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# MALAYSIAN ESSAYS,

No. 1.

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# THE FISHERIES

OF THE

# ORIENTAL REGION.

BY THE REV. J. E. TENISON-WOODS,

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Plates iv, and v.

By the Oriental region is meant the seas within the tropics on both sides of the equator from the longitude of the Himalayas to the Yang-tse-kiang including the islands east of Wallace's line, at least as far as about the meridian of the Caroline Group, the Solomon Islands, the New Hebrides, and New Caledonia. With the exception that the east and west meridional boundaries are arbitrary, the region included forms more or less a true zoological marine province and corresponds nearly with Dr. Günther's Indian region. It may also be called the Malaysian region, for the greater portion of the land included in it, with the exception of North Australia, is inhabited by Malay races.

In dealing with the fisheries of this region, however, it is not so much with Malay as with Chinese fishermen that we have to do. All that is interesting and all that is systematic throughout the province is accomplished by Chinese immigrants who have scattered themselves far and wide on these coasts. It is true to say that in Malaysia the Malay races confine their fishing with few exceptions to their own wants, while the fishing operations of the Chinese are for the purposes of trade and commerce. Few who are not intimately acquainted with the Chinese character can appreciate their extraordinary aptitude for business and trade, and a slight experience of the conditions of life in Malaysia readily explains why fishing absorbs so much of the labour of the coolies who settle on the coast. It scarcely requires explanation, but a few words on the subject will be of interest.

It is supposed that a tenth part of the population of China derives support from fisheries. To use the words of the editor of the *Technologist*. "Hundreds and thousands of boats crowd the whole coast, sometimes acting in community, sometimes independent and isolated. There is no species of craft by which a fish can be inveigled which is not practised with success in China. Every variety of net from vast seines embracing miles, to the smallest hand-filet in the care of a child. Fishing by night and fishing by day; fishing in moonlight, by torchlight and in utter darkness; fishing in boats of all sizes, fishing by those who are stationary on the rock by the sea-side, and by those who are absent for weeks on the wildest of seas; fishing by cormorants; fishing by divers; fishing with lines, with baskets—by every imaginable decoy and device. There is no river which is not staked to assist the fisherman in his craft. There is no lake, no pond which is not crowded with fish. A piece of water is nearly as valuable as a field of fertile land. At daybreak every city is crowded with sellers of live fish, who carry their commodity in buckets of water, saving all they do not sell to be returned to the pond or kept for another day's service."

The obvious reason for all this is, that with the exception of rice there is nothing that enters so largely into the domestic economy of the Chinese as fish; very nearly as much but not quite so extensively as with the Japanese, for until lately, the latter ate no meat at all, while the Chinese considerably supplement their fish food with pork, at least, if not with other meats.

Several circumstances combine to make China a great fishing country. The coast line is long and tortuous, besides having an extensive archipelago of islands. It has a magnificent river system with such a network of small tributary streams that no country can be said to be better watered. These natural advantages have been largely aided by systems of canals or channels of communication which water the vast plains in all directions.

Just as the insular situation of Great Britain has made its people bold sailors and given them dominion over the sea, so the physical character of China has made the people essentially fishers, and spread them over the east to teach nations that industry. For it is Chinese fishermen we meet everywhere in the east, and they are the only men who ply the trade in North Australia. The fishermen supplying the markets of the Straits Settlements are principally Chinese. In nautical skill the Chinese fishermen in the Straits Settlements are far behind the Malays. Although originally a sturdy race their morals and frames are deteriorated by gambling and opium. Their trade exposes them, in those latitudes at least, to little hardship, and their leisure, which is considerable, is spent idly if not viciously. The consequence is that though Chinese immigrants are gladly welcomed in general in the Straits Settlements, the fishermen are ever looked upon with suspicion. They congregate in lonely little spots along the least inhabited parts of the coast of all the Malayan region, and in such places they are ready for anything. Piracy, robbery, murder,—nothing comes amiss. During my stay at Thaiping it became necessary for the Government of Perak to burn down one of the fishing villages between Port Weld and Penang, which had become a kind of piratical hornet's nest. I am sorry to say that I could give many other illustrations of the desperate and lawless character of this class.

The fishmongers of the East are also natives of China, but they are a class far superior to the fishermen. At all the fish markets that I have visited in certain places, namely :—in Singapore, Malacca, Thaiping, Penang, Saigon, Sulu, Menado (Celebes), Amboyna, &c., the fishmongers were Chinese. In Java it is not so for this simple reason : each nationality is confined to its own quarter and has its own market.

To deal with the Chinese fisheries in the East, for they are mainly Chinese, is a subject whose aspects are rather complex. Let us begin with the trade in the Indian Archipelago. The

coasts of the Straits of Malacca, whether on the Sumatran or Malayan sides, are extremely low and shallow. Large mangrove swamps with innumerable shallow streams fringe the shores. Vessels of even moderate draught must anchor a long way out. Sometimes, where the coast is scarcely visible, one meets a succession of bamboo fences, which are fishing stakes or fish traps of clumsy construction. They are closely woven labyrinths in which the fishes get entangled when the tide is in, and remain until the men come to make them captive. The fishing boats, of frail construction, vary from one to three tons burden. They are pulled by oars, and seldom carry sails, so that they do not venture far from shore. The nets are made of twine tanned with mangrove bark. The meshes are not constructed as in Europe, being knotted in a different way, with a fastening that slips and often allows fish to escape. The fishing stakes require very little trouble, and contribute largely to the take. They answer well enough in fine weather, and there is seldom anything else in the Straits of Malacca. The traps are neither ingenious nor durable, but the sea is rich in fish, and they are well sheltered. They form a conspicuous feature all through the Archipelago where the coast is shallow.

The fish trade comprises the following branches, viz. :—(1) fresh fish ; (2) dried fish ; (3) isinglass (fish-maws) ; (4) fish-roe ; (5 and 6) red fish and “sardines ;” (7) sharks’ fins ; (8) baláchan ; (9) fish manure ; (10) tripang, or *bêche-de-mer*. A short description of each of these divisions will be given.

**FRESH FISH.**—The fish fauna of the Archipelago, including the marine and river species, amounts to about 400. This would make it about one-third less than some of the richest fish faunas in the world. The fishes of the Archipelago have received a considerable amount of attention, especially on the Indian and Malayan sides ; but it may be doubted whether there are not a good many additional species yet to be described. It will be understood, therefore, that the above estimate is only approximate. No separation has been made between marine and fresh-



water fishes. In this matter it is hard to draw a reliable distinction. Many freshwater fishes come down to the sea, and many sea-fishes go hundreds of miles up freshwater rivers. However, the general habits of the two kinds require separate treatment. The fishes of the Indian Archipelago belong to what is called the equatorial region. The tropical Atlantic and Indo-Pacific regions are described separately, though the differences between them are neither numerous nor important. The majority of the principal types are found in both, and many of the species are identical. Dr. Günther (from whose essay on *The Study of Fishes* this summary is mainly taken) says that species are far more abundant in the Indo-Pacific region than in the Atlantic. Owing to the innumerable islands, the varying configuration of the coasts, the different nature of the sea-bottom, the long peninsulas, and the archipelagos, this part of the globe is rendered the most perfect for the development of fish life. It is not generally known that the fishes of the Indian and Pacific Oceans between the tropics are almost identical. Moreover, there is a very great number of species which range from the Red Sea and east coast of Africa to Polynesia. This Indo-Pacific fauna, however, does not extend to the Pacific coast of South America.

It would be tedious to go into much detail about the special characters of this region, but a few general conclusions will be of interest. Some 80 genera of shore-fishes are found in the Indo-Pacific region only, but these genera have with some exceptions only a few species. The sea-perches, of which our own *Serranus* or rock-cod is an example, are among the special types, though not confined to the region. They feed on small crustaceans and little fishes. Next follow the coral-feeding Pharyngognaths, which are most numerous in the Indo-Pacific region. They feed chiefly on small marine animals, and such as have compressed teeth appear to eat the crustaceans covering the banks round which these coral-fishes abound. Next follow the Squamipinnes, so-called because the soft and frequently spinous parts of their dorsal and anal fins are so thickly covered with scales that the boundary

between fins and body is entirely obliterated. They are mainly tropical and mostly found near coral reefs. The beauty and brilliancy of the colors of the *Chaetodons*, *Heniochus*, and *Holocanthus* can never be forgotten by those who have once seen the glories of the deep. Such startling contrasts of the brightest colors, vermilion, carmine, shades of blue, orange, and the finest green meet one on every side, exciting one's admiration as much as the bright glories of the feathered tribes in these regions, forming a fitting accompaniment to the indescribable splendours of a coral reef. Their odd forms are also especially exceptional. They are small, and comparatively few are used as food. They feed on small invertebrates, and are rarely found in brackish water.

Next come the Murænidæ or Sea-eels, with long scaleless, snake-like bodies, and wide slits for gill openings. Then follow the Clupeidæ or Herrings, which are regular denizens of this region, and include some splendid food fishes, highly valued for their very delicate flavour. They include Herrings, Sardines, Anchovies, and the *Chanos salmonesus*, a fish valued as much as the salmon. Equalling these in number are the Carangidæ or Horse-mackerels, easily distinguished by the plate-like scales of the lateral line. Our own Yellow-tail in Sydney is an instance of this. The Horse-mackerels are favourite articles of food in the east, and one sees them in all the markets. I think they are the cheapest kind of fish. About 13 species of *Caranx* are known in the markets of Penang. They are at best but poor table fishes. Then follow the Scorpænidæ, a family distinguished by the spines and armature about the head and fins, with skinny appendages resembling the fronds of sea-weeds, which give to them a very formidable and ugly appearance. Generally their colour assimilates to their surroundings, that is an irregular mottling of red, yellow, brown or black. They are commonly small and ugly, with prominent ghost-like eyes, set in large, hollow, lantern-like sockets. They are esteemed as food by some. Wounds inflicted by their spines are exceedingly painful, probably from a poisonous mucus, but they are not followed by serious consequences.

Following these in importance are the Pleuronectidæ or flat-fishes, including the Soles and Plaice. They are pretty numerous, but do not seem in that region to include any highly esteemed food-fishes. Almost equal in importance are the Acronuridæ, inhabitants of tropical seas, and most abundant on coral reefs. This family includes the "Surgeons," so-called from the sharp lancet-shaped spine with which the tail is armed, which they use as a very dangerous weapon. They are brightly coloured and esteemed as food. The Sciaenidæ family, which in Europe includes the "Meagre" and many others of large size, almost all of which are eaten, contributes a large contingent to the fauna of the region. Also the Sygnathidæ or pipe-fishes which are no use as food at all. The Teuthididæ, which include 30 species, all from the Indo-Pacific region, amongst which is the Australian black and white "Trevally," are well-known fish in the east, with venomous spines. All the species are supposed by the Malays of the Straits to be highly poisonous; they are not eaten but are set aside amongst offal of fish to be used as manure.

The above list includes all the families characteristic of the region, but generic distinctions give no idea of the relative proportions of the number of individuals. Those fishes which frequent the seas in large shoals such as the Herring, Mackerel, and Anchovy, are far more commonly seen in the markets, and are abundantly consumed amongst the people. There are tunnies of large size, which seem favourite articles of food, called Tangiri pappan by the Malays (*Cybium guttatum*, Bloch & Schn.). It attains considerable length, and, together with *C. lineolatum*, Cuv., and *C. commersonii*, Lacep., is cut up and sold piecemeal amongst the poorer inhabitants. I do not remember ever seeing a fish market in which tunnies and other members of the mackerel family were not the principal fishes offered for sale. They do not keep well in the climate, but if they are slightly turned this is a recommendation to both Malays and Chinese. The fish mostly consumed by Europeans is the Pomfret, of which there are three species, namely :—*Stromateus niger*, *S. sinensis*,

and *S. cinereus*. The first is the black Pomfret or Bawal-tumbak of the Malays. It is taken in abundance in the Straits of Malacca at all seasons. It is broad and something like a flat-fish, and in the dried state is largely exported. It is considered inferior to *S. sinensis* or the white Pomfret, the "Pample blanche" of Pondicherry, and Bawal-chirmin of the Malays. Renowned for its flavour, it must be eaten fresh; abundant from the Coromandel coast to Hong Kong. *Stromateus cinereus*, Bloch, is a smaller species, and so is *S. argenteus*, Bloch; both of good flavour and equally abundant.

The markets of the Straits Settlements and Archipelago do not usually contain as varied an assortment of marine food as one sees in the markets of China and Japan. But all kinds of fish-food may be said to be eaten, not excepting the little hopping-fish, *Periophthalmus koelreuteri*, Pallas, the Ikan lesah (restless fish) of the Malays. These are little blackish-olive fish, which occur in great numbers in the muddy mangrove swamps and streams. On approaching the water they may be seen making a series of rapid leaps along the surface and on to wet ground. Being true gobies they have strong pectoral and ventral fins by means of which they are able to adhere to the rocks. As far as my observation goes, they never remain in the water. In the Philippines I have seen them clinging round the rocks just at the water's edge, and on the approach of danger hop along the water to some other rock. Their eyes are very prominent, and can be moved independently of one another. Great numbers of them may be seen in the ditches round the fortifications in the Peninsula. It is not considered wholesome food, and is consumed only by the poorest classes.

I have already observed that it is difficult to make an absolute distinction between the marine and freshwater fishes, but still there are certain general differences which may be noted. The two principal families of freshwater fishes are the carps and the cat-fishes or sheat-fishes (Cyprinidæ and Siluridæ). The carps form

a third of all the freshwater fishes known, and the cat-fishes one-fourth. Carps seem to have spread all over the world, except Australia, South America, and the Pacific Islands. Many naturalists believe that they have spread from the Alpine region dividing temperate and tropical Asia.

The Siluroids being fond of warm, muddy, and sluggish waters, are, moreover, able to remain buried in the mud for long periods with little or no water. They are in Australia and South America, and in the Sandwich Islands, though not in the coral islands of the Pacific. A few species are found in the temperate parts of Europe, Asia, and North America, but not in Tasmania, New Zealand, or Patagonia. They are especially characteristic of the equatorial region.

The equatorial zone for the marine fishes extends about 30 degrees on each side of the line, reaching even further south on the eastern and western Australian coast. The boundary of the freshwater fishes differs much from this. It extends in undulating lines several degrees north and south. In Africa the Sahara forms a well-marked boundary. "The line, as it approaches the Nile," says Dr. Günther, "makes a sudden sweep towards the north as far as northern Syria," including some characteristic species near Aleppo and in the Tigris, as also well-marked Siluroid genera in the Sea of Galilee. It crosses through Persia and Afghanistan to the southern ranges of the Himalayas, and follows the course of the Yang-tse-kiang, which receives its contingent of equatorial fishes through the southern tributaries.

The equatorial zone is divided into the *Cyprinoid* or carp division, and that region from which carps are absent. It is in the carp division that the Malayan Peninsula is included with all the Indian region. This region is characterised by Ophiocephalidæ and Mastacembelidæ. The Ophiocephalidæ have a long body, covered with scales of moderate size; no spine in any of the fins, and the dorsal and anal fins long. These fishes though belonging to the Indian region, have one or two representatives in Africa.

In the Malayan rivers the species are particularly abundant, and some attain a length of two feet. Though not belonging to the Siluroids, they are able to survive long droughts by lying in semi-fluid mud ; "or in a torpid state below the hard baked crusts of the bottom of a tank, from which every drop of water has disappeared." They are so truly important in the Indian region that some length of detail in their description may be permitted.

The curious name given to these fishes by Bloch is obviously from their resemblance, in the head at least, to serpents. The body is almost cylindrical anteriorly, with a depressed head, having plate-like scales above. Cuvier remarked that if it were possible to admit such anomalous beings in nature, these strange fishes might be justly considered half fish and half serpents. Having hollow cavities in their heads and means for respiring air, they can live long out of the water and even travel over the ground, especially when it is moist. It is no uncommon sight in India and in China to see them called upon by jugglers and children to exhibit their skill in crawling. This they do in a serpentine manner, using their pectoral and caudal fins alternately like feet. They easily escape from aquaria unless the top is covered.\*

The Malays call these Snakeheads Ikan-haruan ; the Chinese call them Shang-yu, and carry them alive in pails of water, cutting slices from them as they are sold ; a process which I have seen in many parts of China, practised on various kinds of fishes. They breed in grassy swamps or the edges of tanks, in well-walls and holes in river banks. One is said to build a nest among the vegetation near the edges of tanks, using its tail in building, and biting off the ends of the weeds. The male fish keeps guard over the ova, and the fry are nursed until old enough to get their own living. If they don't clear out then, they are sometimes remorselessly eaten. The young, as a rule, are more or less orange or scarlet, with longitudinal bands which disappear as they grow older.

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\* For information about the habits of these fishes the author is indebted to Cantor, Günther, Bleeker, and Day.

Those living in brackish water have a purplish tinge. They are all good eating. I remember buying one from a native who had just captured it in the Salama river. It weighed about seven pounds, and made an excellent curry that evening as we camped on the river banks. Mr. Francis Day says they are well adapted for pisciculture, as they thrive in almost any situation, being voracious and omnivorous. He carried one in a wet handkerchief on a journey of four hours, ascending 1000 feet, and it did not seem the worse for it. He thinks they prefer dirty to clean water. He says, "they are rather voracious, but appear to consider a frog, a mouse or a rat, as luscious a morsel as a fellow fish. When they have stirred up all the sediment and exuded a quantity of mucus they appear to be delighted, their colors become much more vivid, and they ascend to their favourite resort, lying amongst the vegetation just beneath the surface of the water. As soon as clean water is given them they become excited as if they imagined the time had arrived when they should change their abode."

"Amongst the fish which I have personally seen exhumed from the mud, where a tank had been dried up, are some Ophiocephali, whilst they are also the fish recorded by the natives of India as descending with the downpours of rain."\*

How these fishes manage to subsist so long out of the water I shall refer to subsequently. Let me now mention the second family which is characteristic of the Indian region of the equatorial zone. This is Mastacembelidæ, a family which, to my mind, has far more title to the name of snake-fishes. They have long eel-like bodies, having a less repulsive appearance than *Muræna*, and rendered especially eel-like by a soft dorsal and anal fin at the tail only, and very small scales. The structure of the mouth and of the branchial apparatus, the separation of the humeral arch from the skull, the absence of ventral fins, the anatomy of the abdominal organs, afford ample evidence that these fishes are Acanthopterygian eels (Günther).

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\* Day, Fishes of India, Vol. I., p. 362.

Another peculiarity in the appearance of these fishes, is that they have a long, fleshy, pointed snout. On the structure of this snout depends the classification. It may be said to terminate in a pointed movable appendage, which is concave and transversely striated below in *Rhynchobdella*, and without the transverse striæ in *Mastacembelus*. There are only two genera in the family; in all 13 species. In the Perak river I have caught specimens of *Rhynchobdella aculeata* about 18 inches long. They are esteemed as the best of the eel-kind amongst fishes. Mr. Day says it is found in brackish waters within tidal influence, and throughout the deltas of large rivers, extending to Borneo and the Moluccas. It conceals itself in the mud, but dies if it cannot breathe air. In the Thaipung Museum, Perak, there is a kindred species which was found in the stomach of a snake very little bigger than itself.

Another characteristic of the Indian region is the number of Cobitidæ or Loaches, represented in such genera as *Lepidocephalichthys*, with eight or more barbels, a short dorsal fin and scales on the head; *Acanthopsis*, *Acanthopthalmus*, *Apua*, &c. All the species are edible, and I think are called "Balut" by the Malays, though probably the same name is applied by some to the *Mastacembelus* just described. I need hardly go more into detail to describe the Loaches, which are well-known from their peculiar bearded mouths, with scales minute or absent, and dull colours, with blotches and stains sometimes irregular and sometimes in fanciful patterns.

The Indian fresh-water fish region, according to Günther, comprises the whole continent of Asia south of the Himalayas and the Yang-tse-kiang. It includes Sumatra, Java, Borneo and Bali, with adjacent small islands. Borneo has a good many Cyprinoids, and, as far as my investigations go, they are more numerous in the Philippine Islands than Günther seems to think. According to the same authority, the region has received very little from outside its own limits. Formosa, though off the south coast of Asia and partly within the tropics, has a mixed fish fauna, as far as it is known, which is imperfectly. It includes a



Japanese salmonoid named *Plecoglossus*, which, however, is a very aberrant type.

The actual boundary of the Indian fresh-water fish region is difficult to define in South China, but the tributaries of the Yang-tse-kiang carry some of its species considerably north of the tropical line. Much, however, of the uncertainty as to the limits of genera and species, is owing to the little knowledge we possess of the countries through which the northern tropical line passes. Any conclusions that are formed now must only be considered provisional and subject to considerable modification.

Dr. Günther supposed that the fresh waters of Persia have been converted into brine and finally dried up by geological changes. Before this the streams were inhabited by many Indian forms, of which a few survive between Afghanistan and Syria. *Ophiocephalus* and *Discognathus* (Carp) have one representative each: *Macrones* (Siluroid) survives in the Tigris: *Mastacembelus* at Aleppo. Thus, he adds, Indian fresh-water fishes, with those of Africa and Europe, mingle in a district which connects the three continents.

