

me that to this cause the absence of earthworms may be attributed. Ants and burrowing beetles, or the larvæ of the latter, are, however, common, and no doubt do much service in the manufacture of plant-food, as well as in the destruction of the decaying material. At Boise City, Idaho, some enthusiastic disciples of Izaak Walton imported and successfully reared the coveted bait for their fish-hooks in soil suited to the habitat of the Lumbricidæ.

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January 30

P.S.—Are earthworms found in Arabia and Egypt?

ZOOLOGICAL RESULTS OF THE WORK OF
THE UNITED STATES FISH COMMISSION
IN 1883

IN the summer of 1880 the United States Fish Commission steamer *Fish-Hawk* began her first work in dredging upon the Gulf-Stream slope seventy miles south of Rhode Island, working in from 75 to 600 fathoms of water. Upon this steep submarine bank several hundred species of Invertebrates were found which proved to be new to the American coast. Many were entirely new, others had been described from the Mediterranean and the deep waters off the west coast of Europe, and some were identical with fossils from the Italian Tertiary and Quaternary deposits, this being true of the shells more particularly. These species have long since been described in American scientific publications, and two subsequent summers of work in this region have brought to light numerous new and additional species, and at the same time very nearly exhausted the region. The *Fish-Hawk*, built for the purpose of serving as a floating shad-hatching station to work in the shallow inlets of Chesapeake Bay, was, during the summer, when she could not carry on her intended work, made use of for dredging purposes, work for which she was not well suited, for her shallow draft and round bottom rendered her unsafe when far from land and liable to encounter rough weather. She could make trips only when pleasant weather was assured for at least twenty-four hours, thereby losing much valuable time which could have been saved if a perfectly seaworthy vessel had been at the command of the Commission.

Accordingly in 1882 an appropriation was obtained, and early in 1883 the *Albatross* was launched, and made her first trip shortly afterwards. So much has been written about the *Albatross* that a mere passing notice will suffice. She is a 1000-ton iron vessel, 234 feet long, and drawing 12 feet of water. On the port side, near the bows, the sounding-machine is placed. Just forward of the pilot-house is the dredging-machine, and here, in a clear space left for the purpose, the rougher work, picking out the specimens from the mud, &c., is done. Aft of the pilot-house, with a chart-room intervening, are the two laboratories and a store-room,—an upper and lower laboratory, and the store-room beneath. The finer sorting and microscopic work is done in the upper laboratory, this being lighted by a skylight and four deck-windows. The library is in this room. In the laboratory beneath are cases of bottles ready for use and for those containing specimens, and a bench is placed on two ends of the room, where rough sorting can be done. In the room below this, bottles, jars, tanks, dredges, nets, and all apparatus used in the work are contained. Alcohol is carried in a large copper tank. In the upper laboratory are two copper tanks each of 32 gallons capacity, one containing fresh water, the other 95 per cent. alcohol. By means of faucets each can be drawn from its respective tank. The rest of the ship, with the exception of a few state-rooms reserved for naturalists, is given over to machinery and quarters for officers and crew. She is manned from the navy, and is under the command of Lieut. G. L. Tanner, U.S.N. Electricity is used for

lighting, Brush incandescent lights being used for ordinary purposes, while an arc lamp suspended from the rigging lights the deck so well that work can go on as well by night as by day. Engineer Baird, U.S.N., chief engineer of the vessel, has succeeded in making an incandescent light that when lowered to 100 fathoms will neither be crushed nor extinguished. Used in connection with some deep-sea trap, this will undoubtedly give good results in capturing such quick-motived fish as would avoid the trawl but would be attracted by brilliant light. The apparatus in use is the best which the past experience of the Fish Commission, U.S. Coast Survey, and European dredging expeditions could suggest. The vessel is so constructed that she can go backward as easily as forward. When the sounding-wire is running out, she can go completely around it without causing it to depart from its perpendicular. That the *Albatross* is perfectly seaworthy and that the machinery and apparatus and the vessel itself are in the best condition has been proved by the numerous trips made during the year just passed, and by the rough weather encountered. Starting early in 1883 upon her trial trip, she went into water as deep as 1200 fathoms. Afterwards numerous trips were made in the deeper waters off the southern coast of New England, some lasting a month. The principal work was done in from 1000 to 2000 fathoms, the deepest work done on the United States coast by an American expedition. Several successful hauls were made in 2400 fathoms, and one in 2950 fathoms. This latter is the deepest successful recorded haul made with a trawl as far we can find out. Soundings were taken in 3000 fathoms. The naturalist in charge is Mr. James E. Benedict. The *Albatross* has just started on a cruise to the West Indies, where work will be done both on the shores and in the deeper outer waters.

