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THE GREAT BARRIER REEF OF AUSTRALIA;

ITS PRODUCTS AND POTENTIALITIES.

BY

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CONTAINING—

AN ACCOUNT, WITH COPIOUS COLOURED AND PHOTOGRAPHIC ILLUSTRATIONS (THE LATTER HERE PRODUCED
FOR THE FIRST TIME), OF THE
CORALS AND CORAL REEFS, PEARL AND PEARL-SHELL, BÊCHE-DE-MER,
OTHER FISHING INDUSTRIES, AND THE MARINE FAUNA
OF THE
AUSTRALIAN GREAT BARRIER REGION.

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been reproduced here, viz., a view of the low sand cliff immediately facing the beach on Sweer's Island, where the specimens just described were collected. As since ascertained, it was the subject of observation by Captain King, and is referred to in Vol. II. of his "Surveying Voyage to Australia." The composition of the cliff is described by Captain King as "a stalactite concretion of quartzose, sand, and fine gravel, cemented by reddish carbonate of lime." The aspect of this cliff is very singular, its exposed face being, as it were, evenly fluted, and composed of closely-aggregated sand tubuli, which are continued perpendicularly through the substance of the cliff, such structure giving detached portions of the mass, when viewed vertically, a coarsely-honeycombed appearance. Some twenty years ago Sweer's Island was visited by a devastating hurricane, which well nigh wrecked the homestead established there, and during it this cliff, ranging from ten to twenty feet in height, was more or less completely submerged. Similar invasions of the sea have, no doubt, occurred at irregular intervals throughout many centuries. These cataclysmic inundations, supplemented by the showers of spray thrown abundantly on the face and shore borders of the cliff by ordinary storms, amply account, taking into consideration the lime-saturated and cementing properties of the sea-water, here attested to, for this remarkable aggregation of lime and silica. The action of the latest hurricane, and accompanying inundation, it may be here mentioned, was to undermine an extensive area of the face of the cliff, to such an extent, that a large portion has fallen down and lies scattered in huge, heaped-up blocks at high-tide level. A little way inland, out of the reach of the sea and spray, the stratum of siliceous sand and ironstone gravel occurs without any admixture of carbonate of lime.

PLATE XXXIII.

(A.)—OUTER BARRIER REEF, WITH SUBMERGED BÈCHE-DE-MER.

This reef-scene is taken from an area closely abutting upon the one (Plate XXIX.) illustrating the natural habitat of the Giant Clam-shell, *Tridacna gigas*. The specimens of Bêche-de-mer, dimly visible through the water in the foreground, towards the left, are what are known as "ordinary Red-fish," *Actinopyga obesa*, one of the most valuable commercial species. The several small fishing vessels discernible on the distant horizon represent the description of shallow-draught craft most commonly employed in this fishery, and manned with native crews, by whom a clean sweep will presently be made of the many thousands of Bêche-de-mer, similar to those in the foreground, scattered over the vast surface of the reef. There is a conspicuous coral-growth in this reef-view that does not enter into the composition of the preceding plates. This is represented by the obtusely-lobed, or clavate, masses nearest to the front on the left-hand side, and by an isolated corallum in the lower right-hand corner. This species, *Alveopora retusa*, is remarkable for the extremely porous, almost lace-like, delicacy of its superficial corallites.

The polyps which secrete it closely resemble those represented in Chromo plate No. VIII., Fig. 3, being delicate apple-green in hue, and protrusible to long distances beyond their coral basis. A little to the rear of the larger colony-stock of this species are several corymbiform coralla of the brilliant lilac *Madrepora gemmifera*.

(B.)—LADY ELLIOT ISLAND REEF, WITH EXTENDED BÈCHE-DE-MER.

Lady Elliot Island reef, delineated in this plate, is interesting, in addition to the associated Bêche-de-mer, on account of its belonging to the most southern coral islet of the Great Barrier system. It lies in lat. $24^{\circ} 5''$ S., a little south of Bustard Head, is elevated some eight or ten feet only above high-tide line, and is the site of a substantial lighthouse. The corals entering into the composition of the reef include a number of species identical with those recorded in association with the Port Denison reefs; *Madrepora millepora*, *Pocillopora damicornis*, *Lophoseris cristata*, and a species of *Cæloria* being most conspicuously visible. Long-spined Diademæ and Frilled Clams, *Tridacna compressa*, referred to in association with the Palm Islands reefs, were abundant on this reef.