There are thirty-nine families of fresh-water fishes known, of which twelve are represented in the Indian region. They number 625 species or two-sevenths of the known fresh-water fishes. Of these about 200 are Siluroids, and over 300 Carps. The preponderance of these two families is the speciality of the Indian region. There are no known Ganoid or Cyclostomous fishes, though they are present in every other region. We have, however, an *Osteoglossum*, one of the many families of the immense order of **PHYSOSTOMI**. *Osteoglossum* is a remarkable-looking fish; the body is covered with large hard scales, composed of pieces like tessellated armour: head scaleless, the skin being entirely replaced by bone: lateral line composed of wide openings of the mucous duct; dorsal fin on the tail opposite to the anal fin and very similar to it—both confluent with the rounded anal: mouth oblique, wide: lower jaw prominent, with a pair of barbels: pectoral fins long. The general appearance at first sight reminds

one of a ganoid fish. There are only three species known: *O. bicirrhosum* from the Brazils; *O. formosum* from Borneo, Sumatra, and the Malay Peninsula; *O. leichhardti* from north and east Australia. From the fact that this fish is found associated with Sirenidae in every place except the Indian region, Dr. Günther concludes that a Dipnoous form will be found there too.

During my stay in the Malay Peninsula, I made several collections of fishes, but was not always fortunate in bringing them in a good state of preservation to Australia. Most of the fishes were obtained by purchase either directly from the Malays in their fishing boats or in the markets. A few were obtained by fishing with dynamite in some tributary streams of the Perak, such as the Kenas, and some of the mountain streams. The following is the list:—

#### ACANTHOPTERYGII PERCIFORMES.

##### *Fam.* SCORPÆNIDÆ.

CENTROPOGON (INDICUS ?), Day. In the brackish waters of the river Perak, where it was much feared by the natives on account of the spines about its head.

#### ACANTHOPTERYGII BLENNIIFORMES.

##### *Fam.* MASTACEMBELIDÆ.

MASTACEMBELUS UNICOLOR, Cuv. and Val. Perak river near Kuala Kangsa. Though named *unicolor*, it is brownish and has three or four rows of yellow spots or blotches along the sides. The vertical fins have also a yellowish margin.

MASTACEMBELUS ARMATUS, Lacep. Known as the thorny-backed eel amongst Europeans in India. Malay name Ikan-belida.

#### ACANTHOPTERYGII CHANNIFORMES.

##### *Fam.* OPHIOCEPHALIDÆ.

OPHIOCEPHALUS MICROPELTES, Cuv. and Val. Salama river, also the Kinta. This fish attains three feet in length, and is found on the Malabar and western coasts of India, Siam and the Malay

Archipelago. Its colors vary considerably. Old fish are greyish-brown; but young ones, a foot or so in length, are orange-scarlet, with black bands. The scales are roughened in lines which along the body are arched.

*OPHIOCEPHALUS PUNCTATUS*, Bloch. Malay name Toman. It does not attain to such a size as the last, has much coarser scales, especially about the head, where they are large and irregular. The Europeans call it the black caboose. It prefers stagnant waters.

*CHANNA ORIENTALIS*, Gronov. Malay name Ikan-aroam or Seam. Perak River.

## ACANTHOPTERYGII LABYRINTHIBRANCHII.

### *Fam.* LABYRINTHICI.

*OSPHROMENUS OLFAx*, Commerson. This is the celebrated Gourami, which is also known as the Ikan-kalu amongst the Malays. Reputed amongst gourmets as one of the best flavoured fishes of the East: of clumsy form, becoming as large as a turbot. It is easily kept in captivity, and will live on fish, flesh, insects, and certain flowers. Many of the rich Chinese Towkays in Penang, Malacca, and Singapore keep these fishes in tanks, wells, or large earthenware baths, and they are used on special occasions at banquets. They become so tame as readily to come when called by their feeder, and will rise to flies, beetles, but especially the large red *Hibiscus rosa-sinensis*. When at Selangore with Sir C. Clementi-Smith, the "Capt. China" sent the governor one of these fishes in a large tank, so that it might not be killed until just before cooking. This was a civility which we received also in other places. The name is derived from *οσφρησις*, nostrils, and *μηνη*, crescent, alluding to its peculiar smelling organs or *ὀσφρόμενος*, tracking by smell, which is again repeated in the name *olfax*. It is distinguished by its broadly oval shape, short dorsal fin, complicated labyrinthiform supra-branchial organ, and the very elongated filamentous first ray of the ventral fins.

*BETTA PUGNAX*, Cantor. This is the "Pla Kat" or fighting-fish of the Siamese, which is very common in all the fresh waters

of the Malay Peninsula. It is a very pretty little fish, olive above and deep blood-red below, with black bands from the head, and black edges to the scales. Head scaly and depressed, back slightly arched. Cantor says of this fish: "When it is in a state of quiet, with the fins at rest, the dull colours present nothing remarkable. But if two are brought within sight of each other, or if one sees its own image in a looking-glass, the little creature becomes suddenly excited, the raised fins and the whole body shine with metallic colours of dazzling beauty, while the projected gill membrane, waving like a black frill round the throat, adds something grotesque to the general appearance. In this state it makes repeated darts at its real or reflected antagonist. But both, when taken out of each other's sight, instantly become quiet. The description was drawn up in 1840 at Singapore, where a gentleman had been presented with several by the King of Siam. They were kept singly in glasses of water, fed with larvas of mosquitoes, and had thus lived for many months. The Siamese are as infatuated with the combats of these fishes as the Malays are with their cock-fights, and stake considerable sums, and sometimes their own persons and their families, on the issue. The license of exhibiting fish-fights is farmed, and affords a considerable annual revenue to the King of Siam." Cantor, "Catal. Malayan Fishes," p. 87.

*Ord.* PHYSOSTOMI—*Fam.* SILURIDÆ OR CAT-FISHES.

Mud fishes with naked skins or with osseous scutes, but without scales, barbels always present; air bladder generally present; communicating with the organ of hearing. All these fishes are furnished with formidable spines about the head, which give such venomous wounds that loss of limb or life sometimes results.

CLARIAS MAGUR, Bl. Ikan-keeba of the Malays. Common in fresh and brackish water, and attaining at least a foot and a half in length. It is said to be amphibious and will live long after its removal from water. The pectoral fin has a serrated spine, but covered with skin.

*SILUNDIA SYKESII*, Day. Ikan-batu in Malay. Long maxillary barbels, depressed and flattened form. I don't know whether this fish has been recorded previously from the Malay Peninsula, but it is not uncommon.

*SACCOBRANCHUS FOSSILIS*, Bloch, = *SILURUS FOSSILIS*, Bloch; Bl. Schn.; Swainson. Common in all the freshwater rivers from Scinde to China. Mr. Day says (*Fishes of India*, Vol. I., p. 487) wounds from the pectoral spine of this fish are dreaded in India as they are reported to be very venomous, even causing lockjaw. When captured the spine is broken off by blows with a stake. The fishermen dread it so much that they often cut the meshes of their net and allow it to escape. It is esteemed as food and considered invigorating, so tanks are stocked with them in the rainy season. They are easily fattened, quantity rather than quality of food being only requisite.

*MACRONES JULIO*, Ham. Buch. Called by the Anamites Ka-chuoc, and by the Malays Ikan-engior. Found in estuaries and rivers as far as the tides extend throughout the Indian Ocean, Archipelago and South China. Also common at Hué and Saigon, in fresh and salt water. Lurid, bluish-brown on back with red carmine fins, and eight barbels.

*LIOCASSIS POECILOPTERUS*, Günth.

*ARIUS CÆLATUS*, Cuv. and Val. Malay name Ikan-doonee or Saludu. A widespread species found in the mouths of rivers even beyond tidal influence throughout the Indian seas, that is from Bombay to the Malay Archipelago. It attains to a considerable size. It is of a bluish-black color above, white beneath, with a little yellow on the margins of some of the fins. I believe I have seen this species in some freshwater rivers, or on the coast in the Philippines.

*CALLICHOUS BIMACULATUS*, Bloch. Termed Butter-fish by Europeans in Bengal. The Hindoos call it Puff-ta. Extends through the fresh waters of India, Malaysia, and South China. The Anamites name it Ka-leo-muông. Malay name Ikan-keeba,

but I am doubtful of the application of this term. This species is very common.

*Fam.* CYPRINIDÆ OR CARPS.

The Carp family is so numerous in the fresh waters of Europe, Asia, and North America, that even the genera require to be subdivided into groups. There are none in Australia, but they are well represented in the Indian region. The first group is CATOSTOMINA or Suckers, best represented in North America, though two are known in eastern Asia. The second group, CYPRININA, includes most of the Indian fishes.

LABEO NANDINA, Ham. Buch.

LABEO FIMBRIATUS, Bloch. Attains a foot and a half in length and is good eating.

BARBUS BURMANICUS, Day. Called by the Malays Temengalan.

BARBUS TOR, Ham. Buch. Malay name Temoleh. This fish is the celebrated Maha-seer of sportsmen in India. It shows great variation in the length of the head, which augments in proportion to the size of the fish. They are largest and of greatest abundance in mountain streams, which are rocky (Day). To my mind it is a poor, tasteless fish, almost uneatable from the number of bones.

BARBUS NEILLI, Day. Malay name Kereh. Day states that he has seen a specimen of this fish 38lbs. in weight, but it is said to reach 50 and 60lbs.

BARBUS STRACHEYI, Day. = BARBUS MALABARICUS, Day. Named after General Strachey. Malay name Klah.

BARBUS HEXASTICHUS, McClelland. Malay name Sebarin. Grows to three feet in length.

BARBUS JERDONI, Day.

BARBUS APOGON (Kuhl) Cuv. and Val. A small species, widespread through Burmah and the Malay Peninsula. Malay name Tempras.

BARBUS KOLUS, Sykes. Malay name Ikan-klah.

THYNNICHTHYS SANDKHOL, Sykes, Trans. Zool. Soc. II., p. 363.

DANGILA BURMANICA, Day. Malay name Ikan-kawan.

OSTEOCHILUS CHALYBEATUS, Cuv. and Val.

BARILIUS GUTTATUS, Day. Malay name Ikan-seluang. This genus belongs to a different subdivision of the carps.

#### *Fam.* CLUPEIDÆ OR HERRINGS.

ENGRAULIS SETIROSTRIS, Brouss. This is a little silvery anchovy with a golden yellow caudal fin. It extends from the Indian Ocean to south China. Named at Saigon Ka-la-tre by Anamite fishermen.

ENGRAULIS MYSTAX, Bloch. Silvery with greenish back. Caudal fin bordered with black, and a large striated black spot behind the operculum. At Penang and Singapore specimens about eight inches long are seen all the year round in the markets.

ENGRAULIS COMMERSONIANUS, Lacep. The well-known and highly esteemed Ikan-merah or red-fish of the Malays. It is known as white-bait amongst Indo-Europeans, and is captured in the Indian seas in great numbers. Day says it attains to eight inches in length, but I have never been able to obtain one more than half that size.

ENGRAULIS INDICUS, Hasselt. This fish is united with the preceding by Cantor as one species; but the red-fish is silvery, greenish above, a large black spot, sometimes indistinct, just behind the occiput, with a broad silvery band along the sides from the gills to the tail. *E. indicus* has very much the same colors, and is in fact difficult to distinguish; but the snout projects more, and the maxilla is truncated opposite the mandibular joint, while in the true red-fish it reaches the gill-opening.

CLUPEA BRACHYSOMA, Bleeker, = KOWALA THORACATA, Cantor, = ALOSA KOWAL, Günther. This fish is the species described by Cantor, says Mr. Day, and is known from the east coast of Africa through the seas of India, the Archipelago and south China.

*CLUPEA ILISHA*, Russell, = *ALAUSA PALASAH* of Cantor. In Malay *Trubu*. Cantor gives a long account of the preparation of the species, which will be referred to presently. It is called Sable-fish and *Hilsa* by Europeans. It is a silvery fish shot with gold and purple, no spots on the adult, but a row of them on the young, most distinct near the gills. Shoals of these fish swarm up the lower rivers as soon as the monsoon commences, especially those in which the current is not rapid. In the Philippines they are largely caught at this time, but Mr. Day says that great injury is done to these fisheries in India by the weirs without passes for the fishes to get to their spawning ground. He says they continue ascending the rivers for four months though in smaller quantities. In the Malay Peninsula the seasons seem to correspond with those of India.

*COILIA BORNEENSIS*, Bleeker. *Kalanh-kanh* of Anamite fishermen. A golden anchovy with yellow fins; pectoral fin with twelve free rays extending half way down the elongated, compressed, and tapering body. This species is very wide-spread in India, Cochin-China, and the Malay Archipelago.

The above list includes only those which came under my own observation and the number of course might be very much extended. No complete census, I believe, has yet been made of the fishes of the Archipelago or the Straits of Malacca, the latter of which would be of more interest to those enquiring into the true characters of the Malayan region. The following families are peculiar to the fresh waters of the Indian region.

*LUCIOCEPHALIDÆ*, 1 species.

*OPHIOCEPHALIDÆ*, 30 species (1 in Africa).

*MASTACEMBELIDÆ*, 10 species (3 in Africa).

Amongst the *SILURIDÆ* the following sub-divisions are restricted to the same region :—

*CHACINA*, with 3 species.

*BAGARIINA*, 20 species.



The following sub-divisions though not restricted to the Indian region, are largely represented there, as the following figures will show :—

CLARIINA, 12 species.

SILURINA, 72 species.

BAGRINA, 50 species.

ARIINA, 40 species.

Of carps, there are 190 species belonging to the sub-division CYPRIINA, while DANIONINA and ABRAMIDINA (breams), have each 30 species.

The sub-divisions peculiar to the region are RASBORINA (20 species), SEMIPLUTINA (4 species), HOMALOPTERINA (10 species). The Indian region also has 50 species of loaches. These, with a few rare and small sub-divisions make up in all 325 species which are known to exist in the region. This census will be largely increased of course as the country is better explored.

For comparison with the above list, the following census of fishes found in the river Hué in Ton-kin by Dr. Tirant (Administrator of Native Affairs and Mayor of Cholon) is submitted.

1. LATES CALCARIFER, Bloch.
2. SERRANUS MALABARICUS, Bloch.
3. LUTJANUS JOHNII, Bloch.
4. L. ARGENTIMACULATUS, Forsk.
5. AMBASSIS KOPSI, Bleeker.
6. THERAPON JARBUA, Forsk.
7. DATNIOIDES POLOTA, Ham. Buch.
8. GERRES FILAMENTOSUS, Cuv. and Val.
9. G. LUCIDUS, Cuv. and Val.
10. SCATOPHAGUS ARGUS, L.
11. TOXOTUS CHATAREUS, Ham. Buch.

12. *CHRYSOPHRYS RUBROPTERA*, Tirant.
13. *GYMNAPISTUS TRACHINOIDES*, Cuv. and Val.
14. *TEUTHIS CONCATENATA*, Cuv. and Val.
15. *POLYNEMUS TETRADACTYLUS*, Shaw.
16. *UMBRINA RUSSELLII*, Cuv. and Val.
17. *CARANX HIPPOS*, L.
18. *C. LEPTOLEPIS*, Cuv. and Val.
19. *EQUULA EDENTULA*, Bloch.
20. *E. BREVIROSTRIS*, Cuv. and Val.
21. *E. INSIDIATRIX*, Bloch.
22. *CYBIUM KUHLII*, Cuv. and Val.
23. *SILLAGO MACULATA*, Quoy and Gaim.
24. *GOBIUS TENTACULARIS*, Bleek.
25. *G. BIOCELLATUS*, Cuv. and Val.
26. *G. GIURIS*, Ham. Buch.
27. *G. PHILIPPI*, Tirant.
28. *ELEOTRIS CAPERATA*, Cant.
29. *TRYPACHEN VAGINA*, Bloch.
30. *CALLIONYMUS LONGICAUDATUS*, Tem.
31. *MUGIL STRONGYLOCEPHALUS*, Richards.
32. *OPHIOCEPHALUS STRIATUS*, Bloch.
33. *ANABAS SCANDENS*, Dald.
34. *OSPROMENUS TRICHOPTERUS*, Pall.
35. *SYNAPTURA ORIENTALIS*, Bloch.
36. *ARIUS THALASSINUS*, Rüp.
37. *MACRONES GULIO*, Ham. Buch.
38. *PANGASIVS MICRONEMA*, Bleek.

39. *P. MACRONEMA*, Bleek.
40. *AMBLYCEPS MANGOIS*, Ham. Buch.
41. *CALLICHOUS MICROPUS*, Bleek.
42. *C. BIMACULATUS*, Bloch.
43. *CLARIAS DUSSUMIERI*, Cuv. and Val.
44. *C. MAGUR*, Ham. Buch.
45. *HARPODON NEHEREUS*, Ham. Buch.
46. *HEMIRHAMPHUS LIMBATUS*, Cuv. and Val.
47. *HAPLOCHEILUS ARGYROTÆNIA*, Tirant.
48. *CYPRINUS CARPIO*, L.
49. *CARASSIUS AUREUS*, L.
50. *OSTEOCHILUS TRIPORUS*, Bleek.
51. *O. MELANOPTERUS*, Tirant.
52. *BARBUS AUREUS*, Tirant.
53. *DANIO RHEINARDTI*, Tirant.
54. *MISGURNUS ANGUILLICAUDATUS*, Cant.
55. *SQUALIOBARBUS ANNAMITICUS*, Tirant.
56. *CULTER FLAVIPINNIS*, Tirant.
57. *ENGRAULIS SETIROSTRIS*, Brouss.
58. *E. MISTAX*, Bloch.
59. *CLUPEA HUÆ*, Tirant.
60. *C. LILE*, Cuv. and Val.
61. *COILIA BORNEENSIS*, Bleek.
62. *CHATOESSUS MACULATUS*, Richards.
63. *CHIROCENTRUS DORAB*, Forsk.
64. *NOTOPTERUS KAPIRAT*, Lacep.
65. *MURÆNESOX CINEREUS*, Forsk.

66. *OPHICHTHYS BORO*, Ham. Buch.
67. *ANGUILLA BENGALENSIS*, Gray.
68. *TRIACANTHUS BREVIROSTRIS*, Günth.
69. *CARCHARIAS LATICAUDUS*, Mull. and Hen.
70. *TRYGON WALGA*, Mull. and Hen.

It has been the custom of late years amongst naturalists to speculate upon the reasons for the peculiar character of the land and water fauna in every country, and to attribute them to geological changes. It is not so certain that geology is responsible for all she is made thus to bear; but whether she be so or not, I think they go a little too far when they proceed to describe circumstantially the precise geological changes which have taken place. Here theory has been overstrained; we are required to believe in the relative ages of different portions of islands and continents which are said to have remained dry land and so forth, from remote geological epochs. We can acknowledge that the problems to be accounted for are very intricate and puzzling, but it seems to me they are best left as problems.

Mr. Day says in his introduction to the "Fishes of India" (p. xiv.) "Omitting for the present from whence the type forms of vertebrate life were derived, we require to know how it is that some of the identical species of fish are found along the Western Ghauts of India, and in the Himalayas, but absent from the sub-region of Hindostan? and how is it we see some genera identical in Ceylon and in the Malay Archipelago, or in China, but absent from India and Burma."

"The presence of certain Chinese, Malayan, Burmese, and Siamese forms in Ceylon and in the Western Ghauts, with their absence in the intervening alluvial plains of Hindostan, leads to the supposition that, at an antecedent date, some connection existed between these earlier geological formations and the more eastern countries. We observe some identical forms in the island of Ceylon and in Java or China, but absent from intervening localities: but does this prove more than that those intervening stations have passed away."

I need not follow Mr. Day further. This extract will show the nature of the problems to which reference has been made. He thinks that in the alluvial plains of Hindostan there appear to be traces of two fish faunas, one from the north and one from the east from Malaysia. Dr. Stoliczka considers that the Indian plains had once a wholly Malayan flora.

In the census of the Indian fishes given by the same author in the Journal of the Linnean Society (Vol. XIV. Zoology, p. 560) he says that the element most apparent amongst the Indian fresh-water fishes is the Malayan. There is not a single genus which is solely African or Indian, and all the African forms which extend to India are either likewise present in the Malay Archipelago, the Palæarctic region, or in both.

