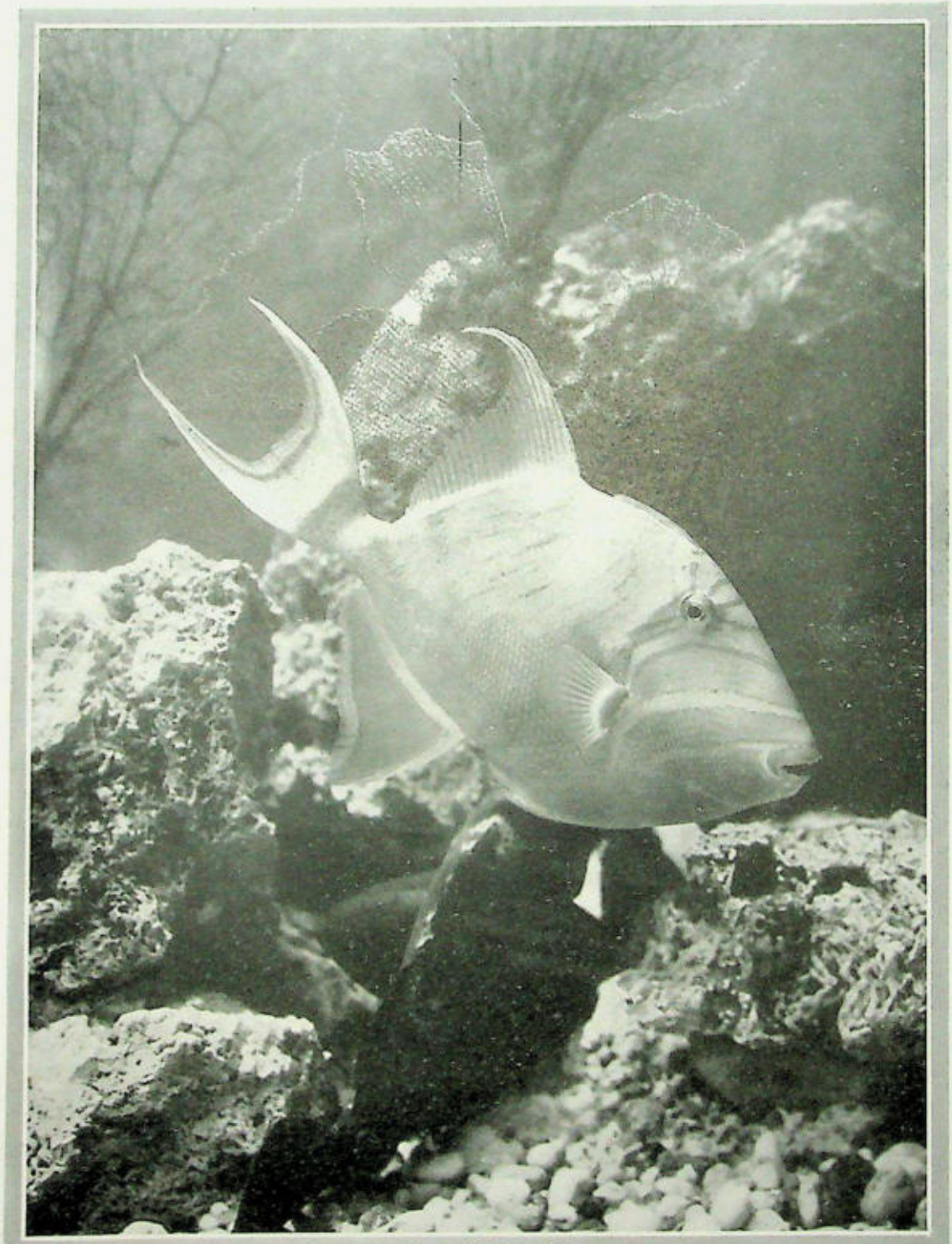
Bony Gar: Long Nosed Gar

Common Catfish

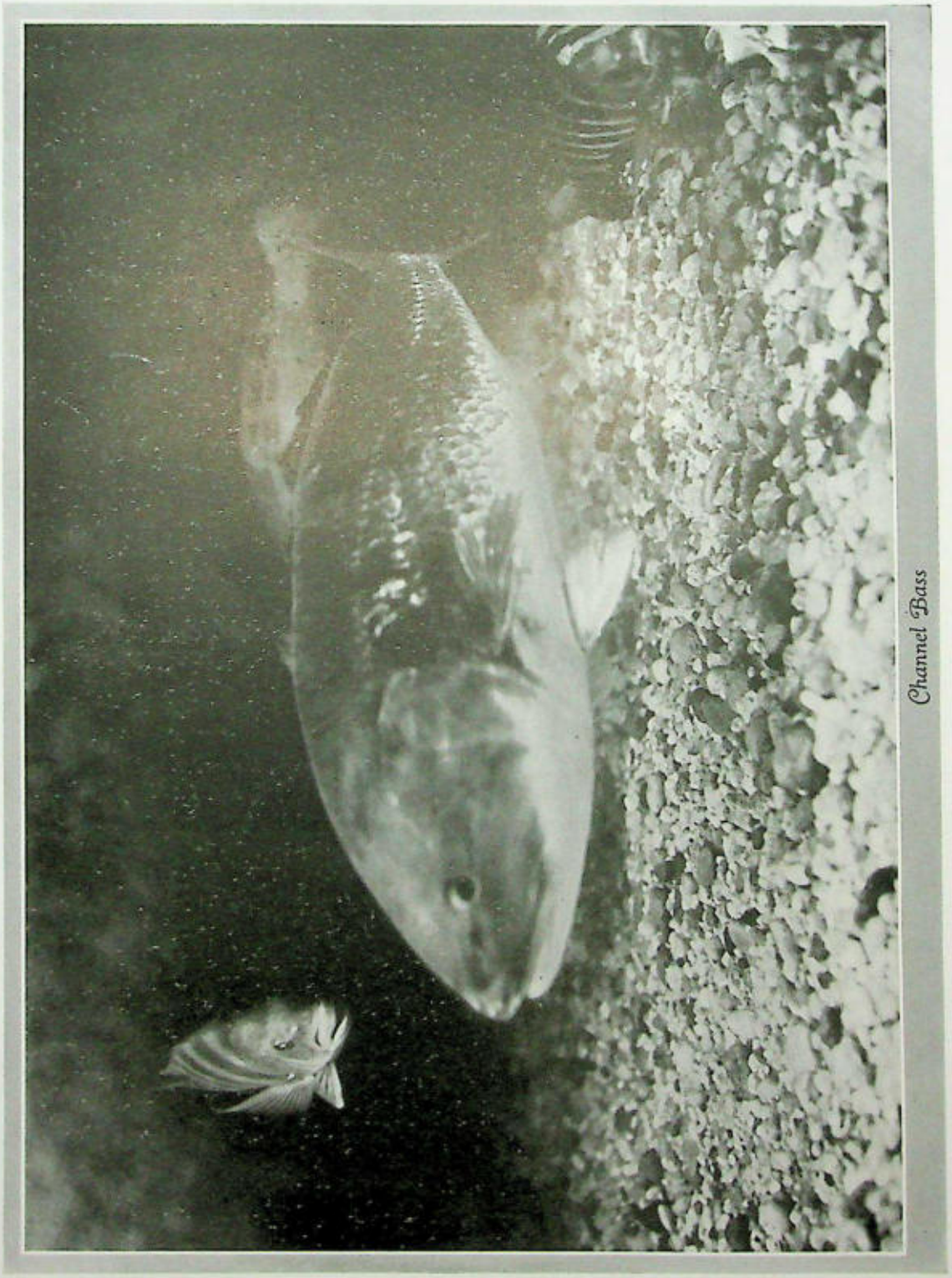


A haven of refuge: Angelfish in a safe retreat

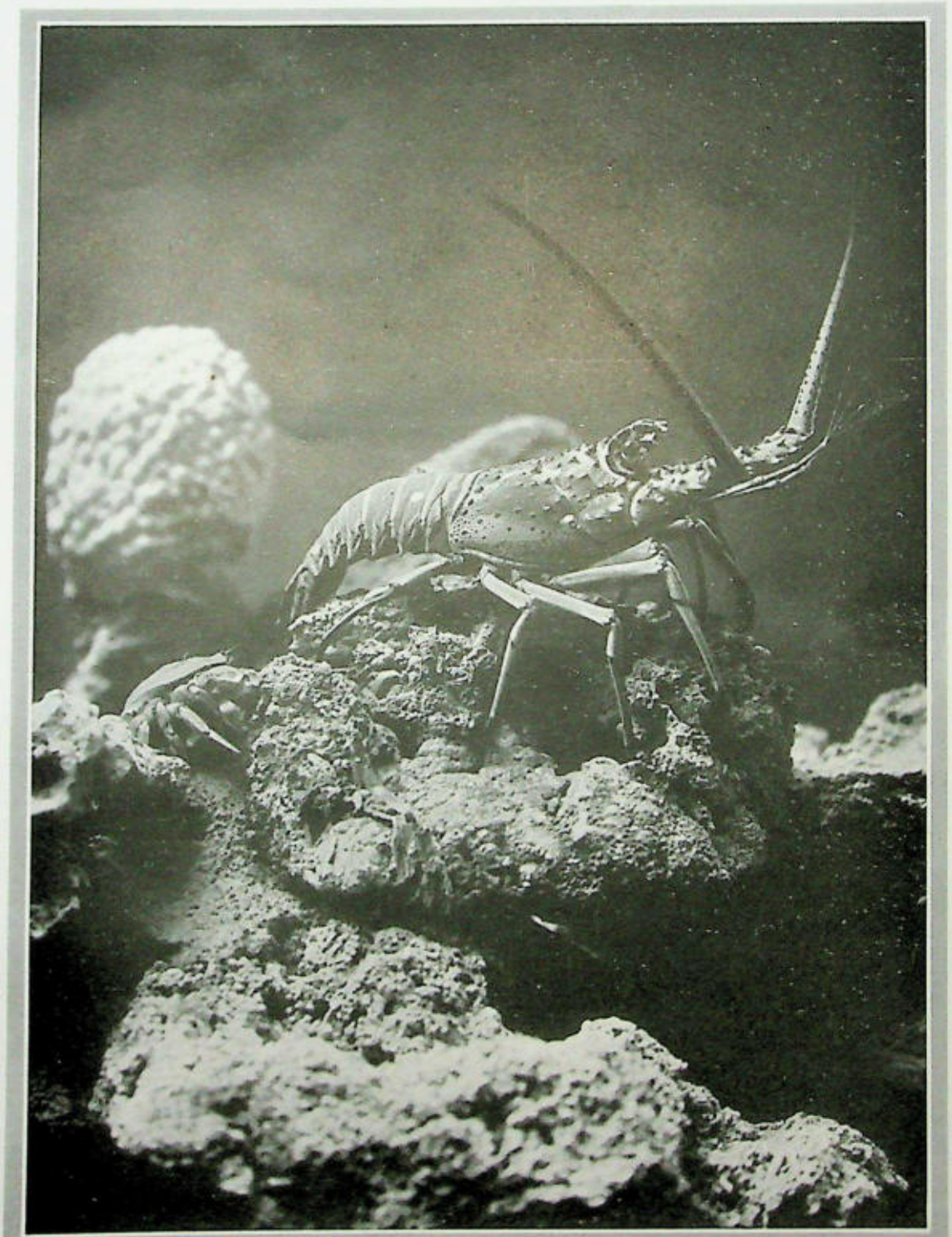
New Rockwork: White bubbles stream from the air-valve



Queen Triggerfish