The previous explorations of the *Challenger*, *Blake*, Norwegian, and French deep-sea dredging expeditions, investigating similar regions in the North Atlantic, have rendered the results obtained by the *Albatross* much less remarkable than they would otherwise have been. Notwithstanding this, and the fact that some worked very near the field chosen by the *Albatross*, many new species—some of them of a very remarkable character—were taken, often in great numbers. The bottom in all the hauls deeper than 1000 fathoms was of globigerina ooze, the absence of pebbles and sand being a well-marked and universal fact. Whenever mud was obtained from any locality, it was thrown into a tub of water, stirred, and allowed to settle, and by repeating this several times a perfectly pure deposit of Foraminifera was obtained. Each sounding and mud from each station was treated in a similar manner, so that samples, and often large quantities, were obtained in this manner, so that material was furnished for a complete monograph of the group. Over fifty species have been found in a partial examination of a few hauls. Every variety, both in form and in colour, is represented in these shells. Numerous new species of Gorgonians and Pennatulids were found in many localities. In these soft bottoms, where no stones are to be found, such animals or colonies of animals as must have some firm basis of attachment are almost entirely wanting. Sponges, barnacles, and hydroids are very rare, occurring at times upon the bare stalks of *Lepidisis* or upon some dead shell. Frequently, barnacles and Actinians are attached to these stalks, fastened in a cramped manner, the base completely surrounding the stem. The barnacles found here are very remarkable, usually being stalked, but one was taken which was sessile. A common mode of fixation among the Pennatulids is by means of a bulb-like process which projects into the mud. *Acanella*, *Lepidisis*, and their allies fix themselves by branching, root-like projections. A number of specimens of an undetermined species of Umbellifera were taken. Three new species of Epizoanthus, or, more probably, new

genera allied to Epizoanthus, were obtained, each with a new hermit crab. Other genera of Actinians were rare, owing to the few opportunities for attachment. The most abundant starfish was a new species of Zoroaster named *Z. diomedea*, found in 1200 fathoms. An Archaster-like species was the most interesting, on account of its immense madreporic plate. Several other species of Archaster, and at least one of Solaster, were also taken. Starfishes from these depths belong to the two very opposite genera *Asterias* and *Archaster*, or their near allies. *Ophiomusium lymani* and *armigerum* formed the greater bulk of Ophiurians, but we dredged, in smaller quantities, *Ophioglypha convexa*, several species of Ophiocantha, and a number of other species not yet determined. One species of soft, flat sea-urchin was quite abundant, and another much larger one was taken in smaller numbers. *Echinus norvegicus*, previously found only rarely in the dredgings of the Commission, was obtained in great quantities in 1000 fathoms. Several other species of Echinus and a number of Spatangoids formed the best part of the collection of Echini. Holothurians were represented by many forms. One, resembling *Leptosynapta* in form and in its anchor hooks, another similar to *Molpadia*, and several others having the form of the typical Holothurian, will undoubtedly prove to be new. The most peculiar species of Holothurian were two new forms taken in great numbers from several localities. They are new species belonging to genera described from the *Challenger* Expedition; one will be called *Benthodites gigantea*, the other *Euphronides cornuta*. We can describe them no better than by giving the names applied by the sailors, Benthodites being called the "lump of pork," and "animated boxing-gloves," while Euphronides was christened "Old Boot," and its resemblance to an old, unblackened, low shoe was certainly remarkable. As the specimens of Benthodites tumbled from the trawl-net, they looked very much like pork, and reminded one of boxing-gloves, on account of their size and apparently useless bulk. In the 2950-fathom haul, a specimen of a Tunicate, allied to *Boltenia*, was taken, and a number of shrimps.

Several new and remarkable Cephalopods were dredged during the summer. *Pleurostoma*, *Bela*, and allied genera were taken in great variety and abundance. One species of *Pleurotomella* was very large. A *Dentalium*, differing in no respect from *D. striolatum*, excepting in size, it being often nearly two inches long, was very abundant in from 1000 to 1500 fathoms. *Nucula reticulata*, *Cryptodon ferruginosus*, and several other species had their range extended as deep as 1500 fathoms. *Dolium bairdii* was obtained, and several specimens of a species which differs from *Dolium* only in the fact that it has an operculum, which would lead to the inference that it is a *Buccinum*. The Mollusca probably have more new species than any other group.