The attenuate, fully-extended Bêche-de-mer in the foreground of this picture represents one of the commonest Barrier Reef species, *Holothuria atra*. It is, unfortunately, of little commercial use, shrinking up to an almost hollow skin when boiled and smoked in the ordinary manner; but it is, nevertheless, occasionally blended in small quantities with the better sorts by unscrupulous dealers. It is possible, with the aid of the hand-lens, to distinguish the individual outstretched tentacles of the specimen here illustrated. As may be observed, its hinder extremity is inserted within a crevice of the coral rock, into which, on being disturbed, it speedily retreats. In like manner it not unfrequently happens that a dozen or more individuals of this species may be seen protruded to their full length from beneath a hollow coral rock. Such abundant development of the species is, however, most conspicuous farther inshore, where there are but few growing corals, and where the reef is strewn with rock masses torn off and transported from the outer edge of the reef. In all cases, as in the specimen here illustrated, the extended bodies are seen to lie in shallow water.

PLATE XXXIV.

VARIETIES OF TREPANG OR BÈCHE-DE-MER.

This plate illustrates the life aspects of three species of Trepang or Bêche-de-mer, two of which, Nos. 1 and 3, are extensively collected and prepared for the Chinese market, while No. 2 is disqualified in the same manner as the variety associated with the preceding plate, in

THE GREAT BARRIER REEF.

consequence of the tenuity of its muscular layers, which shrink to unprofitable proportions in the curing process. Like that form, however, it is occasionally mixed among the better kinds, to augment their bulk. No. 1, *Holothuria sanguinolenta*, much resembles, at first sight, the black species extended in the foreground of the Lady Elliot Island reef-view. It differs from it, however, in several essential respects. In the first place, it does not discharge, when irritated, a stream of cottony-white adhesive filaments, "Cuvierian organs," as does its ally. On the other hand, it exudes a purplish fluid from the surface of its integument when handled roughly. The popular title assigned to this variety of Bêche-de-mer is that of the "Small Lolly-fish." The origin of the title is somewhat obscure, but the name has been apparently applied to it in respect of its near resemblance to an allied species, *Holothuria vagabunda*, known as ordinary, or "Large Lolly-fish," found more plentifully on the outer reef-areas, whose skin surface, when dried, presents the appearance of being divided into roughened lozenge-shaped areas. ♦

The second species of Bêche-de-mer figured, *Holothuria (Bohadschia) argus*, is remarkable for its conspicuous colour ornamentation. The ground tint in this variety is usually bright lilac, superimposed on which tint are chain-like series of rounded or ovate spots of a golden-brown hue; these spots are commonly encircled by a dark-brown inner line and a whitish outer line. No two individuals, however, are precisely similar in their pattern of decoration. A coloured illustration of the species is given in Fig. 7 of Plate XII. of the chromo-lithographic series. Like the common black inshore *Holothuria atra*, it discharges a copious stream of tenacious cotton-like filaments when handled, and is of but little commercial use.

The third species illustrated in Plate XXXIV. represents the most valuable marketable variety. The commercial title applied to it is that of the "Teat-fish," the name having reference to the series of mammiform excrescences developed along each side; these are most conspicuous in living examples, but are also more or less prominent in the cured fish. With reference to the peculiar tooth-like armature of the vent, this Bêche-de-mer is referable to the genus *Actinopyga*; and, in the absence of any discoverable prior intelligible specific description, it is here associated by the author with the combined generic and specific titles of *Actinopyga mamillata*.

PLATE XXXV.

VARIETIES OF TREPANG OR BÊCHE-DE-MER.

Of the two species of *Holothuriæ* or Bêche-de-mer illustrated by this plate, the upper figure represents a type, *Holothuria coluber*, or the snake-like Bêche-de-mer, that much resembles in aspect and general habits the common black *H. atra*, previously referred to. It may easily be distinguished from that form, however, by the pale primrose-yellow tint of the extensile tentacles, and by the fact that it does not discharge cotton-like Cuvierian filaments when irritated.