Channel Bass



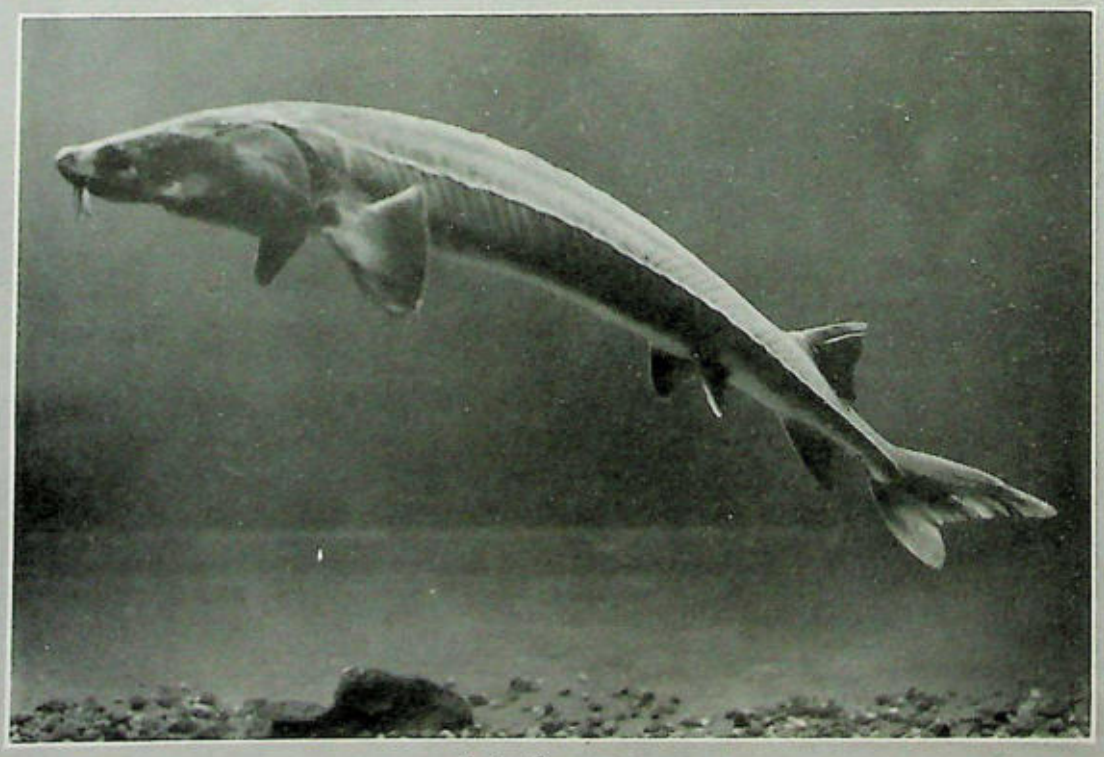
Spiny Lobster

Triggerfishes in two color phases

Rock Hind: An example of protective concealment

A masterly example of rockwork construction

Green Morays



Lake Sturgeon

Castles under the Sea: Rockwork reefs for Tropic fishes.