In several of the 200 to 400 fathom hauls, *Calliostoma bairdii* was taken. This species is remarkable from the fact that it is one of the few animals which, when taken from the cold bottom waters, will survive and flourish when placed in the aquarium. It is one of the few shells found in our deep water which has a truly tropical appearance. Many Annelids, mostly very minute, were taken at nearly every locality. It is probable that many will prove to be new. *Hyalinæcia artifex*, a worm which secretes a horny quill-like tube, was encountered in some of the shallowest dredgings.

Crustacea were represented by many new and interesting forms, especially of shrimps, including many very curious types. In 2300 fathoms we dredged a shrimp nearly a foot in length, and an Amphipod 3 inches long. Some very odd species of crabs, and hermits furnishing types for entirely new genera, were taken on several occasions. Colossendes, that gigantic Pycnogonid, was dredged many times, and several other large species were also

taken. One specimen measured over 2 feet from the end of one leg to the opposite extremity of the other. Notwithstanding this remarkable length of legs, the body was less than an inch long, and an eighth of an inch in breadth. To support this great length of legs, a branch of the stomach extends into the base of each leg. The fish were perhaps the most remarkable, in point of curious structure, aberrant forms, and marked specialisation. One, *Gastrostomus bairdii*, forms the basis of a new order, and is one of the most remarkable recently-described types of primitive anatomical structure, and, especially as regards the skull and branchial apparatus, it presents a remarkable phase of specialisation. Its nearest ally is a *Eurypharynx*, described by M. Vaillant. It is at present in the hands of Mr. John Ryder and Prof. Theodore Gill, the former studying the anatomy, the latter working out its systematic position. Together they propose to publish a complete monograph of the species. Another remarkable fish has no external traces of eyes. Most animals from the bottom have well developed eyes, although their use is unknown, for, unless some such light as phosphorescence is common, they must live in nearly absolute darkness. Some shrimps and a few other species have no eyes whatever. There are as many as fifteen new species of fish described from the *Albatross* summer collection, most of them belonging to new genera, while one or two families have been added. The field of deep-sea research is as yet just begun, and with what remarkable results. Hundreds of new animals, belonging to entirely new types, have helped to fill up gaps in the animal kingdom which had been left unfilled after a thorough examination of all the shallow waters. Such groups as Crinoids, for a long time supposed to be extinct, are now found quite abundantly and in considerable variety in certain localities. And when the whole ocean bottom has been examined as thoroughly as some portions of the North Atlantic, who can tell what curious forms may be found?

The collections obtained have been placed in the hands of the best American naturalists. Prof. L. A. Lee, of Bowdoin College, Maine, has the Foraminifera, Mr. Jas. E. Benedict and Prof. H. E. Webster the Annelids, Prof. S. I. Smith the Crustacea, who will work up the greater bulk, but will turn a few groups over to other naturalists. Mr. Sanderson Smith and Prof. H. E. Verrill will work up the Mollusca, Alexander Agassiz the more important Echini, and the rest of the Invertebrates will be studied by Prof. Verrill. It is not yet determined who will study the Sponges. The fishes are being worked up systematically by Prof. Theo. Gill, and Mr. Ryder is studying the anatomy of the more interesting forms.

RALPH S. TARR

AFRICAN SPIDERS¹

THE paper above noted forms Part III. of an important and interesting series upon the Arachnida of Africa, and was first published in *Annali del Museo Civico di Storia Naturale di Genova*, vol. xx. pp. 5-105. Its subject-matter comprises the collection of Arachnids formed by Count Orazio Antinori in the kingdom of Scioia in the years 1877-1882. Before entering upon the details of this paper it will be well to notice briefly the two preceding ones of the same series. Part I. (published in the same *Journal* in 1880) states that the object of the series is to bring together all the existing materials in the shape of papers and other works on African Arachnida and present them on one plan and method in accordance with the following five zoological provinces:—(1) *Mediterranean* (extending nearly to the Tropic of Cancer, and in-

¹ *Memoire della Società Geografica Italiana*, vol. ii. parte quarta, pp. 1-103 (Roma, 1883). Spedizione Italiana nell'Africa Equatoriale. Risultati Zoologici. IV. Aracnidi di Scioia, e considerazioni sull'Aracno-fauna d'Abissinia, per il Prof. P. Pavesti.