I pass now to other considerations connected with the fish and fisheries. The true Malay population on the rivers of the interior is so small that it is difficult to estimate the proportion of those who give themselves to fishing. The rivers are the highways of the interior, and the agriculture of the country is confined to their banks. This population engages in fishing as one of the means of livelihood. One meets them in their frail canoes on the rivers, in small parties of three or four, capturing their fish by hand-nets, lines, and sometimes, though rarely, spears. At night torchlight fishing is also resorted to. A great blaze is made upon the water with bamboo torches, and the fishes are struck with a long parang or hatchet-knife as they come to the surface. One sees no fishing-weirs or stream nets from one bank to another, but fish traps of various constructions are common. When at Pekan on the Pahang River, I remarked that the fishing boats, which were half-decked junks with one mast, and crews of five or six, went out beyond the bar of the river every morning when the tide served. The fish they brought back each afternoon were poor and small, and confined to a few species. I noticed the following genera which were purchased by the people from the boat side:—*Serranus* and *Plectropoma*, of the Scorpenidæ, *Scorpena*, *Sebastes* and *Centropogon*, *Caranx* and *Psettus*, some mackerel including a large

tasteless *Pelamys*, various mullets, *Sillago*, some Therapons and Siluroids, a few Herrings, Eels, and many Dog-fish, Saw-fishes, shovel-nosed Sharks and Rays.

But if the human enemies of fishes in the Malayan region are but few, it is not so with their other pursuers. First of all must be enumerated frogs, which are the most persistent and wide-spread devourers of fish ova that are to be found. In return the fish devour a good many frogs and their ova too. There is a fish-eating small crocodile, not the Ganges Gavial which does not come down so far as the Malay Peninsula, but uncommonly like *Phyllus johnstonii*, the fish-eating crocodile of North Australia. The snub-nosed or man-eating crocodiles, *Crocodylus porosus*, Schn., and *C. palustris*, Lesson, are found in many of the rivers along their whole course, but I do not think they are very numerous except in a few secluded streams where they are not disturbed. They consume an enormous quantity of fish. Otters too, are more destructive than any one would believe who has not had experience of their depredations. They are very common and sometimes used by the Malays to frighten the fish to the surface. But the feathered tribe supply the largest and most destructive contingent. The cormorants alone destroy fishes to an incredible extent. I have seen specimens shot with a dozen medium-sized fishes in their stomachs.

In 1884 I spent some weeks dredging at Pankore, one of the Dindings or Pulo Sembilan (nine islands), situated near the mouth of the Perak river, in the Straits of Malacca. I had a small steam launch named the Kimta, lent to me by the Perak Government. In dredging I was rather unsuccessful, for the muddy estuarine bottom near the coast was most unfavourable, while all the islands had fringing reefs of coral, where dredging was impossible. I did better in fishing, but this was by going out in a prahu with the Malays. We had a seine net and fishing lines. Pankore is the largest of the islands, and there is a considerable population of Chinese and Malays at the village, which is called Rajah Byong. The Chinese, with the exception of a

storekeeper or two and gardeners, were entirely occupied in fishing, for which purpose they had junks of the regular Chinese pattern. They had a considerable area of bamboo staging; the floor composed of open split bamboo, on which the fish was placed to dry in the sun. On the arrival of the junks the fishes were taken out, and the heads and entrails removed, with a partial rubbing off of the scales. Water was repeatedly poured over them till they were thoroughly washed free from blood. When quite clean they were put into casks in layers, with a thick coating of salt between the layers. They were allowed to remain in this for two or three days, according to the season, and then laid upon the bamboo staging to dry in the sun. In the Straits of Malacca, as in all the Archipelago, there is not much sunshine. Moreover, it rains nearly every day, in tropical showers which are neither light nor brief. These conditions are very much opposed to fish-drying, and before the fish could be finally stowed away, the "Ikan kering" or dried fish was in a semi-putrid condition. This state of things was aided to a considerable extent by the uncleanly habits of the Chinese. The heads and entrails of the fish were thrown into the water and on to the beach, and left to rot in the sun, with results which can be easily guessed. The effluvium around the village of Rajah Byong was unbearable to those who had not been inured to it by previous education.

Whenever the wind blew from the village, towards our quarters, we had to leave the house. Our Chinese servants, in spite of every prohibition, spread their mats under the bungalow at night, and exposed themselves to the full force of these mephitic breezes. The consequence was, they were all stricken down with fever, and some nearly died. Pankore has the name of being a very unhealthy place, but the marvel is how anybody lives there at all. The inhabitants suffer much from what is called malarial fever, but the malaria here is undoubtedly mephitism from putrid fish offal.

Yet in spite of these disadvantages, the dried salt fish of the Chinese is not such bad food. Where meat is almost unobtainable,

or if obtained is coarse and uneatable, the dried salt fish is the only article of food to be relied upon, and, so far as my experience goes, it is both palatable and nourishing. It is soaked and cut up into small dice, and fried until quite brown. A small quantity of this mixed with boiled rice makes a dish, which Chinese, Malays and Europeans seem equally to relish. I feel that I owe a debt of gratitude to this 'Ikan kering,' which I can only now imperfectly repay. When travelling through the wild, untrodden jungle, with much fatigue, and little to get in the way of nourishment, except the inevitable and most insipid rice, Ikan kering came as a boon and a blessing. The insipidity of the rice modified the fiery saltness of the fish, and toned it down into various flavors. It supplied just what was needed to endow it with savor, and cause the most tasteless thing in the world to be relished. For my own part I could always make a sufficient meal on rice and Ikan kering, and so could my companions, which is more than can be said of any other aliment. Moreover, it can be obtained from every Chinese store throughout Malaysia.

Both in Java and the Peninsula fish-fry are dried without cleaning, and are sold to be eaten raw; but another kind of preparation which one meets with everywhere in the East, is the Ikan merah or "Red fish." This is one of the most agreeable delicacies of the East. It is made from *Engraulis commersonianus*, as already stated. The following is the mode of preparation as described by Cantor. In fine weather the fishes are caught in small nets, from shoals which frequent the shore. I have captured thousands of them in this manner in the month of July. After the heads have been removed from those of the medium size, which are the best for the purpose, the fishes are placed in flat, glazed, earthen vessels. Here salt is thrown on them to the extent of an eighth part of the weight of fish. They are then covered with plantain leaves and heavy weights for three or four days. They are next freed from salt, and soaked in vinegar made from palm-toddy. Those who know how sour the toddy is, even when considered drinkable, can guess how strong toddy-vinegar is. Powdered ginger and black pepper-corns



are added. In some places alcoholic spirits are infused, but I think this can only be to please the taste of Europeans, for the Mahometans would object to use spirits, and it could not be obtained in many places where Red-fish is prepared. Finally, powdered "Red-rice" is superadded for the coloring matter. Mr. Cantor, following information obtained from Malacca, says that Red-rice is the variety of *Oryzia sativa* called *glutinosa* (Bras pulut or Bras sepulut of the Malays). The red color is said to be derived from Cochineal. This may be the case at Malacca and Bencoolen, but in most places it is obtained from Arnatto, which is the colouring matter surrounding the seeds of *Bixa orellana*. After a certain time, during which the condiment is left in the pickle, a little more vinegar is added, and the bottles sealed up for sale. It is sold for about half a dollar a bottle. As a relish there is nothing equal to it. Those who are accustomed to dine in the native fashion, have with the curry and other dishes, condiments and sauces, served up in little plates on a tray. These are called 'Sambals,' which is the Malay name for condiment or seasoning. One counts as many as 23 or even more, on little plates, amongst which Ikan merah is always to be found. Most of the 'Sambals' are compounds of chillis and capsicums of the most fiery kind, meant to give an additional glow to the curry. It requires a long seasoning with Malay dishes to be able to bear the majority of the condiments, but red-fish is a Sambal of a type which is a favorite with all.

FISH ROES or "Telor Ikan" are very popular articles of food amongst the Malays. There used to be an extraordinary fishing station in Sumatra at a place called "Bukit Batu," (stone-hill) in the strait formed by the island of Banka. The fish caught have been already referred to, and the fishery is thus described by Mr. Moore.\*

"The fish is called by the Malays 'Trubu.' It is known in all the neighbouring seas, but found with a roe only here, which makes it certain that it repairs to this favoured place for

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\* Notices of the Indian Archipelago, &c., p. 29.

purpose of spawning, (that is to say, in shoals, for it is always plentiful at Penang, Malacca, and Singapore). The Trubu, about a cubit long, is taken in three or four fathoms of water on a mud-bank. About 300 boats are engaged at all seasons in the fishery, with the exception of four days, during dead neap tides. The roes are exported and the dried fish sent into the interior of the island. The Rajah of Siak derives an annual revenue from this fishery of 72,000 rupees, though the sum varies in proportion to the take."

This was more than 40 years ago, and I believe it has even increased since then, so that the amount of fish captured must be very large. The mode of preparation of the condiment is this. The fish is opened and the roes taken out and thoroughly salted; and then they are dried in the sun, so as to leave them still flexible, and capable of compression. They are then tightly packed in casks for exportation. The salting is never very effectually done, so that the eggs become changed in flavour after a time. They are very much consumed in China, exported from Singapore and Penang, but the Chinese generally re-salt them and add a little arrack before they send them away. They are about eight inches long and of a beautiful amber colour. They require soaking to get rid of the superfluous salt, and are generally fried. They are highly esteemed, but to my mind seem rather tasteless, besides being exceedingly rich and indigestible.

ISINGLASS.—Isinglass has long been an export from Malaysia to China. It is unnecessary now-a-days to inform readers that isinglass is derived from fish-maws, or sounds, or stomachs and air bladders. It is generally supposed that it is derived solely from the sturgeon of European rivers, but there are various kinds, which, as this is not a complete treatise on the substance, need not be further described. The isinglass with which we have to deal, is known in commerce as East Indian isinglass. Ever since the Chinese have emigrated into Malaysia they have exported East Indian isinglass into their own country. It has proved a most profitable trade, as fish-maws of certain kinds are much

sought after and valued in China. Not only has Malaysia been a source of this trade, but the Chinese dealers at Penang, Malacca and Singapore, have bought up isinglass from Bombay, Ceylon, Madras, Bengal, Tenasserim and Manila for export to China. The Indian specimens, however, which include those of Malaysia, are not highly esteemed. Most of them have an unpleasant fishy odor, which unfits them for domestic use, and greatly reduces their commercial value. They consist of an unopened swimming bladder, flattened and dried. The shape is roughly oval, from seven to nine inches long, three inches wide, the largest weighing a little over a quarter of a pound. They are dark in color and have a strong fishy odor. Another kind (East Indian leaf-isinglass), is merely the sac laid open and dried. It is wider and thicker than the last.

The following is a list made by Dr. Theodore Cantor of the Malayan fishes which yield isinglass. The list was made in 1850, when the scientific nomenclature of fishes was in a very unsatisfactory state. Dr. Cantor's names and identification are often wrong, and in rectifying them his names have been preserved for reference.

#### MALAYAN FISHES YIELDING ISINGLASS.

LATES CALCARIFER, Bloch. Malay name Ikan siyakup. This fish is found in the seas, back-waters and mouths of tidal rivers in the East, from the mouths of the Indian Rivers to the Malay Archipelago, Australia and China. I have caught this fish with a line in the Mary River 200 miles from Port Darwin in North-Australia, and it sometimes finds its way into the rivers of the north-eastern coast. I have also captured it in the upper waters of the Mitchell River, near the Palmer River gold field, and many hundred miles from the mouth of the stream in the Gulf of Carpentaria. It is easily taken with a hook, using a small land-lizard, a prawn, or a moth, as bait. For eating they are highly esteemed, though not amongst the best table fishes. They yield isinglass in the straits, but little is collected, because the fish is

not so common as others, and the air-vessel is very thin and light, that from a large fish when dried weighing little over an ounce. The species is known as the "cock-up" amongst Europeans.

*POLYNEMUS INDICUS*, Russell. Malay name Ikan kurow. This fish is also found in Australia and extends to India. It attains four feet in length, but is rarely above 20 pounds in weight. A large fish yields about two ounces of rough isinglass. The largest specimens appear to be captured in the mouths of larger rivers. It takes a bait freely (Day). It is frequently found blind, possibly from the friction of mud in river mouths.

*SCIÆNOIDES BIAURITUS*, Cantor, = *COLLICHTHYS BIAURITUS*, Günther, = *OTOLITHUS BIAURITUS*, Cantor, Catal. p. 57. Malay name Ikan salampai. All these Sciænoids, like the Polynemidæ, possess air-bladders with a most extraordinary development of appendages arising from each side. In this species 52 branches issue from each side, each branch being bifurcate, and bearing smaller appendages (See Günther, 'On the Study of Fishes,' edit. 1880, p. 144). Seas and estuaries of India to Malaysia and China. Adult specimens three feet long.

*OTOLITHUS RUBER*, Bl. and Schn. Malay name Jarang gigi. This species, though not esteemed much by Europeans, is largely consumed by the natives from June to August, when it is plentiful. The isinglass is considered very good, of almost the best quality. On each side of the air-vessel are 34 processes, the first four or five of which divide in four branches, the next in three, the next in two, and the last simple and longer, though all have minor ramifications. It contains about 90 per cent. of isinglass, and will set in jelly with 26 times its weight in water. Seas of India to Malaysia. Attaining two and a half feet in length. It is the commonest form in the Indian seas, especially along the Coromandel coast. It is pretty good for the table, spawning from March to July (Day).

*OTOLITHUS MACULATUS*, Cuvier. Malay name Jarang gigi. The origin of this Malay name "gigi" or teeth, has reference to the

prominent, strong canine on either side of both lower and upper jaws, which makes the appearance of the mouth both conspicuous and formidable. This species has the same range as the last.

*SCIÆNA DIACANTHUS*, Lacep. = *JOHNIUS DIACANTHUS*, Cantor, Catal. p. 67. Malay name Ikan tambareh. Seas of India, Malaysia and China. Attaining at least five feet in length. It ascends tidal rivers and estuaries, and is found in the Hooghly as high as Calcutta. A species very similar, is known as 'Jew-fish' in Australia.

*LOBOTES SURINAMENSIS*, Bloch, = *LOBOTES ERATE*, Cantor, Catal. p. 80. Dr. Günther (Catal. Vol. I. p. 338) says this fish is found on the Atlantic coasts of America from New York to Surinam, Caribbean Sea, Ceylon, Bay of Bengal, Straits of Java, Sunda, Molucca and China Seas; and I obtained it in two places in the Philippines, on the coasts of Luzon and Negros. It is also on the east coast of Africa and the Indian seas to Malaysia. On the north coast of Borneo, when in H.M.S. 'Pegasus,' we caught one nearly three feet long. It is excellent eating, yielding but little isinglass. The Malay name is Ikan batu, or Rock fish.

*ARIUS CÆLATUS*, Cuv. and Val. Malay name Ikan doonee or Saludu. This genus has already been referred to, and is easily known by its being a Siluroid with an osseous, or mailed head. The genus is the largest amongst the cat-fishes, being well represented in nearly every tropical country with large rivers. Some of the species are of large size, as much as five feet long. All are well armed with formidable dorsal and pectoral spines. The eggs are mostly hatched in an extraordinary manner, that is, in the mouth and throat of the male fish. When they are captured at this time the stomach is always found to be empty, and in those examined, some of the eggs were in an early stage of development, others nearly hatched, or actually hatched with the yolk bag adherent. The eggs fill the cavity of the mouth and extend far back into the gills. Dr. Cantor mentions three species from which isinglass is derived, *A. truncatus*, *A. militaris*, and *A. arius*. The last-named may possibly be *A. falcarius*, Cuv. and Val.: the other species I have been unable to identify. The only species

I ever saw captured in these regions is the one above-named, but six others are known, mostly of small size. The fish serve as food of inferior quality, and are best when salted. A good deal of isinglass is derived from them, but of a poor kind.

Of all the above fishes *Polynemus indicus* seems to furnish the largest portion of the isinglass. The fish caught are of great size, but mostly when the rivers are low.

A few more facts about isinglass may be mentioned here. What British people know by that name is the beautiful ribbon-isinglass. It is made from the leaf-bladder, which is first softened in the water and rolled out under high pressure into thin leaves, several feet long. These again pass under a cylinder of numerous revolving knives, by which 6,000 of the well-known beautiful transparent fine threads are produced every minute. The Russian Sturgeon isinglass is even further enhanced in value by snow-bleaching, that is, whitened by being buried for a long period in the snow. Pipes, purses, and lumps are fish-maws which have been cleaned but not opened. These are soaked in water for two or three days and the useless parts removed, then it is rolled and cut into various dimensions. It is chiefly used to clarify beer and other alcoholic liquids, for which gelatine cannot be employed because it dissolves in hot water and alcohol, while isinglass merely swells and grows white. This is a good test to distinguish between the two; for what is generally sold as isinglass in shops is only gelatine. The transparent glutinous substance sold in the bazaars as Chinese gelatine, and often mistaken for isinglass, is a vegetable jelly made from rice. Many algals and lichens are also made to serve the purposes of producing gelatinizing substances, such as *Gelidium corneum*,\* from which is prepared what is known as 'Japan isinglass.'

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\* "*Gelidium*, Lam.—A genus of Cryptonemiaceæ (Florideous Algæ), of which one species (*G. corneum*) is very common on British shores. It has a red, pinnated, horny frond, from two to six or eight inches high; very variable in the appearance of its pinnate sub-divisions. Both spores and tetraspores are found on the ramules, the former in favellidia immersed in swollen ramules." Harvey, Marine Algæ.

There are a few more words yet to be said about isinglass, and my apology for saying so much is, that by giving extensive information, I may make these essays of more practical value to Malaysia. It is necessary to know what isinglass is, so that the character of the export may be increased in value, by knowing how to purify it. Isinglass is a word, the clue to whose etymology is found in the Dutch language, where *huizen* means a sturgeon, and *blas* a bladder. The Malays call it *Palongpong ikan*, or *Ari ari ikan*; the Chinese, *U. káu* (Cantor says Loo-pa, but I know not upon what authority). It was known to the ancients, who called it *Ichthyokolla* (*ἰχθὺς*, a fish, *κόλλα*, glue). Dioscorides, who is supposed to have lived in the reign of Nero, mentions it under this name. He wrote a work on the *Materia Medica*\* in which he mentions isinglass. I cannot quote the passage, but I will quote what is said by Pliny in his *Natural History*, which was probably written about the same time. "Ichthyokolla is the name given to a fish with a glutinous skin, the glue from which is also known by the same name, and is highly useful for the removal of *epinyctis*. Some persons, however, assert that it is from the stomach of the fish and not the skin (as in the case of Bull Glue), that the Ichthyokolla is prepared. That of Pontus is highly esteemed; it is white, free from veins or scales, and dissolves with the greatest rapidity. The proper way to use it is to cut it into small pieces and then let it soak in water or vinegar for a night and day, after which it should be pounded with sea-shore pebbles, to make it melt more easily. It is generally asserted that this substance is good for pains in the head and tetanus." Bk. 32. Ch. 24-5.

This passage has a double interest, as showing the antiquity of the controversy about the origin of isinglass, and how ancient is the trade in this material from what is now a part of Russia. If the proper nature of the tissues which produce isinglass had been understood, and the fish that produced it were better known, both the Malayan and Indian trade in the article, with a little careful

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\* Πεδακίου Διοσκορίδου περί ὕλης ἱατρικῆς λόγοι εἶ

European superintendence, would have vastly increased in value. So late as the year 1857 it was not known what tissue produced the isinglass, and consequently what ought to be got rid of and what retained. Care should be taken that the gelatinous portion is not contaminated by the blood or other tissues of the fish, otherwise it acquires a bad smell, and is very difficult to purify.

It should be remembered, therefore, that there are a few tissues which form the several tunics of the air-bladder:—(1) A very fine membrane, which is the epithelial layer; (2) an extremely fine internal one containing crystalline corpuscles, which cause the silvery shining appearance so frequently seen; (3) an outer membrane of fibrous texture, often attaining to considerable thickness. This is the portion which yields the isinglass. (4) Outside this isinglass there is, in many fishes, a layer of muscles.

When the fish from which the isinglass is taken is caught, the air-bladder is cut out and thrown on one side without any care to cleanse or preserve it. It is during this time that it acquires the appearance and smell that deprives it of so much of its value. When Dr. Cantor first had his attention directed to the product, and the demand there was for it in China, he made lengthened inquiries into the best method of improving the trade. He found that the fish which mainly supplied the Malayan isinglass was *Polynemus indicus*, to which reference has already been made. This is the "Suleah fish" of Bengal. It is an exceedingly coarse fish, but when salted and spiced is converted into "Burtah," a piquant relish highly appreciated by Anglo-Indians.

When the air bladders of the Suleah are dry they are pellucid, but so tough that they will turn the edge of a sharp knife. They are tongue-shaped, and weigh about 12 ounces (?). They have always attached to them many of the albuminous membranes, which, if the isinglass is to be of the best quality, must be removed while they are fresh. They are covered by a thin cobweb of small blood-vessels, which if neglected, stains and spots them with blood, and the whole becomes hard and consolidated together, and putrid in places.



The vascular membrane, therefore, should be peeled off at once, from the outside and inside, for it is found on both. It looks like white satin, and is seen to consist of transverse fibres, though there is an oblique fibre outside. When dry it becomes hard, horny, and translucent. The transverse fibre, of which nine-tenths of its substance consists, is perfectly pure isinglass. The oblique fibre is albuminous, but is easily removed by a little friction when dry.