CREATING A PUBLIC AQUARIUM

By C. H. Townsend

DURING the writer's long connection with the New York Aquarium, many cities in the United States have made inquiry respecting the cost of maintaining a public aquarium and the proper procedure in establishing one. Similar letters have also been received from countries as far away as India and New Zealand.

Only a few of these cities have as yet carried such a project to completion. The communications, coming from local chambers of commerce or commissioners of parks, were at first answered at considerable length but the information desired was not such as could be satisfactorily imparted by letters however lengthy and involved frequently the making of drawings and measurements.

It became necessary to advise applicants seeking such information to send an engineer to New York to study aquarium methods and equipment. Some of the cities that established them sent architects, having in mind chiefly an attractive building, without considering in the least, what the region in question afforded in the way of exhibits, how extensive such exhibits were to be, or realizing that an aquarium having fresh-water and marine collections, requires a complicated mechanical equipment. Some of the aquariums that were eventually founded still depend for their marine exhibits, on annual exchanges with the New York Aquarium. The large size of this institution created many years ago and constructed within the walls of an old fort, did not make it a very practicable model for an aquarium of smaller size, while much of its equipment had not until recently been modernized.

The considerations which follow are presented for the benefit of city officials and organizations still making inquiry respecting aquariums. The first points to be determined are those connected with the living exhibits, whether they are to consist of fresh-water or marine life or both and how many kinds are available within reasonable collecting and shipping limits. The transportation of fishes includes that of heavy tanks of water. All existing aquariums are still dependent upon their own efforts in collecting and transporting the aquatic forms which they display, as there are no sources from which such may be purchased. Many inland localities afford but limited variety in fresh-water exhibits, while the gathering and transporting of marine life by rail involves considerable expense and some losses in transit.

Moreover the keeping of marine life is dependent upon the storage of sea water, its constant circulation and filtration, as well as heating in winter if derived from tropical waters. The keeping of fresh-water forms is comparatively simple and inexpensive as compared with those requiring sea water.

Let us consider briefly the list of the more conspicuous fresh-water fishes available for a large aquarium situated, for instance, on the Great Lakes. Among those for which large tanks would be desirable are muskellunge, pike, pickerel, pike-perch, lake, rainbow, brook and other trouts, Atlantic salmon, lake sturgeon, fresh-water drum, long- and short-nosed gars, burbot, bowfin, and two species of black basses. Certain large fishes of the Mississippi are also obtainable, such as shovelnosed sturgeon, giant gar and catfish.

These are about all that can be considered large, numbering perhaps little more than twenty all told. All others such as the various species of whitefishes, basses, sunfishes, chubs, suckers and so on down the list, are of course available, but are less striking in the opinion of visitors, and must constitute the exhibits of the smaller tanks. The Pacific Coast region lies too far away for practicable collecting purposes and the larger fresh-water fishes available there would be limited chiefly to the trouts.

Unless the inland aquarium is to display a great variety of small things, it would be unwise to construct more fresh-water tanks than could be filled. It would also be unwise to construct as many sea-water tanks as would be required for the numerous kinds of sea fishes by an aquarium located on the Atlantic coast. While small aquatic forms of life are attractive to persons interested in natural history, experience indicates that the average aquarium visitor likes to see the big and striking things, paying little attention to the labels describing those of small size.

An exhibit of fresh-water fishes however varied, is one of rather monotonous coloration. The brilliantly colored fishes from Florida and Bermuda undoubtedly lead in attractiveness with visitors to the New York Aquarium, while northern sea fishes constitute a close second. An inland aquarium would necessarily find its marine and tropical exhibits more difficult to maintain than one located on the Atlantic Coast, where transportation by steamer, in tanks constantly supplied with flowing sea water,

makes shipment safe and inexpensive as compared with shipment by rail.

Fishes still constitute the bulk of the exhibits in all aquariums, the number of aquatic reptiles, batrachians, mammals and invertebrates being usually rather limited, although they are entitled to the same consideration. Water plants and insects have hitherto been disregarded. The name aquarium permits of a very broad interpretation and the ideal aquarium has not yet appeared in any country.

The inland aquarium builder should therefore consider very fully the character and availability of the exhibits proposed, before constructing tanks and pools of such number and size as would be difficult and expensive to stock and maintain.

The next points for consideration are those connected with the equipment necessary for the safe keeping of the aquatic forms brought together with so much difficulty and so quickly lost when the conditions of captivity are unfavorable. The possession of a large and beautiful building designed by an ambitious architect, does not imply by any means, that the conditions necessary to successful operation have been considered and provided. Judging from some of the sketches submitted, the proposed aquarium building would serve equally well for a library or a hospital. It is therefore highly desirable that the equipment of the aquarium be studied by an engineer or an experienced aquarist, after which the architect may be called upon to provide suitable housing, and this is possible with a very simple but well-lighted building.

The character of the exhibits and the number of tanks and pools required having been determined, the problem of water supply and its circulation should be undertaken by a competent person. This can best be done by a careful study of methods employed in other aquariums, lest important matters be overlooked and expensive alterations later be made necessary. Fresh water may be taken from city supplies except in cases where such are treated with chlorine or otherwise made unfavorable to fish life.

Sea water must be stored in reservoirs in sufficient quantity to fill both reservoirs and exhibition tanks. Its purity must be safeguarded at all times by proper filtration and aeration. The mechanical equipment necessary to the operation of a public aquarium includes pumps for the circulation of sea water, filters capable of cleansing the entire overflow of the exhibition tanks on its way back to the reservoir, elevated distributing tanks above the level of the exhibition tanks, heaters for winter use in the water system carrying all tropical collections and a refrigerating plant for the cooling of fresh water carrying northern fishes in summer. Sea water pumps and piping must be of non-rusting material lest the water supply become impregnated by iron rust.