Its muscular tissues are at the same time, as in the above-named species, so thinly developed that it yields no profit to the curer. A coloured illustration of the anterior portion of this species, with its characteristic primrose tentacles, is given in Chromo plate No. XII.

The second or lower figure in Plate XXXV. illustrates one of the largest and most remarkable of the Barrier series. The specimen when photographed from life was in a contracted state, and is represented less than one half of its natural size. When fully expanded and distended with water it is not unfrequently three or four feet long, and some six or seven inches broad. Its whole dorsal and lateral surfaces are beset with somewhat rosette-shaped or stellate outgrowths of the substance of the integument; these, in their attenuated and flaccid condition, when the animal is lifted freshly from the water, impart to it a fleecy aspect, which renders the organism appropriately comparable to a washed-out strip of a sheepskin doormat. On contraction, as shown in the illustration, these fleshy appendages exhibit clearly an irregularly stellate contour, and are of the same leathery texture as the integument from which they spring. When dried and cured, these appendages assume the aspect of short pointed thorns, and the species is hence known in the trade by the suggestive title of "Prickly" or "Red Prickly-fish," the longer name serving to distinguish it from an allied form denominated "Green Prickly." *Stichopus variegatus* is the scientific appellation of the Red Prickly-fish, and was conferred upon it with relation to specimens originally collected in the South Sea Islands. The colours of this Bêche-de-mer, while subject to an extreme range of variation, are usually associated with a distinctly reddish ground tint, as particularised in the chapter dealing specially with this animal group. Reference may be also made to that chapter for an account of the incident which led to this Bêche-de-mer, once the most valuable of the Barrier Reef species, commanding of late years a very low figure in the Chinese market.

PLATE XXXVI.

NATIVES OF WARRIOR ISLAND, TORRES STRAIT, PREPARING BÊCHE-DE-MER
FOR THE CHINESE MARKET.

This plate constitutes a fitting accompaniment to the descriptive account given in a subsequent chapter of the processes employed in preparing and curing the famous Barrier Reef Trepanng or Bêche-de-mer for the Chinese market. The scene is at Tud or Warrior Island, once noted for the warlike prowess of its native chieftains, and now one of the most important headquarters of the Bêche-de-mer fishing industry. Situated a little to the north of the centre of Torres Strait, it commands access to the productive Warrior reefs, which extend to within ten miles only of the New Guinea coast. Among the apparatus and appliances conspicuously visible in the accompanying illustration may be noticed the two large cauldrons in which the "fish" are boiled—literally "stewed in their own juice." From the cauldrons they are ladled out with the long-handled net lying on the ground in front of them. The fish are then ready

for manipulation by the natives, who slit them open with a sharp knife and remove the viscera. They are then spread out in the sun for a short interval, previously to being carried to the smoke-house, some of the larger specimens, "Teat-fish," more particularly, being pegged open with short wooden skewers. This is the particular stage of the process represented in Plate XXXVI. Among the other accessories visible in this illustration, attention may be directed to the native bamboo pipe lying, end on, midway between the two figures on the right-hand side, first filled with tobacco smoke by one of the aboriginal belles, and then circulated, after the manner of a "loving cup," among the assembled company. Farther towards the foreground, in the same straight line, is a utensil of universal use in Torres Strait. This is the so-called "Bailer-" or Melon-shell, *Cymbium aethiopicum*, commonly carried in the native canoes for bailing out sea-water, and put to almost as many uses as an Indian gourd.

PLATE XXXVII.