The Malays and Chinese fishermen take no trouble at all about the sounds; they are usually sold unopened and uncleaned, just as they are taken from the fish. The fine net-work of blood-vessels is hardened and dried upon the surface, and darkened with blood-stains. In this state it requires much soaking to soften it, and this softening and washing often dissolve much of the pure isinglass within. The article becomes thus greatly impoverished and deteriorated.

If the isinglass trade is ever to be made of value in Malaysia, the Chinese and Malay fishermen must be taught to cleanse the sounds at once, and strip them of their membrane, when they should be rinsed with a little fresh water and dried in the sun. The longer they are exposed to dry in the air the better.

The following references to the literature of the subject may be found useful:—

*On Isinglass*, by THEODORE CANTOR. Proceedings Zool. Soc. London, Vol. VIII., 1839.

*Catalogue of Malayan Fishes*, by the same author. Journ. Asiatic Soc. Bengal, 1849, Vol. XVIII. (pp. i.-xii., 983-1443). Introduction iii., 2, 28, 59, 60, 62, 63, 65, 68, 70, 72, 74, 81, 170, 256, 258, 259, 261.

CRAWFURD, *Hist. Ind. Archipel.* Vol. III. p. 440. Edinburgh, 1820.

*On Isinglass in Polynemus sele*, by Dr. J. McCLELLAND. Journ. Asiatic Society of Bengal, Vol. VIII. Calcutta, 1839.

Official Papers on Isinglass, in *Calcutta Journ. of Nat. Hist.* Vol. II., 1842.\*

*On East India Isinglass* in *Calc. Journ. of Nat. Hist.* Vol. III., 1843. (*Polynemus sele*, p. 179, Plate VI.).

*On the Production of Indian Isinglass*, by DR. J. F. ROYLE. London, 1842.

*The Fishes of India*, by FRANCIS DAY, F.L.S. London, 1878.

SHARKS' FINS—As in India, there is an extensive fishery of sharks carried on in the Straits of Malacca, but by Chinese. A few Malays also fish for the same purpose off Malacca and some other points on the coast of the peninsula, as well as at Sumatra. In all the islands of the Archipelago, as well as in the Philippines, Siam, Cochin-China, all the Chinese coast right up to Japan, shark-fishery is an extensive industry. Oil may be said to be the first object, and secondly sharks' fins, which are dried and exported to the Chinese ports for soup and for the production of gelatine. They are assorted into black and white fins. The white are the dorsal fins, which are uniformly light-colored on both sides, and are reputed to yield more gelatine than the other. The black are the pectoral, ventral, and anal fins, which realize a lower price. Shark-skin is also exported to a small extent, as it is used by Chinese carpenters and joiners for smoothing and rasping wood. The species preferred are the Ground Sharks, or Shovel-nosed Sharks, which have no teeth of a sharp projecting kind, but obtuse, ridged teeth, which form a kind of pavement on the dentary plate, which has an undulating surface. These fish are very destructive amongst marine crustacea and molluscs, and are said to live in large shoals. Owing to the great injury done by them to the pearl-oysters in Ceylon, it was proposed to close the mud banks where they fed with stakes to prevent their egress. There are

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\* Dr. McClelland commenced the "Calcutta Journal of Natural History" in 1841. The work extended to six volumes, which are regarded as very valuable now. In its pages are several papers upon the fishes of India, particularly on the collections made by Dr. Griffith. These fishes are now in the British Museum.

two genera, namely :—*Rhynchobatus* with a broad snout, a semi-circular or elongated outline, rows of large tubercles and spines on the head and trunk, two dorsal fins, the anterior opposite the ventrals: and *Rhinobatus*, with two dorsal fins, the anterior situated far behind the ventrals. There are two species of the first and three species of the second, four of the five common in the Malay waters. I do not know what the Malay name is, but from their habit of hugging the shore and moving slowly along the bottom, the Tamils call them Mannulavi, or Mud-skate. The fins of some of the rays are used, as also of the smaller sharks, and especially species of *Carcharias* or large man-eating sharks, which are called by the Malays Ikan hiyu; they are, however, principally captured for the sake of the oil obtained from the liver. There are about 17 species, the largest of which is *C. tricuspидatus*, Day.

OTHER FOOD FISHES.—Hilsa or Sabti, the Indian mackerel, the Ikan tanggiri of the Malays (*Cybium commersonii*), makes its appearance in India in July, where it is known to Anglo-Indians as the Seer-fish, attaining to the length of four feet. When of the proper size they are considered the most delicate eating. If small, that is under a foot long, they are dry. From 18 to 30 inches is the best size; above this they become coarse. They can be eaten boiled, baked or fried, but are generally considered very unwholesome. The natives devour them in such quantities, when the shoals come up in July, that it is said to be the cause of fatal epidemics amongst them. There is no special season for them in Malaysia, for they appear in the markets all the year round. They are cured with tamarinds in India, and form a condiment of pungent flavour, called Tamarind-fish, something like red herrings and lemons, which can be obtained at the Hindoo shops in Singapore.

Mango fish or Tupsi (*Polynemus paradiseus*), so named in India from its visiting the rivers annually, to spawn during the mango season. It arrives as soon as the mango is formed on the tree, and disappears at the close of the season, or about the middle of July. This fish is a luxury much sought after by Europeans and

natives, on account of its delicate flavor : indeed it is said to be the most palatable fish known (in India). It is a small fish, not exceeding nine inches in length, yet ten will fetch a rupee at the beginning of the season. They are comparatively rare in Penang and Singapore. I know of no especial Malay name for them.

Mulletts (*Mugil*) are common at certain seasons in the fresh-water rivers. They are called 'Jumpel' by the Malays, and Wong-mi-tsai or Uyu-t'au by the Chinese. No fish are more highly valued by the Chinese in Malaysia, on account of the great quantity of oil they contain ; but they are too rich for most Europeans, who in that climate can scarcely ever eat them with safety.

There are many other much-prized table fishes in India, which are either not known or not appreciated in Malaysia, with the exception of the "Bombay Duck," which the Indians call Bummaloh, and the Malays Luli. It belongs to the family of Scopelidæ, and is the *Harpodon nehereus* of ichthyologists. It is highly esteemed as food, whether fresh or salted. But it is best known as a relish for curries called Bombay Duck. In this case the dried fish is parched upon a pan and eaten dry with the curry. It is very palatable, in flavour much like the dried caplins of Newfoundland and Labrador.

The Bombay Duck, before it is salted and dried, is a fish of most voracious habits, gorging itself with its own species, crustacea, or fishes of nearly its own size. So that if the reason why it is called Bombay Duck be buried in mystery, one can explain the irony of fate which assigns its office to the luxurious and overfed Anglo-Indian. Naturalists tell us that it is frequently found, like our own species, with its stomach and jaws distended with prey, so that we hear without surprise that it is very short-lived. It does not live nearly so long as two other species of *Harpodon*, though at certain seasons, as a kind of indemnification for the brevity of its stay, the whole body becomes brilliantly phosphorescent. Gourmets assure us, that for stomachs that can bear its richness, it is a fish of most luscious flavour if eaten immediately after it is

taken. In the Straits of Malacca it is at all times very numerous, but is most common at Bombay. It occurs from Zanzibar to China, in seas and estuaries, but is rather local. Thus it is not very common at Madras, but augments in numbers up the Coromandel coast, being very abundant in the rivers and estuaries of Bengal and Burmah, and so on to the Straits. It is more rare at Java, and uncommon at Batavia. It attains at least 16 inches in length. The species figured is from Day's "Fishes of India," Vol. II. Plate CXVIII., fig. 1.

In the Maldive Islands the Bonito is prepared in a peculiar way. The fish when caught has the backbone removed, and is laid in the shade, being occasionally sprinkled with sea-water. When softened by incipient decay it is wrapped up very tightly in palm-leaves, and buried in the dry coral sand, when it becomes extremely hard. The condiment thus produced is of a horny consistency and goes by the name of Cummelmums. It is grated upon the rice and gives it a flavour like that which parmesan cheese gives to macaroni.

WHALE FISHING.—Malay fishermen as well as the Chinese go in pursuit of the Loma porpoise with great keenness, as the oil to be derived from it is of considerable value. So also is it with the Pari, or large Ray, which is found of large size upon the mud-banks. They are secured by harpoons in the usual manner, the porpoise by day and the skate by night.

In this fishery no special appliances amongst the Malays are known except that which comes in the general way of other kinds of fishing, but the 'Tijdschrift voor Nederlandsch-Indie' for 1849 gives the following account of whale-fishing amongst the Solorese. "Solor is a volcanic island between Flores and Timor with an area of about 80 square miles. Its inhabitants are Bajow Malays or sea-gipsies, besides mountain aborigines with a bad reputation. The inhabitants of the coast are fishermen, and live by capturing a small whale from which they extract the oil.

"These inhabitants of the shore are hardy mariners and fishers, and think nothing of approaching the whale with their little boats,

eight feet long, to attack the unwieldy monster and tow him to the shore. The way in which they capture him is as follows. Each morning all the boats put to sea to search for their prize. When a whale is observed, they make a signal to each other, and immediately every one is prepared for the attack. This takes place in small boats, in which six or eight men with small paddles row sitting. A harpooner stands in front with his harpoon, not of the best kind, which is fastened to the boat with a rattan rope of fifteen or twenty fathoms. On approaching the whale, the harpooner springs on its back, and drives the harpoon, which is fastened to the boat, with all his force into the animal. The whale, on feeling the harpoon, immediately darts away and dives to the bottom, and of course takes the boat with him. The crew remain, swimming until they are taken up by the other boats. The whale is soon obliged to come up, and the boat generally appears with it; the surrounding boats approach it, and make a second, third and fourth boat fast to the first, in order to impede the whale by the heavy drag. Being thus hindered from making rapid progress, other boats are enabled to run alongside the sea monster and to disable him entirely. The beast is still far from dead when they already crowd upon his huge carcass, cutting and chopping; when the animal is really dead, he is towed in triumph to the shore, drawn up and cut to pieces. Every one is ready, women and children assist, and it is a real holiday for them to dispose of such a sea monster. Every one, small and great, runs with the blubber, which they speedily carry to the mountains, to barter it for maize; while they all give themselves up to unusual enjoyment."

"The oil is not boiled out, but the blubber is hung up in the sun to allow it to drop; the train oil running out of it is then caught in vessels; it is of a nauseous odor, but it is nevertheless made use of by the inhabitants. They find much ambergris floating in the sea; they also kill many sharks, dry the fins and gather birds' nests, all which productions are sold to the Bugis traders for the Chinese market. The payment is made in arrack, copper work, parangs, and iron. The last article is wrought by them for the construction of their prahus, which they call "Kora-Kora."

“The village which most applies itself to the whale-fishing is Lamakera, on the north-east part of the island of Solor, and lying within the Strait. It is the largest, most prosperous and most populous. The four other Mahomedan villages are Layayong, Andanara, Lamahala and Trong, which three last are situated on the island Andanara” (p. 66).

OYSTERS.—Oysters, which the Malays call “Teran” and “Siput,” (though Siput seems to apply to a shell-fish generally) and which the Chinese name Hao or Hau or Hau-mau-lai, are gathered and sold in the Straits. I have tasted some which the Chinese had brought to Durian Sabatang, Pêrak, about 40 miles from the mouth of the river, and where the water was only slightly brackish. The shell-fish were of pretty large size, and brown in color, but utterly tasteless. I believe this is true of all the oysters in the Straits of Malacca. Owing to the large quantity of fresh water, the shells are very thin and poor and much affected by the *Polydora* worm (See Dr. Haswell’s note on a destructive oyster Parasite in Proc. Linn. Soc. N.S.W. Vol. X., p. 273.)

The Chinese never eat oysters in a raw state, thinking them too cold for the stomach. They fry them with oil and rice flour. I believe they have a method of drying them also. The oysters are taken from their shells and scalded just enough to harden the tissues, and then dried in the sun. But rock-oysters, for some unknown reason, cannot be so preserved. They are grown or cultivated, and the mode of culture is of two kinds, producing the Shihao, or Rock oyster, and Bamboo oysters, Yu-tzu-hao.

Rock-oysters are cultivated thus :—pieces of stone are laid at short intervals, at low tide, on the mud banks or mangrove islands, where oysters have been observed. Localities are chosen where the current is strong, and where the influence of the tide permits the stones to be uncovered for at least three or four hours. When I enquired as to the reason for this, I was told that otherwise the mud would destroy the molluscs. Very shortly after the stones are placed in position they are covered with young oysters, which grow to full size in six months. They are then taken from

the stones and brought to market. They say that there is no particular spawning season, and that the young oysters come out like buds on the outside of the shell, subsequently freeing themselves and getting attached to the stones.

Bamboo oysters or Yu-tzu-hao, are grown as follows:—Bamboo laths about two feet long, one and a half inches wide, and about half an inch thick, are pointed at one end, and split at the other. A thin oyster shell is inserted in each split, as far as it will go without wedging the lath asunder. A large thick oyster shell, with a good round hole bored in the middle, is put over the split ends to keep them together. A number of these laths are planted over the mud flats closely together, making them look, when the tide has uncovered them, like a young vineyard. The strong currents in the tidal estuaries where the laths are always placed, are evidently charged with embryo oysters which get caught in what we may call this young oyster nursery. In about a month these have developed into spat. These laths are then taken out and planted wider apart in more sheltered situations, the bamboos being then a foot or less apart. In less than half a year the oysters have grown to such a size that they completely encrust and cover the bamboos, and the plantation has a most odd appearance. When they are sufficiently grown they are collected and sold on the sticks.

This method of oyster culture is by far the best that I have seen, and it is one of the many instances where Chinese industry and invention have been much in advance of that of Europeans. Oyster culture in our countries is a thing of the most recent origin, while amongst the Chinese it has been practised for centuries. The method here referred to is not as often seen in Malaysia as in China, partly because the Chinese cannot get from the Malays the necessary control of the mangrove swamps.

**BALACHAN.**—Any description of the fish food of Malaysia would be incomplete without reference to Balachan or Balachong, which corresponds with what is known in India as Gnapee or Nga-pee. In Javanese it is called Trasi: in the northern Philippine islands



Bagong, and in the southern or Visayan dialects Bacalang, which, however, is merely the name of an edible shell-fish. Crawford, in his Dictionary of the Indian Islands, is my authority for the Tagalo name, which however, I have not been able to verify, though the condiment is known and universally used. I should say here that I do not pretend to fix the orthography of the Malay names, the differences depending on the broad or close sound given to the final "a," and the phonetic variation in giving effect to the nasal "n" or "ng" at the end. Many think that the condiment is peculiarly Malayan, but this is not the case, though it is made in its greatest excellence at Malacca. The article is used over a wide area and by many different nations. Its use may be said to extend from India, through Burmah, Malaysia, Sulu, Siam, and Cochinchina. Crawford says that it is probably the condiment known to the Greeks and Romans under the name of '*Garum*,' adding that the latter is the product of a Mediterranean fish. This is a question which will be examined in a note at the end of this paper. It will be sufficient to say now that the *Garum* of the ancients was certainly applied to condiments which were all modifications of the Malay Balachan, and the name seems to be used to express a briny pickle of any kind in which the principal constituents were salt and fish.

In India, the Balachan, there called Nga-pee, is made of prawns, shrimps, or any cheap fish pounded with water into a fluid mass, and the brine not added until it becomes slightly putrid. The best is said to come from Siam, but I think that of Malacca is entitled to a higher reputation. There it is principally made of prawns (Hudang) and shrimps, with pepper, salt, and sea-weed (*Sphaerococcus lichenoides*), made into a stiff paste. In Anam there are two kinds, viz.:—Mam, which is a non-fermented pickle, the aspect and smell of which would for ever decide its reputation in European markets; and Mamnuoc, or Water of Mam, a fermented pickle of fish or Balachan, which must come somewhat nearer the Roman *Garum* of ancient renown. In appearance and taste it is as good, or as bad as Japanese Soy. (See note at the end of this paper on *Garum*).

## FISHERIES OF THE ORIENTAL REGION,

In Sumatra and many other places in the East, the Malays collect certain species of sea-weed such as *Sphaerococcus lichenoides*, *Gelidium corneum*, and *G. spiniforme*. These, well boiled down, form a jelly called, when dry, Agar-agar, which is largely exported to China. There it is used as medicine, and by coiners for glue. These algæ grow abundantly on rocks round many of the islands of the Archipelago, and quantities get washed up on the beach during the south-west monsoon. When gathered, it is first dried in the sun for two or three days, and then all the salt and lime crystals which are encrusted upon it are carefully washed off in three and four rinsings with fresh-water. It is then spread on mats and exposed to the sun until it is bleached. About half an ounce powdered will make a quart of stiff jelly, which, when flavored with spices, lemon and sugar, makes a most palatable as well as nourishing food for invalids.

*Gelidium corneum* and *G. spiniforme* are used for making a good deal of the confectionery of the Chinese, who call the substance "Yang-tsai." It is found both on the Indian and Malayan coasts, and even as far as China and Japan. The jelly formed by boiling this sea-weed product or crude gélose in water, and allowing the solution to cool, requires a high temperature for fusion, differing in this respect from a jelly made from isinglass, which readily fuses and dissolves in warm water. This character occasions a peculiarity in the taste of culinary jellies made of the new material, inasmuch as they do not dissolve in the mouth like ordinary animal jelly. The jelly of gélose is but little prone to undergo change; so little indeed that sometimes, under the name of "sea-weed jelly" it is exported from Singapore, sweetened, flavoured, and ready for use, and in this state it may be kept for years without deterioration. Of late it has been much used for the purpose of Bacteria culture according to Koch's method.\*

*Sphaerococcus* is one of the genera of the RHODYMENIACEÆ, a family of Florideous sea-weeds of purplish or blood-red colour, with expanded fronds composed of polygonal cells minute and irregularly

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\* See Dymock's Vegetable Materia Medica of Western India.

packed on the surface. The genus referred to here, has a linear frond, compressed, two-edged, with an obscure mid-rib which is distichously branched.

*Gelidium* belongs to the family of sea-weeds called CRYPTONE-MIACEÆ, or purplish and rose-red algæ, mostly bundles of threads of gelatinous or cartilaginous consistency, composed wholly or in part of cylindrical cells connected together into filaments. *Gelidium* is horny, and of very dense structure. The frond is pinnate, compressed and narrow.

FISH-POISONS.—From the number of plants which have the name of fish-poisons among all the Malay races, it would seem as if fishing by stupefying the fishes to capture them is a common practice. I have never seen it done in Malaysia, but I believe it is common. In Malay fish-poisons are called *tuba* (pronounced *tooba*), and I found this name applied to ten different species of plants. There may be more in use, but those enumerated are certainly the commonest. It was not always easy to distinguish between a plant that was regarded as a medicine (*Obat*), and that which was used as above, and the difficulty of communicating in some of the less known dialects rendered it impossible to obtain correct information. The Malays, seeing me collect plants, would frequently volunteer some statement as to the properties of particular species. It was in this way that the poisonous characters were learned, which would otherwise have escaped me, for some of the species at least, are not known to possess such qualities. It may be presumed that it is only in still waters of small dimensions that the process can be adopted. The poison, I believe, is simply thrown into the water, where the infusion is thought to be the cause of the stupefaction. In some of the larger ponds and lakes this can hardly be the case, and possibly the fish are brought under the influence of the drug in consequence of their swallowing small portions of the plant.

Readers need hardly be reminded that this method of fishing was a common one amongst poachers throughout Europe. It is furtively practised perhaps everywhere. One great objection of

course of the practice, is that fish partly or wholly poisoned are exceedingly dangerous as human food, and there are not wanting instances of fatal results from eating them when captured in this fashion.

The following are the plants referred:—

1. *ANAMIRTA COCCULUS*, Wight, Arn. In Malay Tuba-biji, also Tuba-tuni. This is the well-known plant, more familiar to most persons under the name of *Cocculus indicus*, belonging to the natural order MENISPERMACEÆ, and is perhaps the most generally used as a fish-poison, and certainly the most efficacious. It is a climber belonging to the Malayan flora, extending over large trees, with a stout woody stem between two and three inches in diameter with a deeply-cracked, corky, ash-colored bark. It used to be called *Menispermum cocculus* or *Cocculus suberosus*, but as it has stamens combined in a central column and no corolla, it is made into a separate genus called *Anamirta*. Dr. Chistison recommends the medical jurist to familiarize himself with this plant because used as a medicine, it is widely used also for destroying fish, and also by brewers as a substitute for hops,\* an adulteration which is prohibited under heavy penalties. What renders it more formidable as a poison is the difficulty of tracing it, for it leaves no marks on the viscera after death, by which it could be detected. The poisonous properties are principally in the fruit, which is a juicy berry, varying in size from a pea to a small cherry. It is sub-globose, notched, dark brown in color, rough and wrinkled. There is a husk which is acrid and bitter, enveloping a thin bivalved white shell, from which arises a central placenta, contracted at the base and divided above into two cells. Between the placenta and the shell is a yellowish, oily, very bitter seed of semilunar form. The poisonous qualities depend on a substance called pycrotoxine,† a white crystalline substance, usually crystallizing in needles, granular or in transparent plates or silky flexible

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\* So Dr. Chistison says; but more probably to render the beer more intoxicating.