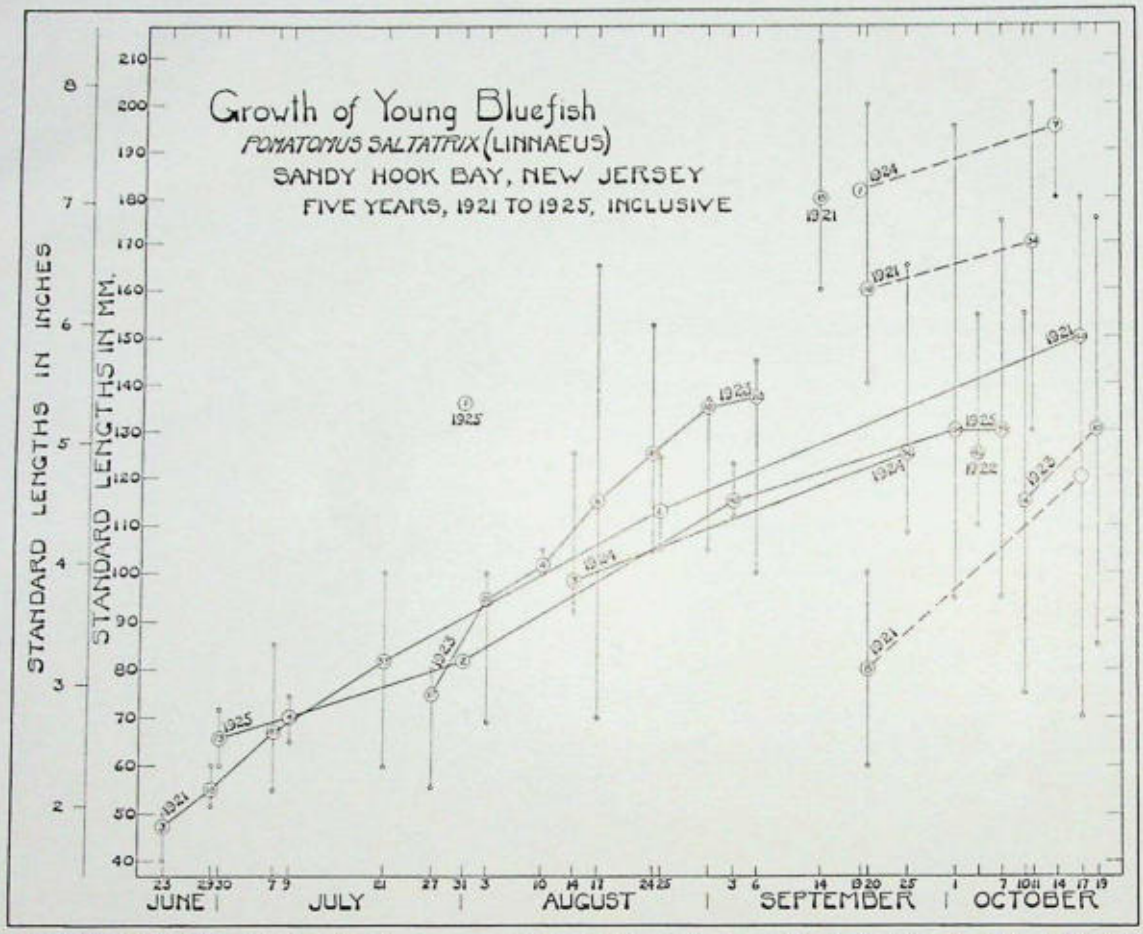
If marine collections are not to be included, the matter of equipment becomes at once a simple one, as pumps, salt-water filters, distributing tanks, heaters and reservoirs are all omitted and the number of employes thus reduced by more than half.

It is not necessary here to consider such auxiliary equipment as medium-sized metal shipping tanks for use by rail or by motor truck, or the extra large wooden tanks necessary for shipments by steamer.

The lighting of the building by skylights over the exhibition tanks is a matter of decided importance. Water is not easily lighted and such skylights are seldom made large enough for satisfactory views of the living occupants of the tanks. Too much light on bright days can be restricted by shades, while on dark days light cannot be too abundant. Artificial light is a most unsatisfactory substitute. The line of skylights above the exhibition tanks should be almost continuous and should be twice as wide as the tanks to light them properly.

While all of the points considered above are of prime importance, there are other matters of secondary importance that should not be overlooked. The mere setting of the heavy plate glass fronts of exhibition tanks by inexperienced persons has resulted in much unnecessary breakage in all aquariums known to us. Water pressure will promptly crack heavy glass that is not evenly supported on every part of its margin.

Persons contemplating the construction of an aquarium are therefore urged to undertake the initial expense of a careful study of some public aquarium known to be in successful operation and thus avoid mistakes that will result in greater expenses for necessary alterations. The New York Aquarium which maintains perhaps larger collections than any institution of its kind, has had its full share of expensive alterations during the past twenty-three years, an experience which a new aquarium should be spared. During this period we have been called upon to write scores of letters on this subject. The present article will be reprinted as a circular to be used hereafter as a formal reply to all inquirers on the subject of aquarium con-



Large circles around numbers indicate modes of groups measured; latter indicate quality of examples. Small circles connected by light vertical lines indicate extreme variations. Heavy lines connecting modes indicate plotted growth for various years shown by figures at ends. Heavy dotted lines are suggested growths of groups of fishes in the bay in Fall. Those below the main group are apparently from some point further north or of later spawning outside the bay. Those above are a mixture of similar groups spawned further south or earlier, and fish of preceding year. Single example, October 17, 1921, indicates a second mode that appeared in the curve on that date, due to mixture of two schools. It may connect as suggested by lower dotted line. 20 per cent to the lengths indicated will give approximate total length of fish.

