be added and will aid in showing how a group of peoples have taken advantage of geographic conditions to aid their social and economic development. Ethnology is but a branch of geography, and by the aid of small groups and actual material the different races or tribes of a country may be made to live again in the imagination. To the college of commerce these exhibits will also prove of value.

The foregoing relates only to the material exhibited in the public halls—the undergraduate side of the museum. But there is another side which must be considered by a strong university—the research or graduate side. Such an institution should accumulate in an accessible manner large series of groups of animals, plants, geological material, etc., for the use of graduate students and for working scientists, both among the faculty and in outside institutions. In this department valuable collections that have formed the basis for formal papers may be carefully preserved for future study. Such material should be cared for by installation in compact drawer cases contained in study rooms away from the museum halls. These collections provide the scientific standing of a university museum.

The question will naturally be asked, Whether the average college can do this? I think it can. Many colleges, of course, are handicapped by lack of funds, and to these the establishment of an adequate museum would be impossible. But there are many colleges and universities in which this department can be established, or, if already established, made stronger. In many cases, public-spirited citizens of wealth would gladly help such a movement if the college museum could be open to the general public and its collections made attractive. I believe that such an arrangement could be made that if the college provided the room, the business men of the town or city would be very willing to bear a large part of the expense of administration of such an enterprise.

I have been asked at different times to indicate the kind of man that is best suited to successfully administer such a department, especially in a college of moderate resources. A curator for this department should, of course, be a man of good education (not necessarily with a doctorate), but above all he should be capable of using both head and hands, with inventive ability, resourceful, and with a pleasing address, working easily in cooperation with other departments. A few such men are available from the ranks of the public museums, but many may have to be especially trained to become college curators.

The items of expense are usually objected to when the subject of a new department is suggested. This need not be great. A good salary for the curator, plus $2,000 per year for development, will accomplish wonders if the curator is of the right sort. Much may be done on less, and greater results will follow larger resources. It would seem possible to establish the kind of museum outlined above in all our larger universities with a relatively small expenditure of money. It is being done at Illinois, and also in some other state universities, and should be in others.

My experience of five years at the University of Illinois has shown conclusively that a modern working museum is a highly desirable part of a large university and that the methods in use in our great public museums are in the main applicable to the needs of the university museum. Most universities are far removed from the large city museum and can not enjoy their privileges. In a university situated as is the University of Illinois, in a small community far removed from the great metropolis, such a place as a museum becomes of wide significance, providing not only material aid for the curriculum but also a place for healthful recreation where the entire student body may go and unconsciously gain knowledge of the great world about them, much of which will be second in importance only to the regular courses they may be taking. It is my purpose at the University of Illinois to show that a natural history museum can be one of the most potent factors in general education.

FRANK COLLINS BAKER
NATURAL HISTORY MUSEUM,
UNIVERSITY OF ILLINOIS

AMPHIOXUS FISHERIES NEAR THE UNIVERSITY OF AMOY, CHINA

THIS note is to announce the discovery of an apparently inexhaustible supply of amphioxus near the University of Amoy. The ease with which these zoologically important little animals are to be obtained here should make them available in practically unlimited quantities for students of biology the world over. It has been my privilege recently to visit the village of Liuwutien,[1] about six miles from the University of Amoy, the source of livelihood of whose inhabitants is the amphioxus fisheries, to make a preliminary investigation of the methods employed in their capture and, as a fitting climax, to partake of a luncheon, several dishes of which consisted in main or in part of amphioxus.

The term fisheries as applied to the capture of amphioxus will no doubt seem strange to zoologists, not so much because amphioxus is not a fish as because of the impression we tend to gather that it has not been found, hitherto at least, in sufficient numbers

[1] Lakotiam in the local dialect.

to justify the use of the term, nor systematically taken for food or other economic purposes. We are most of us wont to see a few specimens at a time, carefully preserved from the rude hands of students. Or, if we have had the experience of dredging for them, as I did some ten years ago in the Philippine Islands, we remember the rejoicings over a few rare specimens obtained. In the present instance, however, because of the great numbers caught and their systematic capture for food purposes, it seems necessary, for lack of a better term, to speak of the industry as the amphioxus fisheries.