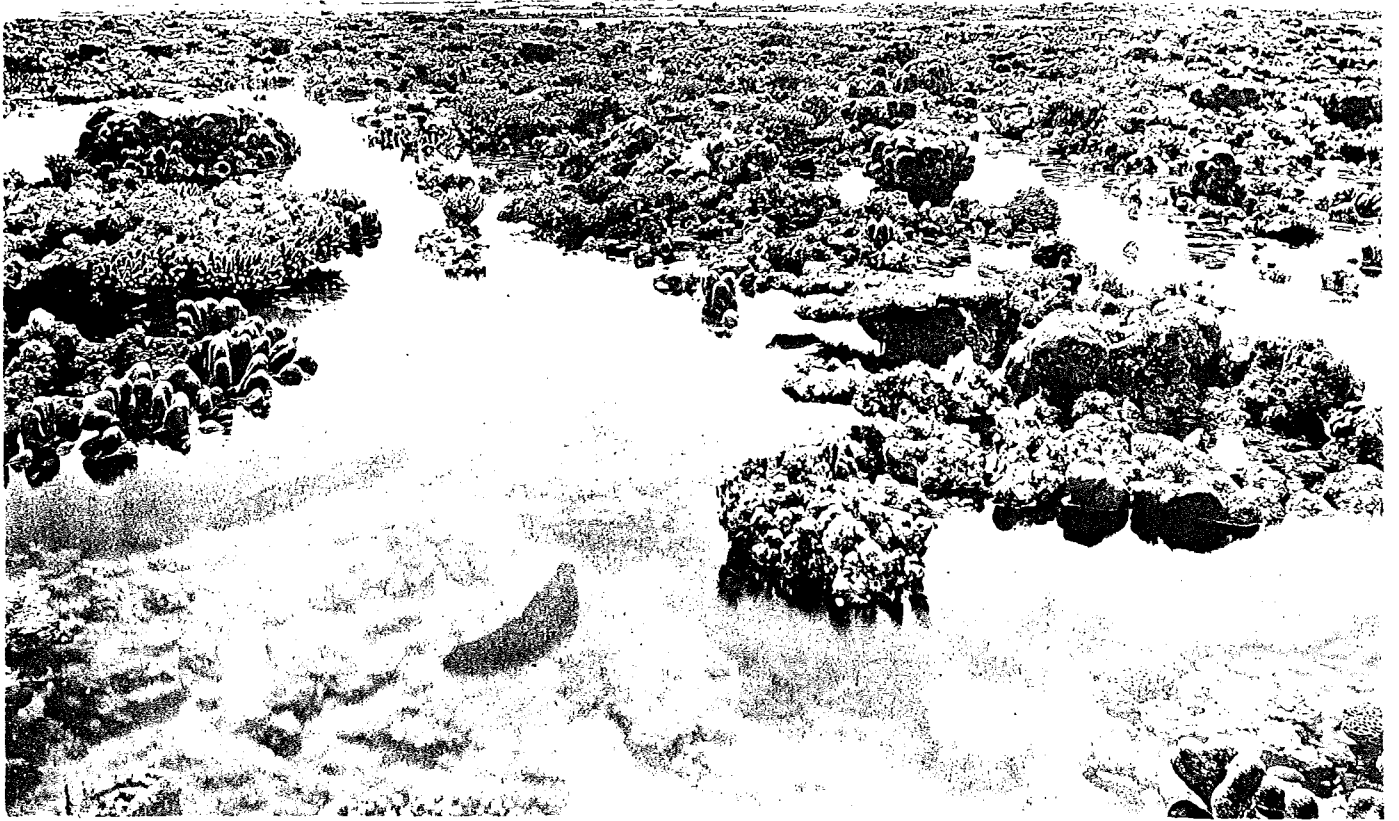
QUEENSLAND PEARLS.

Some idea of the fine size and quality of the pearls produced in the Queensland Barrier district, and more especially from the Torres Strait fisheries grounds, may be gained by a reference to the accompanying plate, portraying the same collection of pearls in two separate positions. All of these individual pearls, thirty-nine in number, were not obtained, as might be imagined, from the single shell on which they rest in the upper figure. They represent the tediously accumulated produce of innumerable mother-of-pearl shells. Not one shell in several thousand produces as fine a gem as any of the three or four of the most perfect specimens included in the top row of the artificially arranged pearl triangle. The two largest and most symmetrical pearls, occupying the first and second positions in this row, weigh some thirty or forty grains apiece, and are worth together, at first sale price, about five hundred pounds. This very interesting little collection was kindly placed at the author's disposal, for this illustration, by Mr. James Clark, owner of one of the finest North Australian pearl-shelling fleets. It represents a small parcel forwarded to him as the supplementary or (so-to-say) unearned increment of a single month's pearl-shelling on one of the most productive Queensland fishing grounds. As explained elsewhere, it is the mother-of-pearl shell that is primarily fished for in Torres Strait, the pearls, when the boat-owner is not also his own diver, being mostly appropriated by the hired diver and the boat's crews.