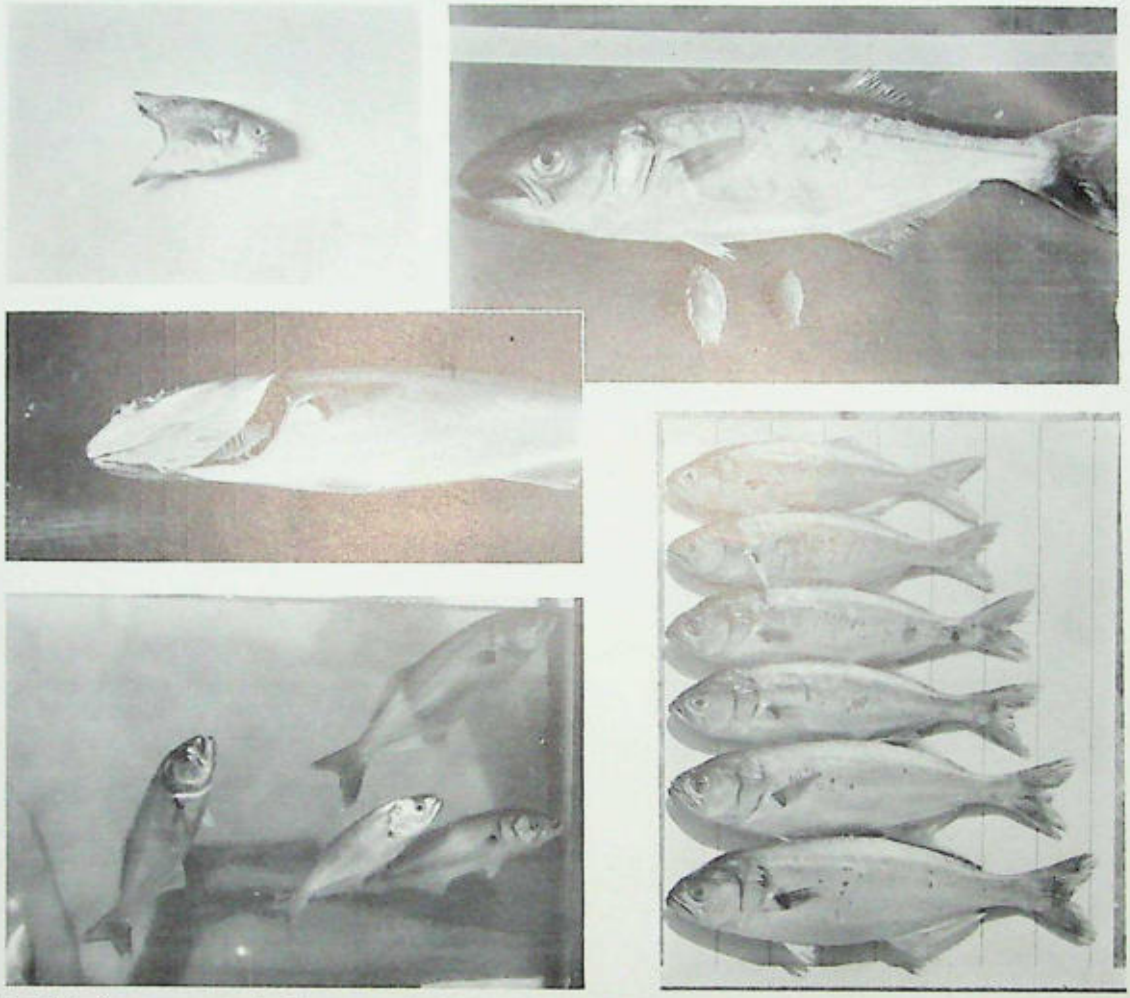
struction. It is scarcely necessary to add that representatives sent to the New York Aquarium will be afforded every facility for studying the aquarium methods employed here.

GROWTH OF YOUNG BLUEFISH

From Observations Made in Local Waters

By C. M. Breder, Jr.

THE growth of young bluefish (*Pomatomus saltatrix*) in local waters is exceedingly rapid. Those found in Sandy Hook Bay for the last five summers, on an average, considerably more than doubled their length between the end of June and the first of October, that is in about three months. This data is based on the actual measurement of 1,034 examples taken in that bay between 1921 and 1925 inclusive. The extreme variations and the modes are indicated on the accompanying chart. The limits of variation are close in the early part of the season and point to a spawning season in late May or early June. Ripe bluefish have been repeatedly reported by Captain W. S. Downs from Fire Island about that time. The young fish first appear in our seines in the latter part of June but are much too small to be retained by the coarser meshes of the pound nets. About the middle of August the more successful ones, those that have attained a larger size, are unable to squeeze through the pound net meshes and many are taken. On about the first of September, owing to the vicissitudes of life, their variation in size, as indicated by the diagram is much greater. Coupled with this is the presence of laggards from the last season which can only be told from precocious ones of the present season by an examination of the tell-tale marks on the scales. About this time they also appear to begin to show their wandering nature



Top (left)—Young pompano mutilated by a young bluefish. Center (left)—Young bluefish with a crustacean parasite in the gill cavity preventing closing of operculum. Top (right)—Young bluefish with two parasites. Lower (left)—Young bluefishes. Lower (right)—Six young bluefish against background ruled in inches; third from top with injured caudal pendunele.

as schools of individuals of all sorts and sizes appear. These we believe have been spawned either south or north of here, depending on whether they are larger or smaller than those which seem to have been reared in the Sandy Hook Bay. Allowing for this there is a remarkable uniformity in their growth rate from year to year.

Their voracious nature seems to be clearly associated with their great speed of growth. The frequent scars found on spearing (*Menidia menidia notata*) young mullet (*Mugil curema* and *cephalus*) and young pompano (*Trachinotus carolinus*) may be assigned in most cases to their depradations. At one time we saw such young bluefish feeding, or rather cutting and slashing a school of anchovies (*Anchovia mitchilii*) in one of the pound nets as it was being raised, and so great was their intent and the confusion of the anchovies that many of both were brought on board. They could have readily passed through the meshes, had it not been for the boiling mass of living fishes of a larger size with which they found themselves carried along. Anyone who has picked up any considerable number of such young bluefish can testify to the strength of their jaws and the sharpness of their teeth. It is not uncommon for a five-inch fish when taken from the water to draw blood from the tougher parts of the hand.

As with most such creatures they are in turn the food of others. Bluefish of a larger size, fluke (*Paralichthys dentatus*), weakfish (*Cynoscion regalis*), and many others, all have shown evidences of having fed on "snappers."

This has been established by an examination of stomach contents. It is not only these larger fishes that keep the small bluefish in check but smaller enemies as well. An example is the large crustacean parasite (*Livonica ovalis*) (Say), which may be found in the gill cavity of approximately every tenth fish in late summer.

A LYRIC TO ENTICE FISHES

By Ida M. Mellen

FISHERMEN nowadays lure their prey with bright, bobbing "flies," shining metal minnows, and such deceptions. There are also certain oils which, if cast upon the waters with the bait, lure the fishes to destruction. In salt water, either bunker oil on a sponge, or the oil of rhodium is said to attract fishes, while anise oil or oil of asafoetida on the bait will "work wonders" in fresh water.

In earlier ages, fishers devised methods which we would now call primitive, but which appeared to give perfect satisfaction, even in the case of singing to fishes which, according to present day belief, do not hear sounds made out of the water.

In one of Charles G. Leland's pseudo-scientific works ("Have You a Strong Will?") he states that on the 17th day of May, 1638, "the Jesuit Athanasius Kircher, going from Messina in a boat, witnessed with his own eyes the capture of sundry *xiphiae* or sword-fish by means of a melodiously chanted charm, the words whereof he noted down." These words are quoted by Leland without translation, and as it has taken the present writer exactly five years to procure a translation of the "charm," Leland's reason for quoting it in the original is obvious.

In another book Leland refers to the charm as a "curious incantation—a lyric employed in Sicily to entice fish—angel fish."

It is extremely doubtful that any fish now known as an angel fish or a swordfish, was of the species taken, but there is no question that the ditty was sung by Sicilian fishermen in the belief that it would lure the fishes.