So far as I have been able to determine, the industry is as old as the village of Liuwutien, at least several hundred years old—so old that the mind of man runs not to the contrary. The amphioxus fisheries are confined, apparently, to a narrow strip of sea bottom less than a mile wide and extending for about six miles along the coast of the mainland of the Province of Fùkien, South China, immediately behind, *i.e.*, to the north of the Island of Amoy, on which is located the treaty port of the same name and the recently organized University of Amoy. This fishing ground is separated from the island by a narrow strait noted for its strong tidal currents which probably have something to do with making this particular stretch of sea bottom especially favorable for the life of amphioxus.

Here on this little strip of coast about 400 fishermen, using 200 small boats, are engaged for from two to four hours on the ebb tide of every calm day during the nine months from August to April of each year in dredging for amphioxus for the market. The catch per boat is said to average about 10 catties (13 1/3 pounds) a day, while double that amount is taken on especially favorable days. This means a catch of about 2,600 pounds, well over a ton for each calm day during the nine months of the fishing season and a total of hundreds of tons of amphioxus taken during the year!

The larger individuals average about three grains in weight. As a considerable number are under weight an estimate of 2,500 to the pound seems conservative. Counting the number of fishing days as 200 per year and the average daily catch per boat as 13 pounds we arrive at the astonishing total of 6,500,000 individuals in the average daily catch and 1,300,000,000 in the average annual catch. Making deductions for boats out of service, etc., we must conclude that on this little strip of Chinese coast somewhere around a billion amphioxi are caught and consumed each year. If we consider the inefficient and unsystematic method of fishing and the unfailing supply we are led to the conclusion that this strip of sea bottom must harbor many billions of the little animals.

The area to which we are told the amphioxi are limited extends out as far as two li, about 3/5 of a mile, and along the coast for about 20 li, approximately six miles. The actual area of sea bottom involved will be seen to be very considerable, in proportion to the part actually taken up in the dredging operations, particularly, since, so far as we know, the fishing is conducted in a very unsystematic manner, the boats working, much of the time, over more or less the same ground. When, in addition to these facts, we take it into consideration that there is never any failure to obtain the organisms in normal quantities we are forced to believe that the number actually taken is so negligible in proportion to the countless billions present as to make extremely improbable any danger of diminution of their numbers as a result of the industry as now conducted.

If, however, the local fishing rights are weakened and the number of fishermen increased, and more effective and systematic methods of fishing employed, as may well be the case in the future, the fact that gamete-laden amphioxi have such a gritty and unpleasantly fishy taste as to make them quite unpalatable during the spawning season of May, June and July may become an important factor in the preservation of the industry.

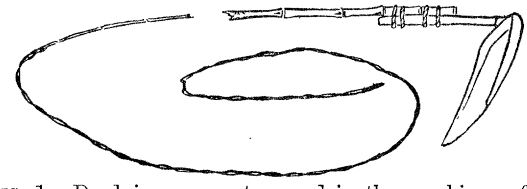

FIG. 1. Dredging apparatus used in the amphioxus fisheries at Amoy, China

The fishing methods and the apparatus used in the local capture of amphioxi while rather primitive are fairly effective. There are two men to each boat, one who sculls and one who manipulates the dredging apparatus. This consists of what appears to be a scoop-shovel blade attached at less than a right angle to a long bamboo (see Fig. 1). To the end of the bamboo is fastened a cable made by twining together two long rattans, to which is spliced another similar cable, the whole reaching a length of from 30 to 50 feet. The dredger stands in the bow of the boat and when fishing grounds are reached, usually in water from two to four fathoms in depth, the dredge is lowered with the blade downwards. When it is resting on the sand the boatman sculls the boat backward for a short distance to bury the blade in the sand. He then sends the boat slowly ahead while the dredger draws in the cable and passes it over the bow of the boat until the bamboo is reached or the apparatus is in a nearly vertical position when it is gently drawn upward and lifted out. The sand brought up on the

blade is dumped into the boat and the operation repeated until a considerable amount of sand containing amphioxi is obtained, when the boat puts for shore to separate the animals from the sand. This is accomplished in shallow water by means of deep, rounded baskets of split bamboo which are whirled about and shaken until most of the sand is washed out through the interstices. The remaining sand, with the amphioxi, is then removed to a much broader and very shallow basket where the final separation is accomplished by the continuation of the process until the animals can be floated off and the remaining coarse sand flipped over the edge.