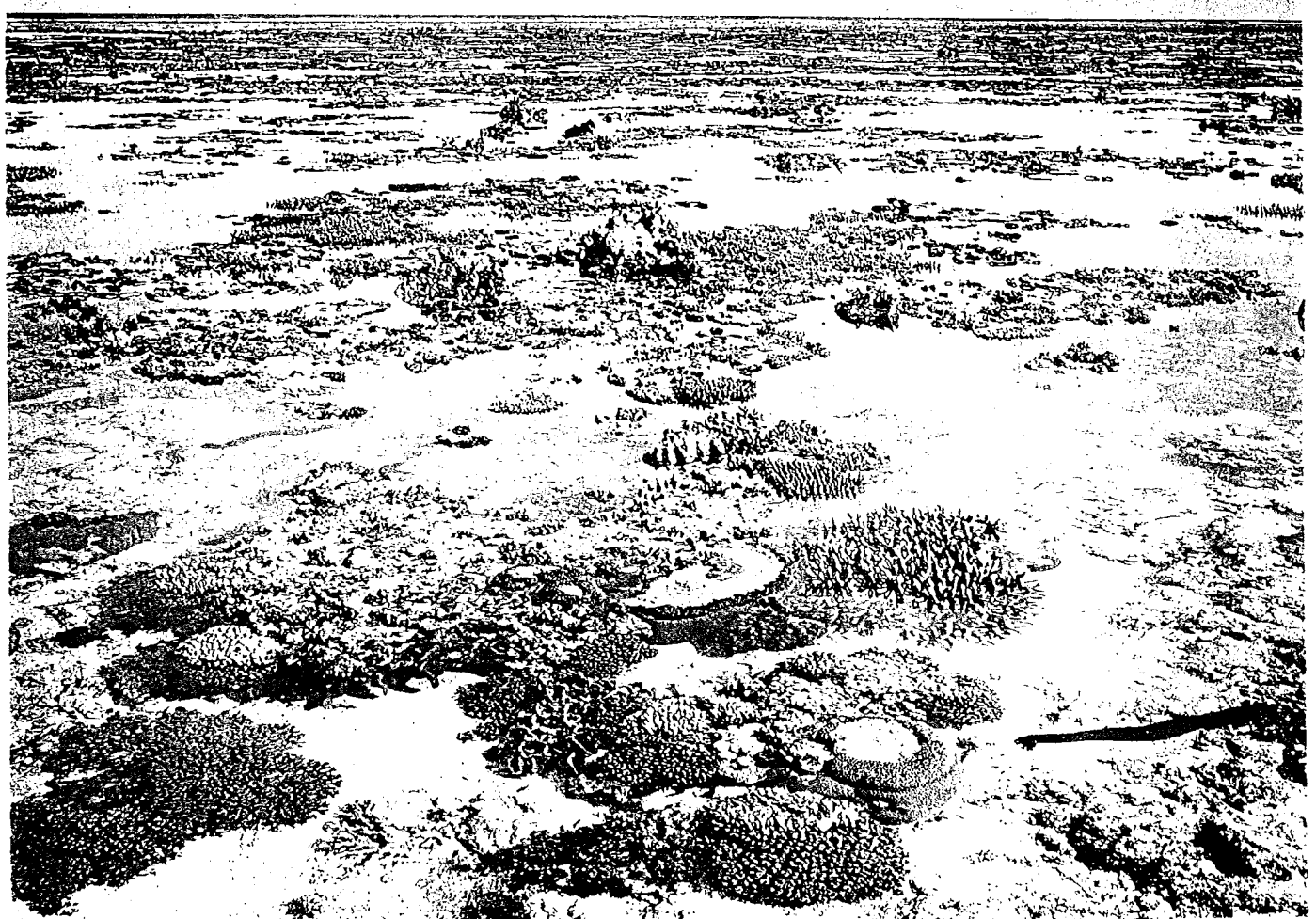
PLATE XXXVIII.

MOTHER-OF-PEARL SHELLS AND ARTIFICIALLY-PRODUCED PEARL.

The lower figure in this plate represents a mother-of-pearl shell, *Meleagrina Margaritifera*, in that earlier condition of its growth when the external surface of the shell is ornamented with



A. OUTER BARRIER REEF, WITH SUBMERGED BÊCHE-DE-MER.



W. Saville-Kent, Photo.

London Stereoscopic Co. Rep.