Wood in his "Natural History," states that Sicilian fishermen chanted a kind of song set to words that no one could understand, the more efficacious because of incomprehensibility—a corruption of some old Greek verses. He says that no bait was employed, because the fishes were so fond of the song that they would follow the boat. One word of Italian, however, would drive them off.

As quoted by Leland from the notes of the Jesuit Kircher, it is as follows:

Mammassudi di pajanu, Palè la stagneta.
Palletu di pajanu, Mancata stigneta.
Majassu stigneta. Pro nastu varitu pressu du
Palletu di pajanu, Visu, e da terra!

In 1920 this ditty started out from the Aquarium on a journey that promised almost to encircle the globe—a journey in quest of a translator; and, like the proverbial navigator who winds up at the point from which he started, it at last ended its wanderings in New York (in 1925).

Translating offices were unable to do anything with it; an Italian lawyer and other friends of Italian extraction failed, as well as Italian scholars in South America and the Professor of Italian at Columbia University could make nothing of it. It was sent to the Italian Discount & Trust Company of New York, in the hope that among their clients might be some old Italian priest who could read the ditty. But they, too, after various attempts, gave up the search for a translator. They offered a suggestion, however, that the ditty be sent to the United States Consul General at Palermo, Italy, with the request that he have it submitted to the University at Palermo, where there were professors who, in all likelihood, would be interested in obtaining a translation, if only from a point of personal curiosity.

Some months after the ditty had been sent to the American Consul at Palermo, Mr. Edward I. Nathan, he replied that despite various efforts, he had found it impossible to get it translated or even to determine what dialect it was in. He had run down a suggestion that it was Sardinian, but that also failed to give results. Mr. Nathan, being himself a student of philology, questioned various persons, and they came to the conclusion that the two first lines were as follows:

Your mother is superb,
Your bather is bold.

At least we had made a start! Every linguist we met was petitioned for aid, but no more progress was made until the present year. Then the long quest came to an end when the writer, having accepted an invitation from a member of the Zoological Society to a rehearsal of grand opera, had the great good fortune to meet there Dr. Alfred E. Viola, Italian Representative of The Roman Choir and Editor of The *Musical World*.

Dr. Viola agreed to try to make a translation. After careful study of the ditty, he concluded that it is a "rigmarole more or less nonsensical like Mother Goose rhymes or 'Eeny, meeny,

miney, mo'; that it is not written in any one understandable language—not all in Sicilian, Italian, or Greek." To add to the difficulty, several errors had been made in the version as quoted by Leland. Dr. Viola also pointed out that "the song was heard and transcribed after a fashion by a German monk who, of course, could hardly follow such a medley of Sicilian and Greek jargon."

Following in part the translation of the two first lines by Mr. Nathan, he renders the ditty thus:

Mother is proud, Catch the bait,
Father is bold. Eat the bait,
Eat the bait, Come to our boat
Father is bold. As it nears the land.

In this form it bears a faint resemblance to Mother Goose rhythm; but as *di* means *of*, he prefers the following interpretation, which he believes is the best that can be made under the circumstances:

Oh, you mothers of fishes, Catch the bait,
Oh, you fathers of fishes, Eat the bait,
Eat the bait, Come to our boat
Fathers of fishes, As it nears the land.

The translation shows that Wood was in error as to there being no bait used in conjunction with the chanting of the ditty.

Although the Jesuit Kircher set down this ditty two hundred eighty-seven years ago, this is probably the first time that it has been done into English.

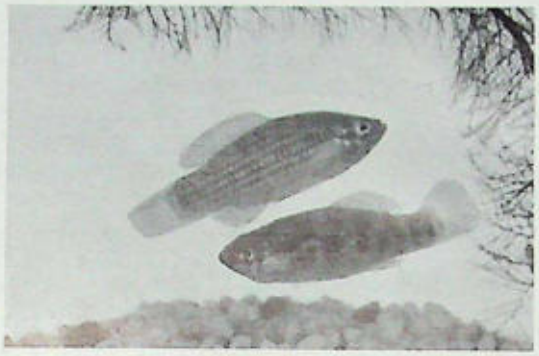
JORDANELLA FLORIDAE *

By E. Calver Bayliss
Member, Toronto Goldfish Fanciers Society of Canada

THIS little fish from Florida fresh waters is only casually mentioned in most books on tropical fishes, and there seem to be little scientific data about it.

Its body is shaped like that of the sunfishes, and the male is prettily adorned with alternate horizontal rows of red and green scales. His back is green, and his anal and dorsal fins are transparent, dotted all over with red. In the center of the body, directly on the middle of the lateral line, is a black spot. As in the guppy and some other tropical pigmy fishes, the sexes are quite differently marked, the female being plainly colored.

The pair upon which these observations have been made are only two and a half inches long, but Jordanelle sometimes attain to four inches.



JORDANELLA FLORIDAE
From a photograph by Dr. E. E. Bade.

Courtship is somewhat similar to that of the guppies, the male swimming in excited circles about the female, and at the same time trying to drive off other males. The female swims up to him, pressing her body against his, while he curls his anal fin about her as well as its short length permits. In this position the eggs and milt are simultaneously expelled, spawning continuing over a period of two hours, the eggs being laid singly or only a few at a time. They have hatched when the temperature dropped to 62° but hatch in about a week at a temperature of 66° to 75°, and are apparently not adhesive as I have seen the parents stirring them up. Spawning takes place at random all over the tank, yet very close to the plants—an apparently unconscious provision for the concealment of the eggs among the plant roots, for if the fishes spawn on sand, the female will eat all the eggs.

The fry appear first at the top of the water, but they soon become bottom-swimming and bottom-feeding, and should one rise to midwater and become alarmed, it will dive in a crooked path to the bottom, hiding there among the plant roots or in the sediment.

In the matter of food, I give the adults dried shrimp, live *Daphnia*, and live white worms (*Enchytraeans*). They nibble at the plants and evidently eat filamentous algae growing there. The young I feed on live foods, such as infusoria, *Canthocampus* (a crustacean similar to the well-known water-flea *Cyclops*, excepting that it swims slowly instead of darting through the water), chopped white worms, and screened *Daphnia*.

At two months the young fishes measured three-sixteenths to three-eighths of an inch in

* When Miss Mellen wrote "Fishes in the Home," in 1921, so little was known about *Jordanella floridae* that only eight lines were devoted to the species in her booklet. Mr. Bayliss of Toronto, Canada, has made the present interesting observations upon specimens in his possession. Unfortunately the little fish still lacks a common name.

FISHING FOR LAFAYETTES

A typical mid-summer throng on a pier in New York Harbor angling for spot or lafayettes.

length, with considerable variation among individuals. These young specimens were exhibited at the Canadian National Exhibition when they were one-half to three-fourths of an inch long and still retaining the infant coloring, a plain mottled gray like that of the mother except for two black spots, one on the lateral line and the other on the posterior edge of the dorsal fin. Some of this batch of *Jordanella* by October first, when they were fifteen weeks old, measured over one and a quarter inches in length. In the young males the spot on the dorsal has disappeared and a reddish hue has appeared on anal and dorsal fins, although the body color remains the same. They show occasional signs of sexual awakening by chasing the little females when the temperature of the tank rises to 70° or more, but at 64° are indifferent.