The inhabitants of the region near the fisheries prize the amphioxus as a dainty. The people of other regions are more or less repelled by its unfamiliar appearance, and hence the greater part of the catch is consumed locally. Emigrants from the locality living in Malaysia purchase a considerable amount of the dried product. The fresh animals remain in an active condition for 12 hours or more after being removed from the water and are available for food for 24 hours or more. They are tender and wholesome and when fresh have a very palatable flavor. No ill effects of any kind are known to follow their use. The economic and social changes now in progress in China will almost certainly result in an increased demand for amphioxus for food purposes. Before any considerable increase in the extent of the industry will be possible the local fishing rights which at present make the industry a regional monopoly must be weakened and of course any such increase would be limited by the actual available supply of the animals which is problematical as yet but seems at least great enough to allow for a very material increase in the catch without appreciably diminishing the supply.

The dried product is prepared by heating the amphioxi after thorough washing in fresh water to drive out the excess salt water, after which they are roasted over a slow fire with a small amount of oil until dehydrated. In this form they are very palatable and keep for several months in the winter and a month or more during the summer. The fresh animals sell for 15 cents Mexican and the dried product for a dollar Mexican in the local markets.

The data given here were obtained for me on our trip of investigation by Dr. Lim Boon Keng, president of the University of Amoy, who kindly questioned the fishermen and other inhabitants and made translation of their answers. Numerous other interesting questions arise as to habits, habitat, structure, physiology and development of this species, some of which I hope to be able to answer in the future. Among these are the actual distribution of the amphioxus in depth and along the coast, and their food, the tidal currents and any other factors which explain their presence in such numbers in this one locality.

It may be of interest to relate here the curious belief of the local inhabitants to account for the presence of these organisms in such numbers at this spot and nowhere else. The name of the lancelet in Chinese is Wen Shen Yü,[2] which being literally translated means "fish of the God of literature" or more idiomatically, "literary composition fish." It is also called "silver spear fish"[3] from its color and its resemblance in shape to the Chinese spear blade and also "carrying pole fish" from its fancied resemblance to the carrying pole of this part of the world which is flattened and tapers towards both ends. The prevalent name, however, is the one first given, which is derived in the following curious manner. The God of Literature of Chinese mythology, named Wen Shen, who was supposed to aid the competitor in the civil service examinations in the classics, at present superseded but at one time all important in China, is supposed to ride about upon the back of a crocodile and is often so pictured. Now, as the story goes, the crocodile of Wen Shen died and the dead body washed ashore and is clearly to be seen only a short distance from the village of Liuwutien in the form of an island known as Crocodile Island,[4] some white rocks at one end of which may be conceived by a stretch of the imagination to be the snout, the wooded portion in the center, the body, and a long sand spit, exposed at low tide, the tail. From this, the carcass of Wen Shen's crocodile, issue the worms or maggots, the amphioxi. And since, forsooth, this is the only dead crocodile of the region there are of course no amphioxi found elsewhere. Lest this may appear to be the strained explanation of some of the local literati allow me to relate my experience with an ignorant boatman while attempting to obtain the animals by dredging just off the sandy beach in front of the University of Amoy, some six miles in a straight line, but more than twice that by water from the seat of the amphioxus fisheries. The boatman whose sampan we hired for the attempt was very curious as to what we were doing and when my Chinese collector explained he threw up his hands in disgust and could hardly be prevented from at once rowing to shore, saying in great contempt for our ignorance of a matter of such common knowledge, "There is no use wasting your time looking for that fish here since there is no crocodile here."

As to the systematic position of the species under consideration I am unable to make any final statement

[2] Wen Shen Yü, locally pronounced *Boon Shiong Hee.*

[3] Yin Chien Yü.