† See Ann. de Chim. LXXX., p. 209; Ann. de Chim. et de Phys. liv. 181; Lancet, Jan. 11, 1851, p. 47.

filaments. It is soluble in 150 parts of water at F. 57° or 25 parts boiling water, and in ether, alcohol, and acetic acid. It is intensely bitter, and has been found to be poisonous to dogs, goats, cows, crocodiles, birds, and some insects. On man its effects are nausea and sickness, with staggering, trembling, tetanic convulsions and insensibility. It is very fatal to fish, roach being killed very easily, but barbel with more difficulty. The barbel is the fish which, of all others when captured by this method, has produced serious results in those who ate it. It is thought that this is because these fish are less affected by the poison, and taking a longer time to die a larger quantity of it is absorbed.\* The method of employing the seeds for the capture of fish is probably to throw a handful or more into the water over-night, and in the morning the fish are found lying on the surface stupefied for the most part, and a few dead. This is what is done in England, France, and to my knowledge in Australia.

2. DERRIS ULIGINOSA, Benth. In Malay Tuba-kayu, in the Sundanese kingdom of Java Tuba-awewe. The genus contains about 35 species, most of them belonging to the flora of tropical Asia. Two extend into tropical Africa and Australia. One of these is the species above-mentioned, of which Mr. James Britten, F.L.S., in the Treasury of Botany, states that the stems are used in Zambesi Land as a fish-poison, and act very effectively and speedily. I was informed in Java that it was the bast of the stem which was thrown into the water, and very soon caused the fish to rise stupefied. It is a tall, woody, glabrous climber, and from the specific name affects swampy grounds. Leaflets in the common form five or seven, one and a-half to three inches long, obtusely

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\* "According to Sprengel," says Pereira (Vol. II., Pt. II., p. 666), "the fruit *Cocculus indicus* was introduced by the Arabians, and was described by Avicenna and Serapion under the name of Maheradsch." In the copy, however, of the Latin translation of Avicenna (Venice, 1564), the word Maheradsch does not occur, but Mahezeheregi or Mahezhera is said to intoxicate fish. Nor can I find it in Serapion. *Anamirta cocculus* is sometimes termed the Levant Nut or *Bacca orientalis*.

acuminate, shining; pod very flat and thin, obtuse at both ends, an inch to an inch and a-half long, the suture bordered by a narrow wing, with one or two seeds. This species is found on all the eastern coasts of Australia as far south as the jungles on the Hastings river. In the Asiatic tropics it is very widely distributed and common.

3. *DERRIS FORSTENIANA*, Bl. Tuba-perampuan or the woman's fish-poison. I found that in the Moluccas this species has also fish-poisoning qualities attributed to it, though why it is called woman's fish-poison I have been unable to ascertain. It grows in Celebes, in all the Moluccas, Borneo, and less commonly in the Malay Peninsula.

4. *ARTANEMA SESAMOIDES*, Benth. In Malay Tuba-berebai. This is a small and somewhat ornamental species of a scrophulariaceous plant nearly allied to the Australian *A. fimbriatum*, and resembling the common fox-glove (*Digitalis*) or the sesamum plant. I was not aware that any poisonous qualities were attributed to it, but in south Sumatra the Lampong Malays use it as a fish-poison. They gather the herbaceous stems and throw them overnight into the water in considerable quantity. In the morning most of the fishes of the pool are found floating on the surface.

5. *PONGAMIA VOLUBILIS*, Z. and M. (*Leguminosæ*). In Sunda named by the natives Tuba-genu. It is a climbing plant very much like *Derris*; in fact it is only separated from that genus and *Lonchocarpus* by the peculiarity of its pods, which are of an oblong form, about two inches long and an inch broad, flat, thick and hard, not winged at the edges, and containing only one thick kidney-shaped seed. In Java there is no plant so much sought after as a fish-poison. The stems, when cut into short lengths and thrown into the water, stupefy the fishes more rapidly than any other fish-poison; sometimes in less than an hour the effects are produced. A closely allied species (*P. glabra*) is extensively diffused throughout southern India, Burmah, Malacca, the Indian Archipelago, S. China, N. Australia, and the Fiji Islands. The seeds produce abundance of oil much used by the poorer classes.

It has a deep yellowish or reddish-brown colour, and is so thick that it solidifies at F. 60°. I believe that this species also possesses in its stem fish-poisoning qualities, but much weaker than the other.

6. *MILLETTIA SERICEA*, W. and Arn. (*Leguminosæ*). In Malay Tuba gatel. Another genus of climbing papilionaceous plants, closed allied to *Wistaria*, with which it is united by von Mueller and others. It is only distinguished from such genera as *Tephrosia*, *Pongamia*, *Robinia*, &c., by minor peculiarities, especially about the seed-pod. It is much sought after as a fish-poison, and by some of the natives is preferred to any other.

7. *MILLETTIA ROSTRATA* (?) Miq. Malay name Tuba-lalur. Another species to which the same fish-poisoning properties are attributed.

8. *HARTIGHSEA ACUMINATA*, Miq. (*Meliaceæ*). This is a somewhat large tree belonging to a genus which has representatives in Australia and New Zealand. In the latter islands its leaves have a bitter taste, and are used as a substitute for hops, or as a tonic. In Malay it is called Tuba-siapa, and on the west coast of Sumatra, at least, is extensively used as a fish-poison, but I do not know what part of the plant is employed.

9. *POLYGONUM BARBATUM*, L. (*Polygonaceæ*). Malay name Jukut-jaran or jarang. This species is common in tropical Asia, Africa and Australia. It is used as a fish-poison in many portions of the Archipelago, and I believe it is the same species which is used by the natives of Australia for the same purpose.

10. *TEPHROSIA* (*Leguminosæ*). A genus which has many fish-poisons amongst its species, for any representative of which I have searched in vain in the Oriental region. In Australia, however, we have a great number of species, about 28. It will assist the comprehension of the previous remarks to mention what is said by Lindley, (*Veg. King*. 2nd edit. 1847, p. 549.) "Many *Tephrosias* are employed as fish-poisons especially *T. toxicaria*, the young branches of which, with the leaves pounded, and sometimes mixed with quick-lime, are thrown into a pool of some mountain stream,

and have an almost immediate effect. The fish are observed to become stupefied and as it were intoxicated, and to rise to the surface, floating there with their belly upwards, so as to be readily taken by the hand. It has been remarked that the larger fish recover gradually from the effects of the poison, but that the younger fry perish. It has been suggested that the action of the plant on the human system would resemble that of *Digitalis*, and might prove in a climate where that plant does not grow, a desirable substitute."

It may be mentioned in connection with this subject, that the elder Pliny in the 25th book of his Natural History, Ch. LIV., attributes fish-poisoning properties to a plant which has been somewhat doubtfully identified as the *Aristolochia pistolochia* of Linnæus. He says "The fishermen on the coasts of Campania give the round root the name of "Poison of the earth," and I myself have seen them pound it with lime and throw it into the sea. The fishes swam towards it at once with astonishing eagerness and were at once struck dead so as to float on the surface." There are two species of *Aristolochia* in the flora of Malaysia but to neither of them are fish-poisoning properties attributed.

FISH MANURES.—Small fishes and those of an uneatable kind are brought ashore by the fishermen and sold as manure. Chinese are also employed by some of the sugar planters on the coast for the especial purpose of catching fish to be employed as manure. The consequences to the health of the very numerous labourers on these plantations can be easily imagined. Many condemn the practice as a great waste of the food-supplies of the people, but as a rule only those species are employed which are not consumed as food. The following is a list of the species which I have seen principally employed as manure.

1. *AMBASSIS NALUA*, Cuv. and Val. A fish belonging to the perch family, comprising the smallest of that extensive group, some of the species not exceeding an inch in length. They are most abundant on the coasts of the tropical Indo-Pacific, and in the fresh waters belonging to that area. The species are numerous



and very difficult to distinguish, some 30 having been described. Colour very plain, a silvery hue pervading the whole fish (Günther).

2. APOGON FUCATUS, Cantor.

3. A. QUADRIFASCIATUS, Cuv. and Val.

4. A. POECILOPTERUS, Cuv. and Val. All fishes of the percoid family, representing a more highly developed form of the family than *Ambassis*, although of similarly small size. Their distribution coincides very much with that of *Ambassis*, but they are chiefly marine, very few of their species entering fresh water. They belong to the kind of fishes which from their habit are termed "Coral fishes," being found in the greatest abundance in the neighbourhood of coral reefs, in company with Chaetodonts, Pomacentridæ, and others. Their colours are ornamental and highly diversified, as is generally the case in coral fishes, the majority of the species showing transverse or longitudinal bands or large spots, and numerous other smaller markings which in the dead fish soon disappear. Nearly one hundred species have been described, of which a few only occur in the Atlantic, one extending northwards into the Mediterranean (Günther).

5. APISTUS CARINATUS, Bl. & Schn. One of the family of Scorpenidæ; of the genus there are only two species from the Indian Ocean. They are very small fishes, and like all the family exceedingly thorny, but of interest on account of the prolongation of their pectoral fins, by means of which they are said to be enabled to take extraordinary flying leaps out of the water.

6. MINOUS MONODACTYLUS, Bl. & Schn. A small fish of anything but prepossessing appearance, with long pre-orbital spines, and a strong sharp spine and three shorter and blunter ones on the operculum. Greyish in color, flesh-colored along the abdomen, fins marked with black, seldom exceeding four or five inches in length.

7. ECHINEIS NAUCRATES, L. One of the sucking fish or Remoras, and probably the most common as well as one of the largest; for, though a slender fish, it is not uncommonly three feet

long. The fish is not considered good for food, but it has the highest reputation as a manure, being especially recommended for fruit trees. It is never very numerous, but single individuals occur at all seasons in the Straits of Malacca.

Wild pigs are at all times much attracted into the cane-brakes by the smell of decayed fish, as well as tigers and other wild animals, including the rhinoceros, as some Malays assured me. Their usual diet is fruit, but even ruminants sometimes take to a fish diet. This is no novelty, as the following quotation will show. It is inserted here, not only for its interest and connection with the subject, but because it will be probably new to most readers. It is taken from the 'Barnstable Journal' (Cape Cod, Mass., U.S., America) of Feb. 7th, 1833.

“FEEDING CATTLE ON FISH.—The cattle at Provincetown feed on fish with apparently as good relish as upon the best kinds of fodder. It is said that some cows, kept there several years, will, when grain and fish are placed before them at the same time, prefer the latter, eating the whole of the fish before they touch the grain. Like one of old, we were rather incredulous on this subject, till we had the evidence of ocular demonstration. We have seen the cows at that place boldly enter the surf in pursuit of the offals thrown from the fish boats on the shore, and when obtained, masticate and swallow every part except the hardest bones. A Provincetown cow will dissect the head of a cod with wonderful celerity. She places one foot on a part of it, and with her teeth tears off the skin and gristly parts, and in a few moments nothing is left but the bones.”

“The inhabitants of Provincetown are not the only people who feed their cattle upon fish. The natives of the Coromandel coast, as well as in other parts of the East, practise feeding their flocks and herds with fish. Herodotus mentions this. The celebrated traveller Ibn Batuta, who visited Zafar, the most eastern city in Yemen, in the early part of the 14th century, says that the inhabitants of that city carried on a great trade in horses in India, and at that period fed their flocks and herds with fish, a practice

which, he says, he had nowhere else observed." See also Nat. Hist. Fishes of Massachusetts by Dr. J. V. C. Smith, Boston, U.S., 1833. See also Semper's 'Animal Life,' Chap. II., p. 64, and Note 13, p. 414.

THE TRIPANG FISHERY.—Esculent Holothurians are found throughout the whole of the Indian Archipelago, through the Moluccas along the Australian coast, and through most of the warmer parts of the Pacific, in fact in nearly every place where coral reefs are extensively developed. The word tripang is Malay, but there are various names for the same animal in all the islands of the Indian region. In Visayan and Tagalo it is *Talipan*, but another quality is called *Munang*. In Celebes it is called *Siwala* and *Tripang* as well. There are other names, too, used in the trade which are partly corruptions of Spanish, Portuguese, and Chinese, such as *Balate*, *Kikisan*, *Ginseng*, &c. The Chinese call it *Hoi-Sham* and *Hai-Shin*, the white variety *Pak*- or *Peh-Hoi-Sham*, the black *Hak*- or *Hek-Hoi-Sham*, the red *Hung-Hoi-Sham*. As far as my observation extends, the tripang fishery is not extensively followed anywhere near the Straits of Malacca. There is more of it, perhaps, in Borneo and to the north of that island where the coral reefs are very extensive. Tripang does not seem to be abundant apart from coral reefs.

The most extensive employment of Malays in this fishery is off the coast of Australia. Every year at the proper season, that is during the north-west monsoon, a fleet of 200 to 400 prahus leave the different parts of Celebes and some of the Moluccas for the Australian coasts, where they pursue the tripang fishery for some months. It would seem that this annual expedition has gone on from time immemorial, and no doubt, as Flinders remarks, nature has to some extent been modified by the intercourse. Possibly this is the origin of the rice-plant which is found in North Australia, the bean (*Phaseolus*) and the bamboo, besides several Indian weeds and food-plants. Flinders met a party of these fishermen in February, 1802. They were from Macassar, and mustered about 60 prahus. The object of their expedition was tripang, which they obtained by diving in from three to eight

fathoms. These Holothurians were very abundant in Arnheim's Bay where Flinders met the Malays, so that a diver would bring up eight or ten at a time. They were preserved by scalding them for a few minutes in boiling water after splitting them up and depriving them of their intestines. They then smoked or simply dried them in the sun stretched on pieces of bamboo after being pressed between stones. The prahus return in the beginning of the south-east monsoon, that is about the end of February. The chief of the Malay fleet told Flinders that he had been trading to Australia every year for the previous 20 years, and he believed that their fleet was the first which came there, a statement which we have good reason to question. The fishery is practised entirely for the Chinese market. I do not think that the Malays consume the tripang, but, as everyone is aware, it is so much sought after in China, and is an expensive luxury, which leads to a very profitable trade. Crawford remarks, however, that as no mention is made of the article by the early Portuguese and Spanish writers, the trade began with the comparatively modern arrival of the Chinese in the Archipelago.

It is scarcely necessary to do more than mention the fishery here, unless it be to correct several popular errors about the nature of the sea-cucumber as the *Holothuria* is called. In the various descriptions of the trade, perhaps the best is that given by Capt. A. Cheyne to the well-known P. L. Simmonds, author of "Animal Products and their Uses," but it is full of expressions as to the dimensions and parts of the animal which would lead to a total misconception of its nature. Thus it is called a fish, and the ambulacral tube-feet are called teats, and it is said of a sort called Bankolungan, that it is "brown on the back; the belly white, crusted with lime, with a row of teats on each side:" furthermore we are told that it is hard and rigid, and scarcely possesses any power of locomotion, while others are said to be known by exuding a white adhesive substance which sticks to the fingers when handled.

It may be necessary, therefore, to explain that tripangs, bêche-de-mer or sea-cucumbers, belong to the class ECHINODERMATA, and

are the most highly organized members of it ; that is to say vermiform animals with a leathery skin in which calcareous granules, plates and spicules are developed. There is no shell like the sea-urchins, and it need not be said there is no back or belly in the ordinary sense of the term. The so-called "teats" are usually distributed in five rows, dividing the body into an equal number of segments, but they may be partly or wholly wanting. They are the ambulacral tube-feet, corresponding with the same organs in star-fish, or in the poriferous zones of sea-urchins. Sometimes these tube-feet are scattered over the whole body, or they are restricted to what, for convenience, is called the ventral surface. There is a long convoluted intestine, a special water-vascular system and a sand canal. The breathing is performed by a respiratory tree or plume of arborescent tubes around the mouth. In the family of Synaptidæ there is no respiratory tree, and the tube-feet are wanting, whilst the skin is furnished with calcareous spicules of various shapes. The Synaptidæ burrow in the mud or sand, and the skin is furnished with anchor-shaped spicules, with a little calcareous disc fastened loosely around the shafts of the anchor. In Chirodotæ the skin has minute calcareous wheels. In the Oncinolabidæ the skin has barbed spicules, and there are tube-feet but no respiratory tree.

It is a matter of regret to me that though I have seen a good deal of tripang fishery in the Moluccas, Philippines, and Australia, and know most of the commercial varieties which will be referred to presently, I am unable to give any details towards their zoological identification. The commoner species collected belong to the genus *Holothuria*. Thus M. Dujardin (Hist. Nat. Zoophy., Echinodermes) gives as the tripang species, *Holothuria edulis*, Lesson ; *H. peruviana*, Lesson ; *H. ananas*, Q. and G. ; but to these must be added probably some of the genera *Müllera*, *Stichopus*, *Psolus*, *Synapta*, and some others. The order is divided into (1) *Apneumona* or sea-slugs, with no respiratory tree, the tube-feet wanting (Synaptidæ) or present (Oncinolabidæ), and (2) *Pneumonifera* with a respiratory tree, such as *Holothuria*, *Thyonemolpadia*, *Psolus*, *Cucumeraria*, &c. The genus *Holothuria* has

been divided into two sub-genera *Thelenota* and *Microthele*. *Holothuria* is in some sort the type of the whole order. It has a cylindrical, more or less elongated body, rounded towards the extremities, tube-feet more numerous on the crawling surface, scattered above and forming raised conical papillæ, mouth surrounded by 20 short tentacles, shield-like, branched at their extremity, forming a double alternating series. All the order have a singular facility for contracting to such an extent as to disgorge the whole of the interior viscera as well as the tentacles. At the end of some months the animal is said to reproduce them. *Synaptae* are perhaps the most interesting animals of the group, with their microscopic spicules like anchors with long shanks fastened to little discs and standing out at right angles to the skin, to which they give a characteristic rough and adhesive feeling on being touched. The milk-white sticky exudation is a form of *cnidæ* ejection in which a poisoning power for defensive purposes is included as in the sea-anemones.

As already stated, the coral reefs are covered at low water with a great many of these sea-slugs of all sorts of dingy colours, but only a small proportion of them are of use for the Chinese market. They are distinguished on the Australian coast by the names of "Black-fish," "Teat-fish," "Red-fish," "Cotton-fish," and so on. Amongst the Malays in the Moluccas, Borneo, and the Philippines, the same kinds are distinguished by the names of Talipan and Munang, Lolowan, Matan, Sapatos-China, Sapatos-grande, Balate-blanco, Hanginan, Bacolongan and Kih-kih-san. Some of these names I give only on the authority of Capt. Cheyne in the "Technologist," for I never heard them; but I have no doubt they are in use, but with a different orthography.

Bacolongan is a well-known Tagalo and Visayan term for the first quality of balate or tripang. It is 11 to 15 inches long, oval, brown, with a row of tube-feet on each side. It is hard, rigid, does not move about much, and usually keeps to the deeper water, and therefore can only be obtained by diving. I have not been able to find any derivation for the name.

Kih-hih-san denotes a species prized equally with the last. It is more plentiful and is found without diving. The word is Chinese, and denotes anything poor, miserable, spiritless, or helpless, possibly referring to the habits of the animal. It is from half a foot to a foot long, black above, greyish on the crawling surface, with the tube-feet as in the last variety.

Talipan is a deep mahogany-red color, narrow, and sometimes two feet long, found in two or three fathoms of water; upper-surface covered with large conical papillæ. The name is a true Philippine term for a kind of balate.

Munang is a small kind, about eight inches long, quite black and smooth, without tube-feet or tentacles, probably a *Synapta*. The name is generally applied to a shell-fish. The above four kinds are the best qualities of tripang. The inferior sorts are as follows:—

1. Zapatos china, or the Chinese shoe, a Spanish term applied to an oval slug with a wrinkled surface found adhering to the coral.

2. Lolowan, found on various parts of the reef, similar to the last, but narrow. The term is Philippine-Malay, and the meaning given to me is probably expressed by the Latin *circumcissus*.

3. Balate-blanco is oval, white and orange, exuding the adhesive cottony threads, burying itself in the sand and coming out at night, whence they are generally gathered by moonlight.

4. Matan differs only in color from the preceding: grey, white and speckled. The name refers to some supposed peculiarity about the eyes or vision.

5. Hanganas, generally a foot long, grey or green, found on the inner side of reefs; the name is applied also to the noise made by the surf on the edge of the reefs. Very inferior in quality.

The method of curing the tripang varies slightly in different countries. Sun-dried slugs fetch the most in the Chinese market, but as this is a process which requires 20 days and more to complete, while smoking only requires four or five days, the latter is

generally adopted, except by the Malays and Chinese. The methods are very simple: a low bamboo shed thatched with leaves is erected with two tiers of open drying frames. The fish are placed on the lower ones, about three feet above a trench as long as the building, nearly as wide as the frames and two feet deep. This is kept filled with burning wood. The slugs are split up, eviscerated, washed in fresh water, and placed first upon the lower frames, and then upon the upper until they are dry, care being taken not to scorch or cook them. They are stowed away in bags, and great care must be exercised in drying them from time to time in the sun, as damp and mould easily destroy them. The following directions for scalding tripang are taken from Simmonds' "Commercial Products of the Sea," p. 110.