CHAPTER VI.

BÊCHE-DE-MER FISHERIES.



BÊCHE-DE-MER, *Sea-slugs, Sea-cucumbers, or Trepang*, as the reef-frequenting animals dealt with in this chapter are variously designated, represent an ordinal group, that of the *Holothuridæ*, which belongs systematically to the class of the invertebrate sub-kingdom which is distinguished by biologists under the title of the *Echinodermata*. The term *Bêche-de-mer*, by which the organisms are now most generally known in trade circles, is the French form of the older title of *Bicho-do-mar*, signifying a sea-worm or sea-slug, which was suggestively applied by the older Portuguese navigators to that marine produce which from the earliest times has constituted so important an article of commerce in China and the Malayo-Polynesian region generally, where it is better known under the colloquial title of *Trepang*. *Sea-slugs* and *sea-cucumbers* are Anglo-Saxon titles, having reference to the general shape of the animals, and they have been applied popularly to various allied species, mostly smaller, and having no commercial value, which are indigenous to British waters.

The class of the *Echinodermata* includes, in addition to the ordinal group of the *Holothuridæ*, or *Bêche-de-mer*, all the innumerable varieties of star-fishes and the spine-bearing sea-urchins or *Echini*. The fundamental structure in each of these orders is identical. This may be most readily understood by an examination of their organs of locomotion, which are found, in each of the allied groups mentioned, to consist of a series of extensile tubular organs, "ambulacra," which terminate in adhesive suctorial disks, and are not possessed by any other class of the animal kingdom. The representatives of the *Holothuridæ*, or *Bêche-de-mer*, are distinguished from their allies, the star-fishes and sea-urchins, by their elongate, somewhat cucumber or sausage-shaped bodies, which are capable, in all the commercial forms, of great contraction and extension. The mouth, which is situated at one extremity of the body, is surrounded by a series of plumose or tufted tentacles; a circular or pentagonal aperture at the opposite end is the vent.

The food of Bêche-de-mer consists chiefly of the microscopic calcareous-shelled animals known as Foraminifera, which are swallowed in combination with a large percentage of sand and broken fragments of shells and corals. The process of feeding, as observed by the author in a large number of varieties, is in all cases identical, and somewhat remarkable. The tufted, moplike, tentacles are one by one swept over the surface of the ground, or reef, upon which the animal is feeding, and in corresponding order they are recurved towards the mouth, and thrust with the adherent food-matter down the creature's throat; in reverse order they are extended to annex more pabulum. The largest-sized commercial Bêche-de-mer obtained from Queensland waters is the ordinary "prickly-fish" or "prickly-red," *Stichopus variegatus*, which, in its fully-extended state, may measure four feet or more in length, with an accompanying diameter of four or five inches. Eighteen inches is the more ordinary extended length of black, red, and teat-fish. In all instances these organisms are capable of contracting to about one-half of their extended length, the body under contraction becoming, of course, thicker.

The process by which Bêche-de-mer is prepared for the market, in Queensland, is as follows: The "fish" are first collected in sacks by wading or diving off the reefs during the low spring-tides. They are then, immediately on their arrival at the dépôt or curing-station, placed in large iron caldrons, and boiled for twenty minutes. They are next taken out; split up longitudinally with a long, sharp-pointed knife; gutted; and exposed on the ground in the sun until the greater portion of the moisture has evaporated. The largest specimens, such as prickly and teat-fish, are frequently spread open, so as to dry more readily, with small transversely-inserted wooden splints. The greater amount of moisture having been got rid of, the fish are transferred to the smoke-house. This is usually composed of corrugated iron, 10 feet or 12 feet high, and fitted, in its upper half, with two or three tiers of wire netting, upon which the Bêche-de-mer are laid. The wood most in favour for the smoking process is that of the red mangrove, *Rhizophora mucronata*. Twenty-four hours is the usual period for which Bêche-de-mer are left in the smoke-house. By the end of that time they have for the most part shrunk to a length of six inches or less, and in aspect they may be likened to charred sausages. They are then ready for bagging up and despatch to the nearest market.