[4] Pien Tan Yü.

in the absence of the necessary literature. That it is a species of the genus *Branchiostoma* seems probable, since the gonads are paired and the metapleural folds meet symmetrically behind the atriopore. It differs from *Amphioxus lanceolatus* as described in the literature at present available to me in several particulars, most strikingly in the presence of somewhere near 25 pairs of oral tentacles or cirri (Fig. 2). Whether or not it is the *Branchiostoma belcheri* reported from Singapore to Japan I am unable to determine, having no description of that species at hand.[5]

I am sending specimens with this note to Professor E. G. Conklin, of Princeton University, with the request that he have it determined and if possible publish the name of the species with this note for the information of zoologists.

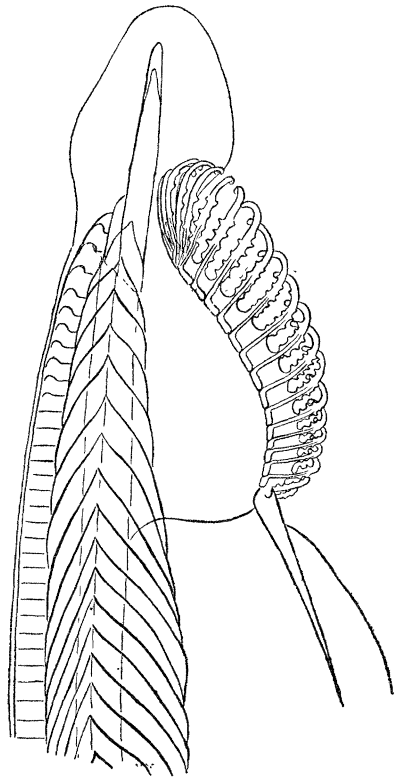

FIG. 2. Anterior portion of body of amphioxus from Amoy showing about 20 oral cirri of the right side, x Ca. 34

[5] Mr. J. T. Illick has examined some of the specimens sent me by Professor Light and finds that there are:

20 ± pairs of cirri

20 ± pairs of gonads (not well developed)

65 ± Myotomes of which 39 are anterior to the atriopore, 17 are between the atriopore and anus, and 9 are post-anal.

He concludes that this species is probably *B. nakagawae*, or *B. belcheri* and these may be identical. (See Cambridge Natural History, Vol. 7, p. 138.) A later note from Professor Light informs me that the species is probably a new one, which he is now engaged in describing—E. G. Conklin.

The outline drawing of the anterior end of one of the animals discussed in this note and the diagram of the dredging apparatus used in their capture were very kindly made for me by Mr. E. Larsen of the Chinese Postal Service, the former being a tracing from a detailed drawing he is making of the anterior region of a specimen slightly under an inch in length and the latter being a diagram from the apparatus as shown in several photographs which were taken for me on the fishing grounds by Professor H. H. Chung in charge of the department of botany in the University of Amoy.

S. F. LIGHT

PROFESSOR OF ZOOLOGY,
UNIVERSITY OF AMOY

SEVENTH YEAR OF THE TROPICAL RESEARCH STATION OF THE NEW YORK ZOOLOGICAL SOCIETY

THE Tropical Research Station of the New York Zoological Society was founded in January, 1916, after many conferences of Henry Fairfield Osborn, Theodore Roosevelt, Madison Grant and William Beebe. The site chosen was the district immediately around Bartica, British Guiana, in typical tropical rain forest, sixty-five miles from the coast and at an elevation of only twenty-five feet. The station itself is at Kartabo, at the point of junction of the Cuyuni and Mazaruni Rivers, where intensive research work has been carried on in a quarter of a square mile of jungle and shore.

Under the directorship of William Beebe, five expeditions have been made into this field. There have been thirty-two months of actual work, covering every season of the year. Research work at the station has been carried on by twenty-eight workers from America, England, Scotland and France, and two hundred and forty-six visitors have been entertained. One hundred and forty-one contributions have been published, including four bound volumes.

From the limited area under intensive research there have been collected notes, materials and specimens as follows: (1) Life history notes on 75 species of mammals, 451 species of birds, 108 species of reptiles and amphibians, 130 species of fishes; (2) nests and eggs of 152 species of birds, many new to science; (3) skins, skulls and skeletons of 56 species and 650 individual mammals; (4) 1,550 bird skins; (5) 110 bird embryos; (6) hundreds of reptiles, amphibians and fish; (7) 85,000 insects, of which one item is types of 50 new species of termites; (8) 4,500 other invertebrates; (9) 550 KOH specimens;