"Bacolongon and Kih-kih-san will require to be boiled about five minutes or more, if the pot is nearly full; they should be well stirred, and should be taken out when thoroughly heated through, by which time they will feel quite hard and elastic. The cut part of the fish, when properly boiled, should be of a blue and amber color. The Talipan and Munang require to be boiled fully ten minutes. The Munang dries very quickly; but the Talipan is very difficult to cure, and often requires two boilings before it will dry. The Zapatos china requires to be boiled about 15 minutes; if properly boiled it will dry very quickly. The Balate blanco and Matan need very little boiling, say three or four minutes, if the pot is nearly full. They should be taken out as soon as they shrink and are thoroughly heated through. The Hanganas should be boiled about 20 minutes. This sort must be very carefully handled when raw, as it will break in pieces if held any time in the hand. It appears to me that there are two ways of boiling *bêche-de-mer* equally good. The first is to take them out when boiled about a minute, or as soon as they shrink and feel hard; the other method is to boil them as before stated; but in boiling either way, the slugs ought, if properly cooked, to dry like a boiled egg immediately on being taken out of the pot."

It is further added that much care is required to prevent broiling or blistering, but too little heat will render it liable to get putrid in



a few hours. The splitting up and evisceration must not be delayed too long or decomposition rapidly sets in: if the fish cannot be attended to at once, they should be kept in warm water, and not exposed to the sun.

ASTERIADÆ, STARFISHES, BRITTLE STARS, &c.—The following list includes all the species identified by me, as well as some which I take from the list of M. Edmund Perrier.†

ASTERIAS TENUISPINA, Lamarck.

CALVASTERIAS ASTERINOIDES, Perrier.

\*ACANTHASTER ECHINITES, Gray.

CIBRELLA ORNATA, Perrier.

ECHINASTER ERIDANELLA, Valenc.

E. FALLAX, Müll. and Trosch.

\*MITHRODIA CLAVIGERA, Lamarck.

\*FROMIA MILLEPORELLA, Lamarck.

F. MONILIS, Valenc.

METRODIRA SUBULATA, Lamarck.

\*LINKIA DIPLAX, Müll. and Trosch.

\*L. MILIARIS, Linck.

\*L. MULTIFORA, Lamarck.

L. PACIFICA, Gray.

L. PAUCIFORIS, von Martens.

L. ROSENBERGI, von Martens.

\*SCYTASTER ÆGYPTIACUS, Gray.

S. TUBERCULATUS, Müll. and Trosch.

\*S. VARIOLATUS.

OPHIDIASTER PUSILLUS, Müll. and Trosch.

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†Nouvelles Archives du Museum d'Histoire Naturelle, Deuxième Série. Tome I., 1878.

- \**CULCITA NOVÆ-GUINEÆ*, Müll. and Trosch.  
 \**C. PENTANGULARIS*, Gray.  
 \**C. SCHMIDELIANA*, Retz.  
*GONIASTER OBTUSANGULUS*, Lamarck.  
*GONIODISCUS CUSPIDATUS*, Lamarck.  
*G. GRACILIS*, Gray.  
*G. PLEYADELLA*, Lamarck.  
 \**G. SEBÆ*, Müll. and Trosch.  
 \**GYMNASTERIA CARINIFERA*, Lamarck.  
*G. BISERRATA*, von Martens.  
 \**PENTACEROS MURICATUS*, Linck.  
 \**P. OBTUSATUS*, Lamarck.  
*P. SUPERBUS*, Möbius.  
 \**P. TURRITUS*, Linck.  
*PENTAGONASTER INÆQUALIS*, Gray.  
 \**P. SEMILUNATUS*, Linck.  
*STELLASTER BELCHERI*, Gray.  
 \**ASTERINA EXIGUA*, Lamarck.  
 \**A. GIBBOSA*, Pennant.  
 \**A. PENICILLARIS*, Lamarck.  
 \**ARCHASTER ANGULATUS*, Müll. and Trosch.  
 \**A. TYPICUS*, Sars.  
*ASTROPECTEN JAVANICUS*, Müll. and Trosch.  
*A. POLYACANTHUS*, Müll. and Trosch.  
 \**LUIDIA MACULATA*, Müll. and Trosch.  
 \**PTERASTER CRIBROSUS*, von Martens.

The species marked with an asterisk are common to other regions. The Malayan region, according to M. Perrier, in spite of some secondary differences ought to be considered not only in the matter of the Asteriadae, but in other departments, as forming one vast region of zoological geography. The most intimate affinities unite the faunas that belong to its different portions, to which, however, he thinks more properly the term *Pacific Region* should be applied.

The Indian species, properly speaking, are so few in number that they may be inserted here for comparison.

ASTERIAS RUBENS, L.

PENTACEROS AFFINIS, Müll. and Trosch.

P. REGULUS, Valenc.

P. REINHARDTII, Lütke.

P. VERRUCOSUS, Müll. and Trosch.

P. WESTERMANNI, Lütke.

DORIGONA LONGIMANA, Perrier.

ASTROPECTEN EURYACANTHUS, Lütke.

M. Perrier says that it is sufficient to cast one's eyes on this list and to compare it with the preceding to see that the Malayan and Indian regions differ completely in starfishes. If the genera are nearly allied, the species are absolutely distinct.

ECHINOIDEA.—Hardly perhaps connected with the fisheries, but still deserving mention, are the Sea-urchins, &c. The Straits of Malacca are essentially the home of the sea-urchin known as *Diadema setosum*, an urchin of great beauty in the water from its spines five and six inches long, straight, stiff and black, like hairpin wire. When the tide is out the ledges of rock are seen to be simply covered with them as closely as they can lie. The natives call them Bulan-babi or round pig, and they regard the formidable spines with much dread. Next in numbers is *Temno-pleurus toruematicus*, which was frequently brought up when dredging, together with a *Salmacis*. The following species have also been identified:—

## ECHINOIDEA OF THE ORIENTAL REGION.

- CIDARIS METULARIA, Blainv.  
 PHYLLACANTHUS IMPERIALIS, Lamarck.  
 DIADEMA SETOSUM, A. Agassiz.  
 ECHINOTHRIX CALAMARIS, Pallas.  
 E. TURCARUM, Schynr.  
 COLOBOCENTROTUS ATRATUS, L.  
 HETEROCENTROTUS MAMMILATUS, Klein.  
 H. TRIGONARIUS, Lamarck.  
 ECHINOMETRA LUCUNTER, Leske.  
 \*E. OBLONGA, Bl.  
 STOMOPNEUSTES VARIOLARIS, Lamarck.  
 \*STRONGYLOCENTROTUS TUBERCULATUS, Lamarck.  
 TEMNOPLEURUS TOREUMATICUS, Klein.  
 SALMACIS BICOLOR, Agassiz.  
 S. DUSSUMIERI, Agassiz.  
 \*S. RARISPINA, Agassiz.  
 \*S. SULCATA, Agassiz.  
 MESPILIA GLOBULUS, Agassiz.  
 TRIPNEUSTES ANGULOSUS, Leske, = *Hipponoë variegata*, Gray.  
 FIBULARIA OVULUM, Pallas.  
 \*F. VOLVA, Agassiz.  
 CLYPEASTER HUMILIS, Leske.  
 LAGANUM DEPRESSUM, Lesson.  
 L. DECAGONALE, Bell, = *Peronella decagonalis*, Agassiz.  
 L. PERONII, Agassiz.

ARACHNOIDES PLACENTA, L.

ECHINODISCUS BIFORIS, Leske.

E. LEVIS, Klein.

\*LOVENIA ELONGATA, Gray, Celebes; Northern Borneo.

BREYNIA AUSTRALASIE, Leach.

ECHINOCARDIUM AUSTRALE, Gray.

BRISSUS CARINATUS, Lamarck.

MATALIA STERNALIS, Lamarck.

\*SCHIZASTER VENTRICOSUS, Gray. Locality uncertain, but probably Banguay.

Those specimens marked with an asterisk were collected by the author. The list, no doubt, would be much increased were a special search made.

CRUSTACEA, CORALS, MOLLUSCA, &c.—The crustacea do not form a very important part of the fisheries of Malaysia, but they occupy a considerable place in the natural history of the region. Like the fishes, the species are widespread, though some of their peculiarities are somewhat local. They are not so well known, however, or not so popularly known as other members of the animal kingdom from the difficulty of preserving them. But few collectors have the necessary skill for removing the perishable portions of the animal and leaving only the shell, and thus we do not often find specimens of crustaceans except in educational museums. Even there the collections are defective, and perhaps there is no portion of zoology which makes slower progress.

The great naturalist of the province, George Everard Rumpf, collected in this department of the animal kingdom as in every other, and in his *Thesaurus Imaginum Piscium Testaceorum, etc.*, published in Batavia in 1711, figured a good many crabs, lobsters, crayfish, &c., which are common to Malaysia and the adjoining islands. The engravings are in many cases very well executed, so

as to leave their recognition a matter of no difficulty. The letter-press gives a Latin name as well as the appellations by which most of the species are known in Malay, the local dialect, and Dutch. Many of the references of Linnæus are to these figures, and thus they serve to fix the names of the species. There appears to have been little change in the Malay nomenclature during the last 180 years.

Perhaps it may be well to remind readers that the class Crustacea is divided into four large sub-classes, and these again into fourteen or fifteen large orders. The sub-class MALACOSTRACA is the one that contains all those singular beings which we distinguish by the names of crabs, lobsters, crayfishes, prawns, shrimps, squillæ, hermit-crabs, &c. Outside this sub-class there is only one species which need occupy our attention, which is in the small sub-class MEROSTOMATA, so-called because the upper ends of their legs are furnished with masticating jaws. There are only two orders in the MEROSTOMATA, one of which is extinct, and the other called XIPHOSURA, because the tail is long and sharp like a sword. The animals which form this order are the king-crabs.

Every one familiar with books of natural history must have seen a representation of the strange animal known as the *Limulus* or king-crab. It is one of those strange organisms which come like spectres from the domain of palæontology suggesting, by the odd combination of claws, nippers, spike and shield, an offensive thing, with all the noisomeness of the spider and the venom of a scorpion. Hugh Miller has made a Romance of Geology out of such beings from the Old Red Sandstone. We don't expect to see them living now-a-days, but this one has strayed to us from remote palæozoic times. It is a survivor that claims relationship with forms belonging to the very morning of animal life. Its structure gives hints of trilobites, and it is an important connecting link with such strange creatures as *Hemiaspis* of the Upper Silurian. There is evidence that at one time there were many other orders, and that MEROSTOMATA was a sub-class which played an important part in the muddy waters of early palæozoic

times. The period is so remote that it makes us wonder to meet with even two survivors, which are all the king-crabs known to be living to the present day. The remarkable variations of the typical structure can be seen by referring to any of the recent works on palæontology, where the forms of *Prestwichia*, *Neolimulus*, and *Bellinurus*, while preserving the likeness, most curiously modify the details.

A *Limulus* shell is divided into three parts; the cephalic, the abdominal, and the sword-like tail. The head is protected above by a semicircular dome-like shield, on the upper part of which are fixed a pair of compound and a pair of simple eyes; below it has six pairs of legs, the first pair bent upwards, each having claws or nippers at the end, with masticating jaws at the base. The abdomen is protected above by a six-sided shield. Below this are six pairs of leaf-like appendages which carry gills and are used for swimming, while the first pair is an operculum which overlaps and protects the rest. To this is appended the long and sword-like tail. The Malay name is Balancar.

King-crabs are by no means uncommon in the Malaysia. I have obtained many specimens from the Malays, the largest being about two feet in length, which came from Cuyo in the Philippine Islands. It is a burrowing animal which delights to thrust its shield under the mud in shallow water. It shovels away the slime on each side of it, using its tail as a fulcrum, while its legs pick up its food in the shape of worms, small crustaceans, and other organisms, which are disinterred by its excavations.\*

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\*Mr. Alexander Agassiz writes as follows to the "Sillimans Journal":—"Mr. C. D. Walcott has called attention to the fact that when collecting fossils he finds large numbers of Trilobites on their back (Ann. Lyc. Nat. Hist., N.Y., Vol. XI., p. 155, 1875. Twenty-eighth Report, N.Y. State Museum, Dec. 1876.) From this he argues that they died in their natural position, and that, when living, they probably swam on their backs. He mentions, in support of his view, the well-known fact that very young *Limulus* and other crustacea frequently swim in that position. I have, for several summers kept young horseshoe crabs in my jars, and have noticed that besides thus often swimming on their backs, they will remain in a

Amongst the MALACOSTRACA I can only pause to consider two orders of the sub-division PODOPTHALMATA, which have a carapace, and their eyes mounted on stalks. These are STOMAPODA and DECAPODA. The former have six or eight pairs of legs, the gills are not enclosed in a cavity, and the shell is comparatively thin. The commonest example of this is the *Squilla nepa* or *Squilla mantis*, an animal which is often seen and taken for food amongst the islands of the Archipelago. It may be easily known by its zebra-like markings, and by the dactyli of the raptorial limbs being armed with six spines. The carapace is usually marked with more or less distinct longitudinal ribs. The long spines at the interior margin of the dactyli are formidable weapons and capable of giving deep wounds; it must therefore be handled with care.

The *Mantisquilla* must not be confounded with the *Pseudosquilla*, which is much smaller, and has no longitudinal ridges on the carapace, while the dactyli of the raptorial limbs are armed with three slender spines including the terminal, which is the longest. The Malays call this Hudang-laut or sea-prawn.

There is another small *Squilla* named *Gonodactylus chiragra*, which is allied to *Pseudosquilla*; but the penultimate joint of the raptorial limbs is not armed with a comb of teeth, and the dactylus is considerably dilated at the base, and is capable of giving a severe wound to those who are inconsiderate enough to meddle with these

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similar position for hours perfectly quiet, on the bottom of the jars where they are kept. When they cast their skin it invariably keeps the same attitude on the bottom of the jar. It is not an uncommon thing to find on beaches, where *Limulus* is common, hundreds of skins thrown up and left dry by the tide, the greater part of which are turned on their backs. An additional point to be brought forward to show that the Trilobites probably passed the greater part of their life on the backs, and died in that attitude, is that the young *Limulus* generally feed while turned on their backs; moving at an angle with the bottom, the hind extremity raised, they throw out their feet beyond the anterior edge of the carapace, browsing, as it were upon what they find in their roads, and washing away what they do not need by means of a powerful current produced by the abdominal appendages." *Amer. Jour. Sci.*, January 1878.



little creatures in the water. They are about three or four inches long, and of generally green colour. All the species are widely distributed throughout the oriental region, and are very common on the coral reefs of Australia. There is another species named *Gonodactylus graphurus*, equally widely distributed, but rarer; distinguished by a median keel on the sixth segment and several small prominences on the tail. There are other species besides, which I need not particularise, so let us pass to the other order or DECAPODA, which are so called because they have always ten legs, with a strong large shell, besides having their gills contained in an enclosed chamber.

The DECAPODA are divided into three tribes, viz., the Macrura or long-tailed, the Brachyura or short-tailed, and the Anomura or irregular-tailed. The Macrura include the lobsters, shrimps and prawns, which are very well represented in Malaysia. Most of the prawns have a wide range and extend even to Australia. Thus *Penaeus canaliculatus*, which is commonly seen in the markets and of large size, is common on the coast of Australia as well as the south coast of China and Japan, and extends from the Gulf of Suez on the one side to the Loyalty Islands on the other. There are five or six other species which are equally widely distributed. All kinds of prawns are called Hudang by the Malays.

The rivers of the Malay Peninsula and some of the islands have one species at least of freshwater prawn (*Palaemon ornatus?*) and probably another small species known to naturalists as *Leander natator*.

The crabs or short-tailed DECAPODA are well represented in all the waters which wash the Malayan coasts, with some land representatives as well. The Malays call them Ketam or Katam. In the Philippine dialects this becomes Catang, besides similar terms in the cognate dialects, but the spelling is liable to great variation. As articles of food, most of the species are highly valued by the natives. The methods adopted in fishing for them call for no special remark. Crab and lobster traps are used. It is in these seas that that extraordinary Brachyuran, the spinose *Parthenope* (*P. horrida*, L.) occurs. It has a singular and formidable

heart-shaped carapace, which, together with the long ponderous claws are covered with the roughest spines and tubercles. Spinose crabs are rather the rule in this region. When dredging off the Dindings almost every cast of the net brought up numbers of the long-armed and spinose species of *Lambrus*. The little smooth nut-crabs, *Leucosia* and *Myra*, were equally common from about 10 fathoms. I also found more than one species of those long slender-clawed spider-crabs (*Iphis*), with curious projections from the carapace. The spotted crab is also a denizen of these regions, known to naturalists as *Carpilius*, remarkable for the round and smooth carapace with peculiar notches and projections, huge claws and three, four, or five large round red spots. In the Straits of Malacca also occurs the tortoise-crab (*Calappa hepatica*, L.), but it is generally distributed throughout all the oriental region, extending, with *Carpilius*, *Lambrus*, *Myra*, &c., along all the coasts of tropical Australia. Indeed it may be said that with regard to the crustacea, the differences between Australia and Malaysia are not numerous, while the species common to both would make too long a list for insertion here. In the tortoise-crab the carapace is wide, extending over the limbs like a dome, and perfectly covering them, even though the claws are very large and compressed, and has a wide projecting shell on the upper margin. When squatted down, with their limbs securely housed, they are like a box. The name *Calappa* is derived from the Malay word for cocoa-nut, but according to Rumphius the crustacean is also called Cattam-bisa or the poisoned-crab.

It would be useless to attempt to enumerate all the different species of crabs that are found in this region. I may mention Ketam-batu or stone-crab, a large species, Ketam-ayam, *Neptunus pelagicus*, which is the common edible crab of Sydney in Australia, *Ranina dentata* or Ketam-Radoc, the toothed frog-crab which is said to travel on land and clamber over the roofs of houses. This last-named is one of the very grotesque forms, with a carapace like a scoop, and disproportionately small abdomen: rough, white, spiny projections on the edge of the shell looking like artificial teeth complete the curious make-up.

On the rocks of the coast we have abundance of those half land and half sea crabs, called painted crabs (*Grapsus strigosus*, or *variegatus*), which are found in all warm parts of the globe. The painted crab is seen on the very margin of the water, advancing with the receding tide or retreating before the water as it advances. Crowds of them may be observed standing on tiptoe on rocks, where the spray is dashing, while their somewhat small claws are incessantly going between the ground and their mouths. I think they live on the slimy Confervæ and small algæ, which form the green mossy coating or water marks on rocks only partially covered by the tides. They are wary creatures which keep a sharp lookout from their stalked eyes. Make any noise that you will and they go on with their feeding unconcerned; but make a slight movement and they are off with wonderful swiftness, making jumps and performing inexplicable feats of climbing and dashing in amongst the spray, as though reckless of life or limb. I imagine that it is the self-same species that we have on all the coasts of tropical Australia. It is not eaten anywhere: I know not why. Some crabs are said to be poisonous; such as the *Carpilius* and *Calappa*.

The fighting-crab or calling-crab, as the Malays have it (*Gelasimus vocans*, in Malay Ketam-pangil), is found on the mangrove and muddy flats. All who are familiar with eastern tropics must know these creatures. When the tide has receded, the mud flats are seen to be riddled with their burrows, while the owners speckle the ground with moving variegations. They have one huge yellow claw as big as their whole body, so oddly disproportionate to their size indeed, as to look as if borrowed from some larger species. I believe it has been given for digging purposes alone, and if the crab is watched it will be seen to be a very effective implement. When the animal has strutted about and fed itself, and the tide is returning, it goes to the edge of its burrow, and with one sweep of its great claw puts a goodly heap of mud on the brink, and then quietly subsiding down into the pit draws the heap of mud after it, and its place is known no more. The term calling-crab is probably from a sharp clicking noise they make, very like the cracking of a whip.

*Ocypoda ceratophthalma*, Pallas, and *O. cordimana*, Desmarest, are the names of two racing crabs, common in the Indian region, and known by the surprising rapidity with which they run sideways over the sands, or burrow into them to escape detection. Their long eye-stalks, grey colour, and swiftness of foot must serve for their identification anywhere.

When out exploring in Perak I found, at a height of 4000 ft. above the sea, a small, smooth green crab which probably belonged to the genus *Geocarcinus*. These animals are found in all tropical countries, living at some distance from the sea in burrows which they excavate near marshes or in moist forests. It is said that they feed at night, and moreover that they migrate at certain seasons to the sea to deposit their eggs; but accurate observation is needed on these points.

Amongst the long-tailed crustaceans the rock-lobster has not been mentioned, the *Palinurus fasciatus*, Fabr., of naturalists and Hudang-ondor of the Malays. When off Malacca in October, 1883, I had the good fortune to catch, with a hook and line, one of the largest specimens of this rock-lobster that I have seen. The antennæ were enormous, being over six feet long, while the variegated white and black carapace and showy spines made it one of the handsomest species of the genus. Many persons call this a crayfish, but as that term is applied to the freshwater lobsters it had better be restricted to them. It will be remembered, of course, that *Palinurus* has no large claw like the common lobster. The curious long-tailed lobster, *Ibacus antarcticus*, L., known by the wide, flat carapace, and the large and leaf-like outer antennæ and partly flexible tail-pieces, is found from India to Australia, but is not common. It is not confined to the tropics.