Whether *Jordanella* can safely be kept with other species, I am not prepared to say more definitely than that they appeared to bite off the fins of the zebra fish (*Danio rerio*); the young, however, agree well enough with hybrids of Mexican sword-tails and *Platypoecilus rubra*.

This little fish is found in St. Johns and other rivers and lakes of Florida. It might be named Jordan's Florida killifish.

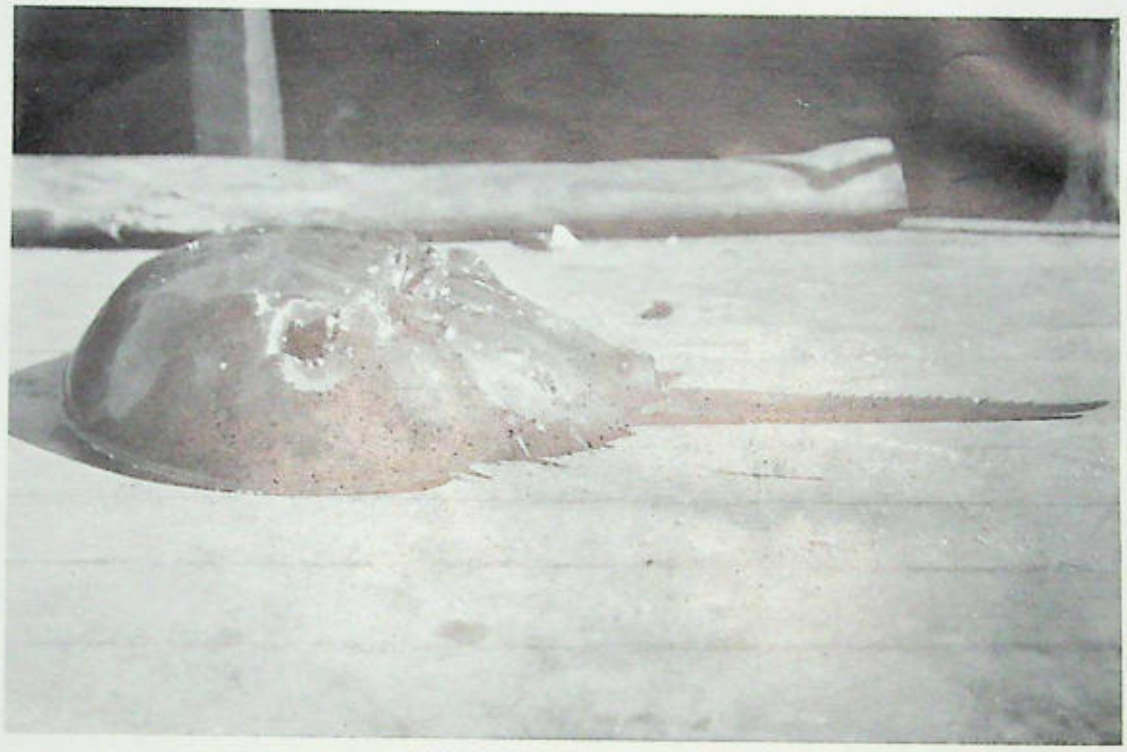
THE SPOT OR LAFAYETTE

Notes on the Local Abundance of this Species During 1925

By C. M. Breder, Jr.

THE spot or lafayette (*Leiostomus xanthurus* Lacepede), always more or less periodic in its abundance, was found to be exceptionally numerous in local waters this season, even running far up into our much polluted water ways. As far from the ocean as Nyack on the Hudson, small boys, as well as those of a larger size decorated the wharves and piers with their gear and themselves in efforts to harvest these small but by no mean unworthy tidbits of the sea. On one occasion, two boys by means of a single hand line apiece, were noted to nearly fill a water bucket in a short time.

The old fishermen's yarn runs that this species appears in abundance once in seven or seventeen years; a statement that is dependent on the locality and the temper of the usually positive but not always reliable yarn spinner. Although they certainly are very variable in their frequency no definite periodicity has ever been satisfactorily fixed for them or a concrete cause assigned as to the reasons for this phenomenon.



A HARDY HORSESHOE CRAB
Still living with a hole completely through shell and body.

They are reported to have been abundant in New York Harbor during the summer of 1902, 1908 and 1917 and the legendary account states that the name "lafayette" originated because of of an unprecedented run of them at the time of one of that great Frenchman's visits to this country. It should be noted, however, that the intervals between runs are 6, 9 and 8 years, respectively. This averages closer to 8 than to 7, with an extreme variation of 3 years.

These that were found this year in Sandy Hook Bay first appeared in great numbers about the middle of July, and they were abundant from then on until the fall closed our season of activity. But the greatest numbers were seen in the early part of September. Measurements failed to show any preceptible growth from July 31 to October 1, all of them averaging about 13 cm., and ranging from 8.45 to 14.5 cm. in standard lengths without the tail fin. This translates to an average entire length of about six and one-quarter inches. An examination of a fair specimen showed that these fish were hatched in the fall of 1923, the spot being a late spawner. That is they were nearly two years old this summer. The scale also indicated that during the winter of 1924-25 they averaged 9 cm. in standard length. They are not known to spawn north of Delaware Bay, although it is possible that they do so occasionally.

This species is the smallest of the Croaker family (Sciænidæ) found in this locality. The largest example that I have examined was 30 cm. over all. The scales of this specimen, taken at Atlantic City in 1920, indicated an age of four and one-half years, while the maximum recorded length for the species is 33 cm.

The food of the spot consists, in a large measure, of small crustaceans and other small organisms that they can gather from the bottom, and for which its small, inferior mouth is fitted. However in the Aquarium they feed readily and thrive on cut fish for which they soon learn to come close to the surface of the water.

A Hardy Horseshoe Crab.—A specimen that has been transfixed through and through by some sharp instrument, probably a fish spear, and survived to heal the wound entirely. Note the barnacles attached on the regenerated shell surrounding the hole. Through this orifice the legs may be seen operating as the animal crawls. This specimen is now living in the Aquarium apparently in perfect health.—*C. M. B., Jr.*

FOETAL SHARKS
From a specimen taken off Cape Hatteras.

A New Shark Story.—In a radio talk on "The Dreadful Shark," Miss Mellen referred to a cruel method formerly employed by sailors who wanted to get rid of a man-eating shark that was following the ship. They would heat a brick red hot, wrap it in a pile of old clothes and drop it overboard sizzling. The shark, of course, would instantly swallow the fatal bundle, and would trouble the sailors no more.