An essential matter that demands the most careful attention of those engaged in the Bêche-de-mer fishery is the maintenance of the cured fish in a thoroughly dry condition. The prepared produce readily absorbs moisture; should it get wet, or have been insufficiently cured, it has a tendency to dissolve into a tenacious, glue-like, mass of the most repulsive aspect and abominable odour. Properly cured and maintained in a first-class condition, the dried animals (to use a trade expression) should rattle like walnuts in their bags. To insure their delivery in the Hong Kong market in the same prime condition, the precaution is sometimes taken of transporting them in tin-lined cases.

The fishery for Bêche-de-mer is carried on chiefly by means of small luggers of five or

six tons burden. These make daily voyages from the curing-station to the neighbouring reefs, which are exposed only at low water; or a fleet of them may remain in the vicinity of the reefs, one or more acting as tenders to convey the fish to the curing-station, and to bring back supplies. A few large schooners or other ships, of from twenty to forty or fifty tons, are fitted out from both Thursday Island and Cooktown, which carry on board with them smoke-houses, small boats, and all the appliances requisite for collecting and curing. These craft shift their anchorage from place to place among the reefs, sending their boats in all directions to collect the fish. The crews employed in gathering the Bêche-de-mer consist chiefly of mainland aborigines, or "Binghis," as they are termed in the North, with a frequent admixture of Torres Strait and South Sea Islanders and Manilla men; these latter are frequently entrusted with the command of the separate boats. The natives of New Guinea were formerly employed extensively in this fishery, and proved to be very industrious and profitable workmen. For the craft licensed from Port Kennedy, Thursday Island, the aboriginal crews are recruited to a large extent from the Batavia River, in the Gulf of Carpentaria; the crews employed on the boats fitted out from Cooktown are derived chiefly from the east-coast districts. The annual licence fees, payable in Queensland, are similar to those of the pearl-shelling industry, and are as follows: For every small boat, 10s. per annum; for every ship or lugger up to ten tons burden, £3, and an additional 10s. per ton for every ton over this measurement; £20, however, represents the highest fee payable. All aborigines employed in the Bêche-de-mer fisheries have to be brought to the nearest port for registration and for discharge before the shipping master; for which formality, in the former instance, a fee of 2s. 6d. per head is charged. The wages earned by these aborigines range from 5s. to 20s. per month, with all rations provided, 10s. representing the most customary one. These wages are invariably paid in kind, goods to the amount earned, consisting chiefly of clothing and tobacco, being usually selected. The lowest wage named, that of 5s. per month, is earned by the women, or "gins," who accompany the men engaged, and at many of the curing-stations are employed mainly in cleaning and preparing the Bêche-de-mer for the smoke-house. A highly characteristic illustration of this stage of the curing process is afforded by the photographic view reproduced in Plate XXXVI., wherein the natives, chiefly women, of Warrior Island, Torres Strait, thus busily employed, are surrounded by the not very elaborate paraphernalia of their craft. A good average take for a station on the Barrier fishing grounds, working (say) with only four boats, carrying collectively twenty to twenty-four men, is one ton of cured Bêche-de-mer per month. Two tons per month, with the same craft and number of hands, is an occasional but exceptionally abundant take. More often than otherwise, however, the full measure of a single ton is not realised. The collection of the Bêche-de-mer is accomplished during the low tides in the new and full phases of the moon, and eight or ten days in each lunar month are thus not profitably utilised. The greater portion of the Bêche-de-mer is simply picked off the

reefs when the water has receded ; but the finest red and black fish, and the prickly-fish almost exclusively, are obtained, by diving during the same low tides, from a depth of two or three fathoms.