It need hardly be said that hermit-crabs abound on the Malaysian coast, as they do in all tropical seas, including the genera *Pagurus*, *Eupagurus*, *Diogenes*, *Calcinus*, *Cenobita* and others. Any one who has been in the tropics need not be told how exceedingly numerous the hermit-crabs are. Such a thing as an empty sea-shell is what is rarely seen. They are filled with these adventitious lodgers, but for the most part so carefully concealed that

some little skill in observation is required for their detection. Where it is possible, the hermit-crab having withdrawn within the spiral chamber of his borrowed house, closes the aperture with the larger of its claws. In the case of the shells belonging to the genus *Nerita*, the resemblance of the claw to the natural operculum is very close, but it will not bear inspection. A very slight attention reveals the lobster claw. As a matter of fact the animal tries the deception sometimes on shells that have not a shelly operculum. Many naturalists speak of the deception as if it was the result of some reasoning power on the part of the animal, but an attentive consideration of the facts would, I think, show that the animal acts in a blind manner in the matter. In a large number of cases there is no imitation of the operculum. *Nerita* seems to be the genus the shape of whose aperture especially favors it. It is also one of the commonest shells found on the beach and among the mangroves.

The soft unsymmetrical abdomen, always without calcareous plates and often with ventral appendages, is very liable to injury without some very hard protecting covering such as a molluscan shell. It seems to accommodate itself in shape to the windings of the spiral chamber, so as to hold with such a tenacious grip, that the animal can seldom be extracted without injury. Sometimes the hermit-crabs will rush impetuously out of the shells through fright, but as a rule they hide themselves as best they may, keeping perfectly quiet until an opportunity of escape seems to offer. A friend of mine once, attracted by the beauty and variety of the shells on the beach at Tanjong-kling near Malacca, collected a number of these spoils of ocean for the adornment of his room. He left them on his dressing-table at the bungalow, and when he returned after dinner they were gone. All night long his slumbers were disturbed as if a game of marbles were being played upon the floor. He made sure it was a serpent in his room, and dreaded to expose his feet to the danger of being bitten by getting out to see. It was the hermit-crabs cruising about and dragging their shells along the boards. In the morning they were found scattered all over the floor, having travelled fast and far during the night.

Finally, some mention is due to the *Birgus latro* or cocoa-nut land-crabs, which, if mentioned last, are certainly not the least amongst the crustacea. The Malays call them Ketam-calappa or cocoa-nut crab, and Ketam-canary and Ketam-mulana. In Amboyna in the days of Rumphius they were called Katattut and Atattut, I presume in the Alfura dialect. The animals are not common anywhere, and as they are very destructive to cocoa-nuts they are vigorously sought after, more particularly as they are excellent eating. Amboyna and some of the Philippine Islands are the places where they seem to be best known. They are nocturnal in their habits, and live in burrows under-ground, sometimes at a little distance from the sea, and 300 feet and more above it. As to how the cocoa-nuts are procured there are conflicting accounts. Some say that the cocoa-nut tree is climbed, which seems difficult to believe. The popular account about the animal scooping out the nut through the germinal eye is absurd. The eye is beaten out, and the shell broken away by the huge claws. The husk is first completely stripped off, and the shell nipped into pieces by the powerful pincers. A great deal of oil is at certain seasons got from the tail.

When in Borneo at Labuan, I saw large tracts of the low marshy ground dug up into heaps, which the natives informed me was done by land-crabs. I tried to get specimens but was unsuccessful.

The following is a list of crustacea collected at Singapore by Surgeon-Major Archer, supplemented by a few species found by myself:—

## PODOPHTHALMIA.

### BRACHYURA.

### OXYRYNCHA.

#### MAIIDÆ.

MAIA MIERSII, Walker (n.sp.)

ONCINOPUS NEPTUNUS, Adams and White.

DOCLEA MURICATA, Herbst.

- D. OVIS, Herbst.  
 D. TETRAPTERA, Walker (n.sp.)  
 EGERIA LONGIPES, Herbst.  
 HYASTENUS ORYX, A. M.-Edwards.  
 H. PLANASIUS, Adams and White.  
 H. DIACANTHUS, De Haan.  
 SCHIZOPHRYS ASPERA, M.-Edwards.  
 MICIPPA MASCARENICA, Kossman.  
 M. CURTISPINA, Haswell.

## PARTHENOPIDÆ.

- GONATONOTUS PENTAGONUS, Adams and White.  
 CERATOCARCINUS DILATATUS, A. M.-Edwards.  
 LAMBRUS LACINIATUS, De Haan.  
 L. LONGISPINUS, Miers.  
 L. LONGIMANUS, Leach.  
 L. PRENSOR, Herbst.  
 CRYPTOPODIA FORNICATA, Fabr.

## CYCLOMETOPA.

## CANCRIDÆ.

- ATERGATUS INTEGERRIMUS, Lamarck.  
 A. FLORIDUS, Rumph.  
 ACTEA SPONGIOSA, Dana.  
 A. AUREOLATA, Dana, var.  
 A. RUEPPELLII, Krauss.  
 XANTHO SCABERRIMUS, Walker (n.sp.)  
 LOPHOZOYIMUS EPHELITICUS, L.

## ERIPHIIDÆ.

- PILUMNUS VESPERTILIO, Fabr.  
 P. DE HAANII, Miers.

*P. LABYRINTHICUS*, Miers. ,  
*ACTUMNUS SETIFER*, De Haan.  
*ERIPHIA LÆVIMANA*, Latr., var. *SMITHII*, McLeay.  
*TRAPEZIA CYMODOCE*, Herbst.  
*POLYCREMNUS OCHTODES*, Herbst.

## CARCINOPLACIDÆ.

*HETEROPLAX DENTATUS*, Stimpson.

## RHIZOPIDÆ.

*TYPHLOCARCINUS VILLOSUS*, Stimpson.  
*CERATOPLAX CILIATUS*, Stimpson.  
*GALENE BISPINOSUS*, Herbst.

## PORTUNIDÆ.

*NEPTUNUS PELAGICUS*, L.  
*GONIOSOMA NATATOR*, Herbst.  
*G. CRUCIFERA*, Fabr.  
*G. INÆQUALE*, Walker (n.sp.)  
*ACHELOUS WHITEI*, A. M.-Edwards.  
*THALAMITA SIMA*, M.-Edwards.  
*CAPHYRA ARCHERI*, Walker (n.sp.)

## CATOMETOPA.

## MACROPTHALMIDÆ.

*GELASIMUS VOCANS*, L.  
*PODOPTHALMUS VIGIL*, Fabr.  
*OCYPODA CERATOPHTHALMA*, Pallas.

## GRAPSIDÆ.

*GRAPSUS STRIGOSUS*, Latreille.  
*PACHYGRAPSUS TRANSVERSUS*, Gibbes.  
*SESARMA BOCOURTI*, A. M.-Edwards.



## PINNOTHERIDÆ.

PINNOTHERES OBESUS, Dana.

DOTILLA MYCTIROIDES, M.-Edwards.

## OXYSTOMATA.

## LEUCOSIIDÆ.

LEUCOSIA CRANIOLARIS, L.

L. WHITEI, Bell.

L. MARMOREA, Bell.

L. HÆMATOSTICTA, Adams and White.

MYRA AFFINIS, Bell.

M. CARINATA, Bell.

M. AUSTRALIS, Haswell.

PHILYRA PISUM, De Haan.

NURSIA PPLICATA, Herbst.

OREOPHORUS RETICULATUS, Adams and White.

TLOS MURIGER, Adams and White.

ARCANIA 11-SPINOSA, Adams and White = A. PULCHERRIMA,  
Haswell.

ONYCHOMORPHA LAMELLIGERA, Stimpson.

## MATUTIDÆ.

MATUTA VICTRIX, Fabr.

M. LUNARIS, Herbst.

M. BANKSII, Leach.

## CALAPPIDÆ.

CALAPPA LOPHOS (Herbst), var.  $\gamma$ , De Haan.

## DORIPPIDÆ.

DORIPPE SIMA, M.-Edwards.

D. ASTUTA, Fabr. (young specimen).

## ANOMURA.

## DROMIIDÆ.

- DROMIA VULGARIS, M.-Edwards.  
 D. RUMPHII (?) Fabr. (young specimen).  
 CONCHÆCETES CONCHIFERA, Haswell.

## PORCELLANIDÆ.

- PETROLISTHES DENTATA, M.-Edwards.  
 P. CORALLICOLA, Haswell, var.  
 POLYONYX OBESULUS, White.  
 P. COMETES, Walker (n.sp.)  
 PORCELLANELLA PICTA, Stimpson.

## PAGURIDÆ.

- DIOGENES MILES, Fabr.  
 CLIBANARIUS VULGARIS, Herbst.  
 CENOBITA PERLATA, M.-Edwards.  
 DIOGENES AVARUS, Heller.

## GALATHEIDÆ.

- GALATHEA ELEGANS, Adams and White.

## MACRURA.

## GEBIIDÆ.

- GEBIOPSIS DARWINII, Miers.

## THALASSINIDÆ.

- THALASSINA ANOMALA, Herbst.

## SCYLLARIDÆ.

- THENUS ORIENTALIS, Herbst.

## PALINURIDÆ.

- PALINURUS ORNATUS, Fabr.

## ALPHEIDÆ.

ALPHEUS COMATULARUM, Haswell.

A. MINUS, Dana.

A. EDWARDSII, Audouin.

## PALÆMONIDÆ.

PALÆMON CARCINUS, Fabr.

## PENÆIDÆ.

PENÆUS MONODON (Fabr.), var. CARINATUS, Dana.

P. VELUTINUS, Dana.

P. AFFINIS, M.-Edwards.

ACETES INDICUS, M.-Edwards.

## STOMATOPODA.

SQUILLA NEPA, Fabr.

GONODACTYLUS CHIRAGRA, Fabr.

MOLLUSCAN FISHERY.—Though I propose in another place to deal with the mollusca of the Malaysian region, this account of the zoology would be imperfect without some reference to the trade in shells for ornamental purposes. Those who have been to Singapore in one of the mail-boats will not be likely to forget the crowds of Sampans or native boats, freighted with most beautiful corals and brightly coloured shells. They are arranged in such a manner as to be really very attractive, and probably no seas can surpass this region in the beauty, variety of form, and brilliancy of colour of its corals and shells. For a few dollars, a boat-load of these curiosities may be obtained. The species principally offered are four or five species of scorpion-shells (*Pteroceros lambis*, *chiragra*, and *scorpius*); the large conch shell (*Triton maculatus*), the thorny wood-cock (*Murex tenuispina*), besides *Murex haustellum*, *palma-rosæ*, *adustus*, *saxatilis*, and others. About ten species of cone are commonly offered, all brightly coloured, and notably the marbled cone (*Conus marmoreus*). *Voluta vespertilio*, *Mitra episcopalis*, and *M. vulpecula* are always offered in abundance

with large and very finely shaped or colored specimens of *Fusus*, *Pleurotoma (babylonica)*, *Melo*, *Ranella*, *Terebra* or augur-shell, and *Turbinella cornigera*. The finely enamelled and brilliant cowries and olives are, of course, numerous, notably *Cypræa tigris*, *histris*, *argus*, (rarely) *arabica*, *mappa*, *annulus* (very common), and *Ovulum ovum*. The olives are confined to one or two species, such as *O. irisans* and *O. oryza*, but they are served out in bushels in beautiful preservation, with abundance of *Naticas* and *Neritas*; *Nerita costata*, *atropurpurea*, *polita* and *albicilla*. *Trochus niloticus*, and *Turbo marmoratus* are also common, and, together with the nautilus shell, often deprived of the outer shelly coat, which is chipped off with ruthless vandalism to display the nacreous interior. The bivalve shells are well represented by the clams, *Hippopus maculatus* and *Tridacna squamosa*, always abundant and of large size; the beautiful *Pecten pleuronectes* (both the thin red and white porcelain varieties) is common, with *Placuna placenta* which is used instead of glass in the window-frames in the Philippines, Macao, &c.; and the clumsy-looking *P. sella* in all the glories of its gold and purple nacre. Curious pinnæ, mussels, cardiums and pearl oysters must complete this list, which has only partly enumerated the conchological splendors of the Malayan region.

CORALS.—A great number and variety of corals are exposed for sale along with the shells, including, of course, a large proportion of branching Madreporæ, such as *M. secunda*, *abrotinoides*, *nobilis*, *echinata*, *acervata*, *arbuscula* or *rosaria*, *appersa*, *conigera*, *brachiata*, *plantaginea*, *subulata*, *spicifera*, *securis*, besides a good many encrusting species. The Fungia or mushroom corals are very abundant, including *F. patella*, *danæ*, and *echinata*, with *Herpetolitha limax* and *Polyphyllia pelvis*. The large cup-shaped *Turbinarias* are abundant, with the usual cespitose tufts of *Seriatopora*, *Pocillopora*, the thorny *Mussas*, besides numerous brain-corals, *Favia*, *Symphyllia*, *Astræa*, and other meandroid LITHOPHYLLACÆA. *Galaxea astræata* is plentiful; and one day, when fishing off the Dindings, my line became entangled with a

large specimen of *Dendrophyllia nigrescens*, which is stated to be a Fiji species. At one time it was my intention to form a list of the species which might be considered peculiar to Singapore, but I soon found that there is absolutely no appreciable difference between the coral faunas of Singapore, the great Australian Barrier Reef, the Fiji Islands, and the islands of the Pacific. There may be local species, but these are only few in number. A good number of Malays are employed in gathering corals from the reefs, which they bleach and sell, mostly to the passengers on the mail boats.

PEARL SHELL AND PEARL FISHERIES.—The eastern region has always been famous for its pearl fisheries; but more in the direction of the Aru Islands, New Guinea, and so on towards Australia, and the Sooloo Archipelago than the Indian Archipelago proper. Mother-of-pearl oysters have always been a valuable export from the Philippine Islands. Speaking of the Aru Islands, Mr. Earl says ("Jour. Ind. Archip." Vol. IV., p. 490): "But the great sources of wealth are the pearl and tripang banks which lie on the eastern side of the group, and are often several miles in width, being intersected by deep channels, some of which will admit vessels of burthen. The tripang or sea-slug is of several varieties. The greater portion is caught in shallow water, where it can be picked up off the bank without diving. The pearl oysters are of two varieties. 1st. The large oyster, with a strong thick shell, from six to eight inches in diameter, which furnishes the mother-o'-pearl shell of commerce. These are obtained by diving, and are highly prized, being nearly always in demand at Singapore for the European and Chinese markets. This oyster produces few real pearls, but certain gnarled, semi-transparent excrescences are occasionally found on the surface of the inner shell, which are so highly esteemed by the Chinese that they often attain enormous prices. The other description is the small semi-transparent pearl oyster, having the inner surface of the shell of a bluish colour (probably a *Unio*). The shell is of small value as an article of commerce, but the oyster itself often

contains pearls which, although individually of no great value, are so numerous as amply to repay the labour of collection. Pearls of sufficient size to undergo the process of boring are sometimes found, but the greater portion are what go by the name of sea-pearls, and are only marketable in China, where they are much valued when pounded and mixed with some liquid, as a medicine."

The Sooloo Archipelago has, for some hundreds of years, enjoyed a reputation for its pearl-fisheries. Barbosa, who wrote in Lisbon in 1516, referring to a time about five years earlier, says "Leaving Cipit to the east we saw to the west two islands called Zolo and Taghima. Near these islands grow pearls. The two pearls of the King of Borneo, of which I have spoken, were found here." (Primo Viaggio, p. 125).

When in Sulu in November, 1885, I had an opportunity of seeing something of the pearl-fisheries. The principal dealers are the Chinese, who sometimes have some fine specimens to offer for sale. All that I saw were beautifully round, and of fine golden colour, for which a fair price was asked. The island may be said to be an emporium for pearl-shells and pearls. The stores where they were offered for sale were those of general dealers, a combination of grocers and provision merchants, while seemingly ready to buy and sell everything like all Chinese shopkeepers, who are traders to the manner born. They had large stocks of shell, which they were ready to retail by weight at a price which would make a pair cost about a dollar and a half. The pearl oysters of this region may be known by the peculiar rich golden color of the nacre. The island is used as a convict station by the Spaniards for Indians and Mestizos. Many of these gain a livelihood by painting or carving upon them rough representations of the Last Supper, the Crucifixion, and other Scriptural subjects. As the waters round the island are unusually deep, the fishery requires divers of astonishing powers of endurance. I will not venture to repeat the stories that I have heard on this subject. A diver will frequently bring up about 30lb. of shell. I need not describe the methods adopted, which are well known. From the Island of Labuan, also, pearls are sometimes sent to Singapore to the value

of about £11,000 per annum; but latterly the trade has much declined. The price of pearls varies very much. The quotations available give for a good round white pearl of three grains about 17s. to £1, and one of thirty grains from £85 to £100.

**OTHER SHELLS.**—The trade in shells as curios has already been referred to, but there is still a small commerce in shells for manufacturing and useful purposes, such as—(1) Nacreous shells for buttons, brooches, and similar useful articles; (2) iridescent shells for inlaying work; (3) small shells for shell-flowers, basket-work, ladies' ornaments; (4) cameos; (5) domestic articles.

For some of these uses the Straits Settlements could secure an extensive trade as far as nacreous shells are concerned, and some of the smaller ornamental kinds, particularly the porcellanous cowries. Quite recently a highly fashionable ornament for ladies has been manufactured in France from the beautiful scarlet and black *Strombus luhuanus*, which is one of the commonest shells in the Archipelago, and might be shipped therefrom by tons. Cameo shells of a fine character might be found in the very common *Murex saxatilis*. A valuable export might also be obtained from the opercula of certain Turbos (used for studs, sleeve-links, &c.), and in the larger clam-shells (*Tridacna gigas*, and *squamosa*, *Hippopus maculatus*, &c.), and the common large cones (*Conus litteratus* and *millepunctatus*).

**CUTTLE-FISH.**—Cuttle-fish are consumed in the Malayan region as amongst all the Easterns where they can be caught; but they do not appear to be nearly so abundant as on the Chinese and Japanese coasts. The Chinese fishermen in the Straits use for their capture a set of hooks like the arms of a chandelier, made fast round a piece of wood with a sinker to which the line is fastened. The hooks are long and very sharp, but without barbs. The bait, which is generally a crustacean, is fastened to the centre-piece, and the Cephalopods are taken below by the hooks as they bite at it. A cuttle-fish boat, for there are special craft for the fishery, is one of the most interesting sights which the fishing industry affords. The capture is effected by means of a net, at

night time, the fish being attracted by lights and fires. They are lightly salted, pressed and sun-dried. All kinds are eaten, but the best is the little *Sepiola*, which is really a dainty morsel when properly cooked.

NOTE ON THE AERIAL RESPIRATION OF FISHES.— Professor Jobert of Dijon, who was lately engaged in making some zoological investigations in Brazil, at the instance of the Emperor Don Pedro, has ascertained some exceedingly remarkable facts in connection with the respiration of certain fishes. A Siluroid fish which inhabits the neighbourhood of Rio de Janeiro (*Callichthys asper*) and is noted for its power of living a long time out of the water, was found by him to swallow small portions of air, from which it partly absorbs the oxygen by the agency of the walls of the intestinal canal; the carbonic acid formed and the unabsorbed nitrogen passing away by the anal aperture. On examining the structure of the intestine, Professor Jobert found its inner surface bearing a multitude of filiform appendages arranged in tufts and composed essentially of blood-vessels.

A somewhat analogous case was observed in several other fishes inhabiting the valley of the Amazon. They live in stagnant water the temperature of which often exceeds 104° F.; but this does not appear to be sufficient to support their respiration, and they are obliged to come frequently to the surface for a supply of air. Sometimes also, the water in which they have been living is dried up, when they are seen making considerable journeys by land in search of more favourable localities, crawling on the ground by means of their pectoral fins. Some of these are species of *Callichthys*, and like the *C. asper* of Rio de Janeiro, they possess a double respiration—respiring the air contained in the water surrounding them by means of their gills, and also the atmospheric air which they swallow, and which passes through their intestine. The escape of the exhausted air from the anal aperture of these fishes is said to produce a constant bubbling in the water which they inhabit, and M. Jobert's investigations, though imperfect, sufficed to convince him that the air evacuated contained much



carbonic acid, and less oxygen than atmospheric air. The vascular tufts clothing the wall of the intestine originate from adjacent veins in the same way as the afferent vessels of a lung. Species of *Doras* and *Hypostomus* inhabiting the Upper Amazon, respire air in the same way as the *Callichthys*, but in the *Hypostomi* the used air is returned towards the mouth, and escapes by that orifice or by the branchial apertures.