This story brought out a still more interesting one from one of the "listeners in"—Chief Maher of the Brooklyn Fire Department, who wrote Miss Mellen as follows:

"When I was a young man, I was on the *U.S.S. Brooklyn*, assigned to the Indian Ocean. We were sent to the Coast of Madagascar to protect the interests of some Americans who were in business out there. The sharks were very large and numerous in these waters. When we went from the ship to shore with the cutters they used to follow us and rub their backs against the bottoms of the boats.

"We heated a 20 lb. shot one day almost red hot and wrapped it up in a goatskin and threw it overboard amongst about a dozen sharks. There was a scramble for it and after a while one big fellow floated to the top of the water and we put a bowline around him and hoisted him to the cat-head.

"Lo and behold he had two holes—the size of the shot—in his belly and it was concluded that he grabbed the shot as soon as it went over and that it burned a hole in him, and that he dived after it and got it the second time.

"This may be worth telling in your next talk. If you find anyone who don't believe it, refer them to Chief Maher of the Fire Department."

No one who is acquainted with the voracious nature of the sharks and their apparent insensibility to pain, will doubt the truth of this story. We have heard of dog sharks being split open so that no food could be contained in the organism, yet they appeared to suffer no pain, and would go on swallowing things that inevitably fell out of the stomach as promptly as they went into it.—*I. M. M.*

Foetal Sharks.—Captain Ejnar Maller recently brought the accompanying photograph to the Aquarium with the following data:

His vessel the *Danefolk* of Copenhagen, fishing off Cape Hatteras about the middle of April 1924, took a shark which he estimated at two meters, a little over six feet. On opening it there were found nine foetal young which were apparently about ready for birth.

While it is of course difficult to ascertain the species from such photographs of even advanced embryos, they appear to be the young of the edged shark (*Carcharhinus limbatus*) with slight doubt.

Mr. J. T. Nichols says of this species "Females are with young about twenty-two inches in total length, almost ready for release in April in the Bay of Florida. The young number three to six, may be of either sex or equally divided, females apparently somewhat predominate. . . . . Breeding females in Florida are between five and five and one-half feet in total length.*

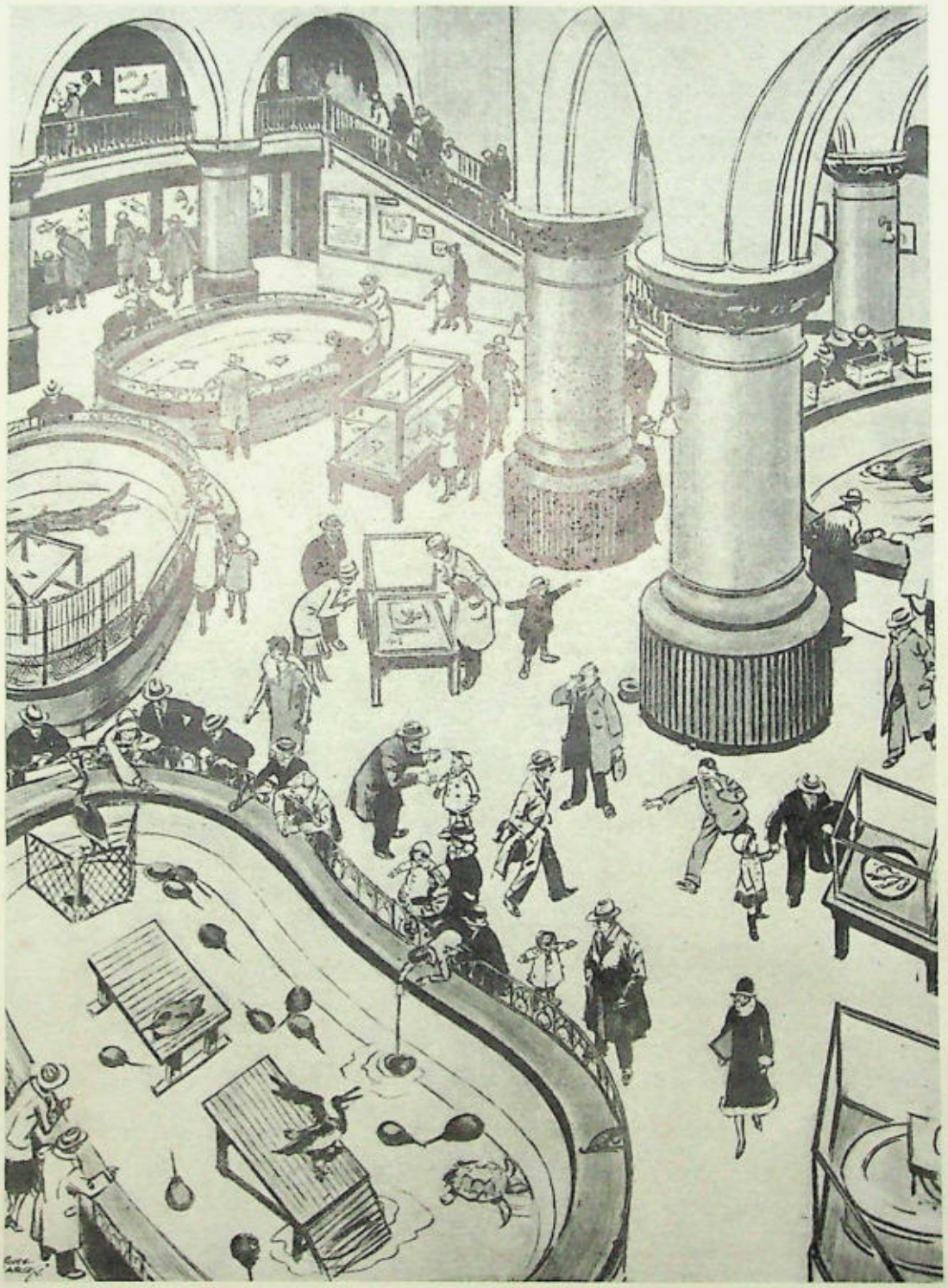
This information checks well with the present material in time of year, in number of young, for the female from which these were taken was larger than any of his, and in their size, which was given as about two feet. Judging from the photograph they all seem to be females. If our identification is correct, although we cannot be absolutely certain of the species, this is the highest number of young taken from such a female that we know of.—*C. M. B., Jr.*

Two Tons of Fishes.—A large run of fishes recently (November) in the East River, New York City, almost resulted in shutting down the generators of the Brooklyn Edison Company.

More than two tons of "lafayettes" rushed the screen well which strains the water used in the huge condensers. The fish passed through the screens into the submarine tunnels and jammed against the condenser tubes.

The crews were obliged to stop the generators one at a time and shovel out the fish.—*Telegram* (N. Y.).

* Quoted with permission from the unpublished manuscript "Marine Fishes of New York and Southern New England," by J. T. Nichols. Corrected to January, 1925.



From a drawing by Tony Sarg.

A gathering of the Izaak Walton set at the New York Aquarium.

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