In *Sudis gigas* and some species of *Erythrinus* aerial respiration takes place by the agency of the swimming-bladder, which in the latter, has long been known to communicate with the outer world through the œsophagus, and to be furnished internally with numerous cells formed by membranous folds. Prof. Jobert finds that the walls of the swimming-bladder, including all these folds, are richly provided with blood-vessels, mostly originating from the venous system, and that it is thus converted into a true lung, by the possession of which the fishes are enabled to live for a long time out of water. Of the reality of this respiration Prof. Jobert convinced himself experimentally by obstructing the air-duct leading to the bladder; the fish soon died by suffocation. These observations are particularly interesting as establishing further bonds between the true fishes, the *Lepidosiren*, and the perenni-branchiate *Batrachians*, which possess at the same time branchiæ and true lungs. (*Comptes Rendus*, Ap. 15, 1878).

NOTE ON THE GARUM OF THE ANCIENTS.—Crawford appears to have quoted second-hand, so it may be of interest to show what the ancients said on the matter. There is a good deal explained by the elder Pliny in Book XXXI., chapter 44, and a doubtful reference in Horace, 8th Satire, line 46. The following is what Pliny says:—

“Another liquor, too, of a very exquisite nature is that known as *Garum*. It is prepared from the intestines of fish and other portions of offal, macerated in salt, and in fact it is the product of their putrefaction. *Garum* was formerly preserved from a fish called ‘*Garos*,’ by the Greeks.”

This word "Garos" occurs again in Book XXXII., chap. 53, where Pliny gives the names of all the animals that exist in the sea, 176 in number. Like the majority of the names enumerated there, Garos has not been identified. By a strange coincidence the Malay word for salt at the present day is Garam, and it is just possible that we may trace in this an Indian origin for the condiment. Just as our word indigo, from the Latin *Indicum*, asserts the Indian origin of the pigment brought from the East amongst the Greeks and Romans; and the Sanscrit names for elephant, ivory, monkey, and peacock amongst the Hebrews, tell us of the intercourse between the Hindoos and Jews in ancient times, and the country from which these animals were derived; so the word Garum in Latin and Garos in Greek traces the origin of this classico-oriental condiment. Now the Sanscrit word for salt is "Sara," and this word is represented in the Malay "Garam," the Roman "Garum," and the Greek "Garos," and even the Javanese "Trasi." For the natives of South Celebes use for salt the word "Gara" and "Sela." In Sulu the term used is "Gasi;" in Buru (North Moluccas), "Sasi;" in Gilolo, "Gasi;" in Amboyna, "Tasi;" in some small islands south-east of the Moluccas (Matabello), "Sira."

But let us go on with Pliny, and finish with what he says about Balachan. "At the present day, however, the most esteemed kind of Garum is that prepared from the Scomber in the fisheries of Carthago Spartasia; it is known as 'Garum of the allies,' and for a couple of congii we have to pay but little less than one thousand sesterces. Indeed there is no liquid hardly, with the exception of the unguents, that has sold at higher prices of late; so much so, that the nations which produce it, have become quite ennobled thereby. There are fisheries too of the Scomber on the coasts of Mauretania, and at Carteia on Bœtica, near the Straits, which lie at the entrance to the ocean; this being the only use that is made of the fish. For the production of Garum, Clazomenæ is also famed, Pompeii too, and Leptis; while for their Muria, Antipolis, Thurii, and of late Dalmatia, enjoy a high reputation.

In Chapter XXXIV. in the same book, the following passage occurs: "Alex,"\* which is the retuse of Garum, properly consists of the dregs of it when strained; but of late they have begun to prepare it separately, from a small fish that is otherwise good for nothing, the Apua of the Latins or Aplaissæ of the Greeks, so called from the fact of its being engendered from rain. The people of *Forum Julii* (the present Frejus in the south of France) make their garum from a fish to which they give the name of Supus. In process of time Alex has become quite a luxury and an infinite number of various kinds is prepared. Garum also is manufactured of a color to imitate old honied wine, and flavored so that it can be taken as a drink. Another kind again is dedicated to those religious observances which enjoin strict chastity, † and that prepared from fish without scales is used." ‡

Pliny makes other references to Garum, as for instance, in Book IX., Chapter XIX., in a passage which enables us to identify the fish which he names Scomber in the preceding quotation.

"All kinds of fish grow with remarkable rapidity, and more especially those in the Euxine; the reason of which is the vast number of rivers which discharge their fresh water into it. One fish, the growth of which is quite perceptible, day by day, is known as the Amia. These fish and the Pelamides, together with the Tunnies, enter the Euxine in shoals, for the purpose of obtaining a sweeter nutriment, each under the command of its own leader, but first of all the Scomber appears, which is of a sulphurous tint when in the water, but when out of it resembles other fish in colour. The salt water preserves of Spain are filled with these last fish, but the Tunnies do not consort with them."

In Book IX., chapter 30, there is another reference to Garum. Pliny is writing of the various kinds of Mullet, and he

\*Qy.—*αλυκη* (?) written also hellex, a pickle or brine, or a salt liquor at the bottom of salt-pits? Cato uses the term Alex also for a small fish.

†In the festival of Ceres, the votaries were obliged to abstain from meat, but were allowed the use of Garum.—Dr. Bostock in the "Sacred Rites of the Jews."

‡This is probably a mistake of Pliny's, as the Jews were not allowed to eat fish without scales. See Lev., Chap. XL, Ver. 10.

says:—"The masters in gastronomy inform us that the Mullet when dying assumes a variety of colours and succession of shades, and that the hue of the red scales, growing paler and paler, gradually changes, more especially if it is looked at enclosed in glass. M. Apicius, a man who displayed great ingenuity in all that related to luxury, states that it is a most excellent plan to let the Mullet die in the pickle known as the 'Garum Sociorum;'"\* for we find that even this has found a surname; and he offered a prize for anyone who should invent a new sauce made from the liver of this fish. I find it much easier to relate this fact than to state who it was that gained the prize.

In Book XX., chapter 23, treating of garlic, he says that it is a remedy for leprosy when reduced to ashes and applied as an ointment with oil and garum.

Horace refers to Garum in the 8th Satire, line 46. This poem, as most readers will remember, relates the particulars of the supper given by Nasidienus to Maecenas, Horace, and some of his friends. In the conversation a contemptuous description of the fare is given, with ridiculous comments from the host by way of making every dish pass for something extraordinary. Speaking of a lamprey he says:—

"His mistum jus est oleo quod prima Venafri  
Pressit cella, Garo de succis piscis Iberi,  
Vino quinquenni, &c;"

Or, this sauce is of the primest Venafrian oil mixed with Garum, made from the juice of Spanish fish, five-year-old wine, &c." Commentators vary in their interpretation of the passage. Some say that the Garum was a juice or pickle of certain fishes called Gari which were suffered to dissolve in salt. It is, however, a gratuitous assumption that there ever were such fishes, and if there were it is hard to believe that they were so very soft as to let themselves be dissolved in brine. It is difficult to reconcile this with any kind of evolution which made them salt-water fishes:

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\* Bostock and Riley translate this expression as "Garum of the Allies," but I prefer to leave it as it is, regarding it as a popular name for the sauce in question.

Others translate the *Garum* and the Spanish fishes by the words Spanish Mackerel, and they bolster up the assumption by stating that these fishes were, or are, very common on the Spanish coast. There is no ground that I know of for the statement; Mackerel have no more right to be called Spanish than Finnish. It is to be hoped that this specimen of classical criticism is not a sample of the whole.

The word is found in Greek lexicons also as *γάρον* and *γαρος* translated *garum*, or a pickle of fish made with salt.

To sum up: the result of these quotations seems to be beyond all doubt, that the *Garum* or *Garos* known to the Romans and Greeks was a sauce composed of fish preserved in brine. It must have been very like the Indian *Balachan*, which is partly fluid, from the fish of which it is composed being allowed to ferment and disintegrate. There appear to have been different kinds amongst the ancients. The word *Garum* is, no doubt, of Sanscrit origin derived from the name of sauce or pickle, represented in Malay and its dialects in the present day by the same, or nearly the same designation.

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Professor Stephens of the Sydney University has added at my request the following note:—

It may seem at first sight so improbable that a Malay word should have gained a footing in the vocabulary of Greek and Latin cooks or epicures, that it may be worth our while to consider very briefly the circumstances of the case. The earliest mention of "*Garum*" is made by Cratinus, in the fifth century before the Christian era (apud Ath. II., xxv., 75), "Your basket shall be filled to the rim with *Garum*." Pherecrates, about the same date has "He got his beard with the *Garum* all befouled" (Ath. l.c.). Sophocles (ibid.), "Of the *Garum* of salt fish." Plato, the comic dramatist, "With stinking *Garum* will they drench and smother me." Another passage is quoted by Athenæus from Æschylus, to show that the noun might be masculine or neuter (*γάρος* or *γάρον*). In like manner Pliny uses both *Garos* and *Garum*, H.N., XXXI.,

43-44. This uncertainty as to the proper form points to a foreign origin for the word, for which an otherwise unknown fish, γάρος, is evidently invented to account. Pliny (l.c.) also gives a string of confused notes upon the subject, taken as it seems from his commonplace book, and set down with several errors, omissions, and misplacements. It is, however, plain from this author, as well as from allusions in Horace and Martial, that *Garum* was obtained from the Spanish peninsula, and mainly at Carthage. It was believed to have been originally made, like the Italian *Halec*, of small fish, but finally at least the best quality of *Scomber*. This is certainly not Mackerel, but according to Pliny's description, H.N., IX., 19, perhaps the *Coryphæna*, commonly called Dolphin. This looks like the advertisement of a manufacturer. The splendour of colour for which this fish is renowned would to a Roman imagination assuredly suggest some more exquisite flavours than could be found in more homely fish, and this prejudice the foreign pickle merchant would of course turn to his own advantage. Anyhow, it is plain that the Romans knew nothing for certain about its manufacture, but that they obtained what they called *Muria*—made from Tunny—from Byzantium; that *Halec* was prepared in Italy from all sorts of fish, and that *Garum* was regarded as infinitely superior to either. The Phœnician origin of Carthage, and the Eastern commerce of the Phœnicians, reaching as far as Ceylon and Malacca,\* might reasonably account for the introduction of an Oriental term into the dictionary of trade; and since the word is evidently foreign to Latin and Greek, the hypothesis of a Malay origin for *Garum* seems probable enough.

*Note.*—A description of the mode of manufacture is, it must be observed, given in the "Geoponica," at the end of Book XX.; but the work, compiled about A.D. 800, is of slight authority, and is practically anonymous; although, indeed, the account tallies well with the quotation given above from Cratinus, which contains the first mention of the word.

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\* For the ancient commerce of Ceylon, see "Heeren's Asiatic Nations," Vol. II., Appendix XI.

EXPLANATION OF PLATES.  

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- Fig. 1. *Harpodon nehereus*, C. and V. (The Bombay Duck).  
2. *Mastacembelus armatus*, Lacep.  
3. *Ophiocephalus micropeltes*, C. and V.  
4. *Arius cœlatus*, C. and V. (a Siluroid).  
5. *Periophthalmus koelreuteri*, Pall. (Hopping Fish).

NOTE.—The above figures are copied from Day's Fishes of India.

1844

1845

(1846)

1847

1848

1849

1850

1851

1852

1853

1854

1855

1856

1857

1858

1859

1860

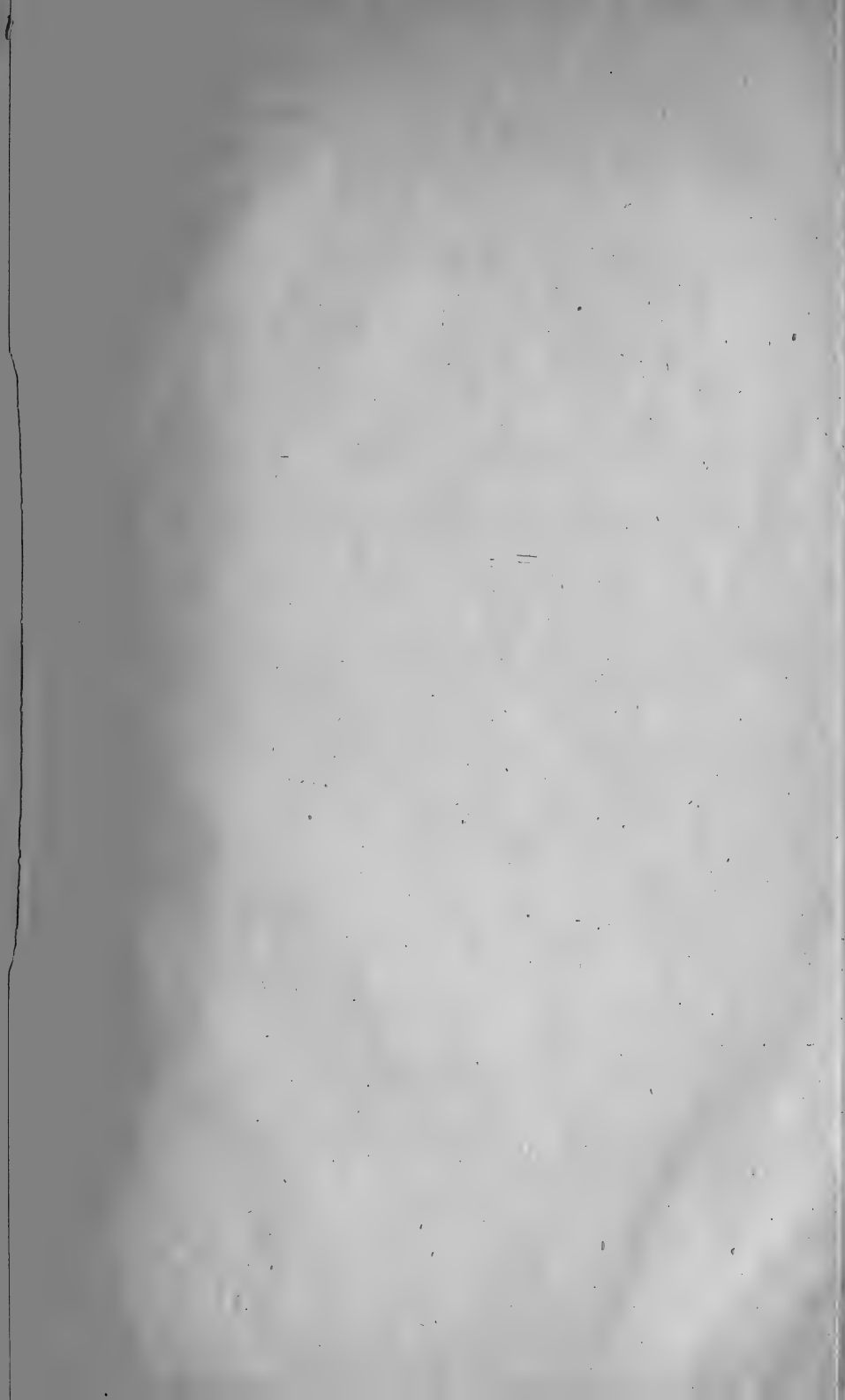
1861

1862

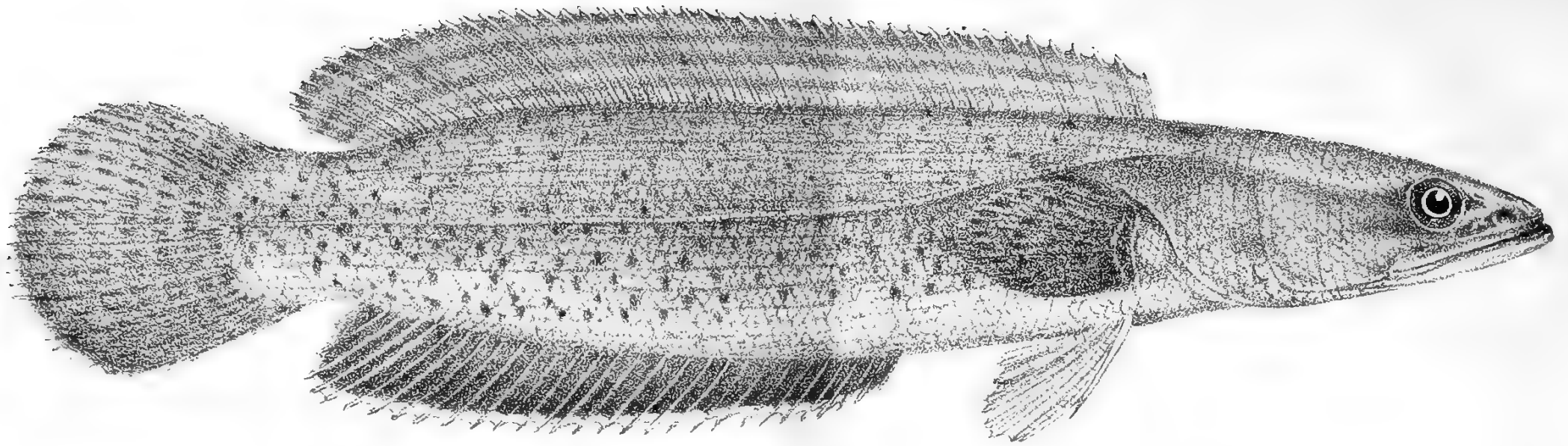
1863

1864





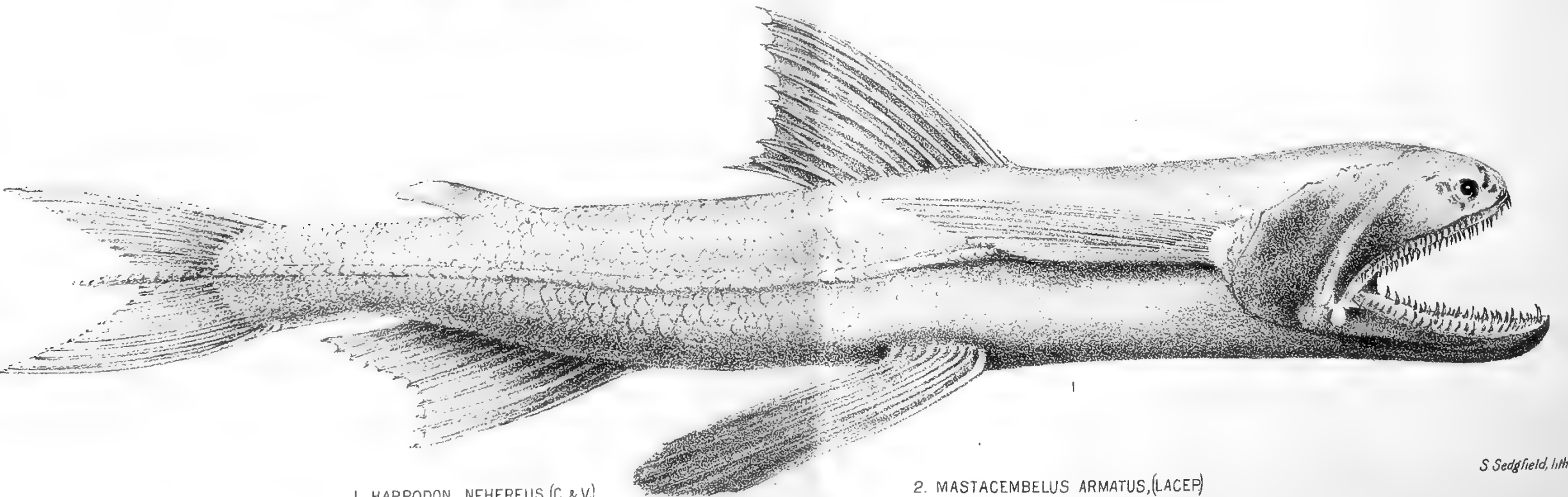




3



2



1. HARPODON NEHEREUS, (C. & V.)

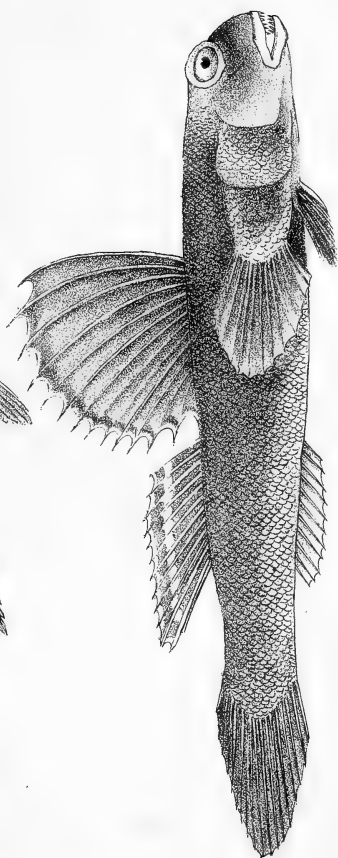
3. OPHIOCEPHALUS MICROPELTES, (C. & V.)

2. MASTACEMBELUS ARMATUS, (LACEP)





4



5

4. *ARIUS CŒLATUS*, (C. & V.)  
5. *PERIOPHTHALMUS KOELREUTERI*, (PALL)

*S. Sedgfield, lith.*











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