The *Bêche-de-mer* fishery can be profitably conducted with a much smaller outlay of capital than that required for operating with pearls and pearl-shells. The craft employed is much smaller ; no costly diving apparatus is required, nor the hire of skilled divers, tenders, and pumping hands. As previously related, the aborigines from the Queensland mainland are extensively employed in this fishery, undoubtedly one of the few industries in which Australian native labour can be turned to profitable account. The native as a rule does not take kindly to agriculture or to any manual work of a persistent character. To fishing and hunting, however, he is "to the manner born," and there is not an employment that could be devised more to his liking than his attachment, accompanied by his wife and picaninnies, to a liberally-found *Bêche-de-mer* camp, with comfortable quarters, plenty of "tucker" and work which is to him almost his natural recreation. The attachment of the aborigines to fishing pursuits is practically demonstrated by the persistence with which the same families, or individuals, will year after year seek re-engagement at the hands of honest employers. Doubtless, many a tale could be told throwing discredit on their trustworthiness: tales of the massacres of station owners, of boats and stores decamped with, and of the European or Manilla "boss" being marooned on a coral islet, or left to perish on a temporarily exposed reef. There is usually, however, an obverse side to these tragic pictures, which shows that the aboriginal was not the initial aggressor. In the earlier days there have undoubtedly been many cases of natives being kidnapped and compelled to work against their will ; of interference with the women ; and of glaring breaches of faith on the part of the employers respecting the wages, in coin or in kind, paid over to the crews on the completion of their engagements. Injustices referable to the last-named category are not altogether unknown now ; but in face of the excellent regulations rigidly enforced by the Queensland Government concerning the engagement, discharge, and payment of the aboriginal crews, all these abuses are rapidly becoming mere traditions.

A monument erected in Cooktown bears testimony to a touching tragedy in a *Bêche-de-mer* camp some ten years ago, in which a wild tribe of aborigines were the aggressors. The camp, in this instance, was established on Lizard Island, and was worked by a man named Watson, who resided there with his wife and child. During his absence one day with all hands, excepting a Chinese gardener, natives from the mainland attacked the camp. Mrs. Watson and the Chinaman bravely defended it, and ultimately caused the blacks to retreat. In the night, fearing that a more serious attack was contemplated, Mrs. Watson, with her infant and the Chinaman, embarked in an old iron ship-tank, all the boats being absent, and floated away in the hope of being seen and picked up by one of the passing steamers. They ultimately

reached No. 5 Island of the Howick group, where there was no water, and where they must have perished from hunger and thirst. This was only too surely proved by the discovery, only a few days later, of their bodies, together with a scrap of Mrs. Watson's writing, giving the broad details of the episode.

Little or nothing has as yet been accurately ascertained concerning the breeding habits and rate of growth of Bêche-de-mer. Fish of approximately the same size, and these mostly of adult growth, are almost invariably found upon any reef. Such reef, if apparently cleared of fish one year, is found in another year to be tenanted by fish of a similar adult growth; and it would appear from the evidence so far available, that these are continually migrating from deep water to the upper strata of the reefs. On none of the reefs investigated by the author, on which red, black, and teat-fish were collected in some abundance, were any small or young individuals obtainable, and only in the case of lolly-fish were specimens of about one-half of the adult dimensions found mingled with the others. From one informant only was evidence obtained concerning the observation of well-developed spawn, or roe, being found inside any of the commercial species of Bêche-de-mer. This observation related to the surf-red and teat varieties, in which masses of yellow spawn, resembling beef suet, had been noticed during August and September. With the majority of Bêche-de-mer, or *Holothuridæ*, known to science, the young are liberated in the form of multitudes of microscopic ciliated larvæ, which float, like oyster spawn, for some time on the surface of the water. In a few rarer and more exceptional deep-sea varieties, the young Bêche-de-mer are produced in a form resembling that of the adult on a miniature scale; and these remain clinging, like the young of the female scorpion, to the parent's body for a considerable period. No such phenomenon has as yet been observed in the commercial species; and it would appear that the floating embryos settle into deep water to undergo their metamorphoses, and only make their appearance on the superficial reefs on approaching the adult state, when they are in a fitter condition to cope with the strong tides and heavy seas that circulate through and break upon these areas.

As intimately connected with the investigations prosecuted concerning the breeding phenomena of Bêche-de-mer, their rate of growth, and the habitats of the different varieties during successive stages of their existence, the question naturally arose whether regulations were necessary, or desirable, for prohibiting their collection or exposure for sale below any appointed size. From the knowledge so far available, the institution of any such regulations would appear to be premature. A careful examination of the minute epidermal spicules of all the leading varieties of Bêche-de-mer with the aid of a microscope demonstrated the fact that these differ from one another, in separate species, to an appreciable extent. It was by this means found that the fish placed upon the market, chiefly from New Guinea, as small-black fish, was not, as commonly believed, an immature ordinary-black fish, but an entirely distinct species. Subsequent inquiries elicited the fact that this variety never grows to a large size, and that it was collected on

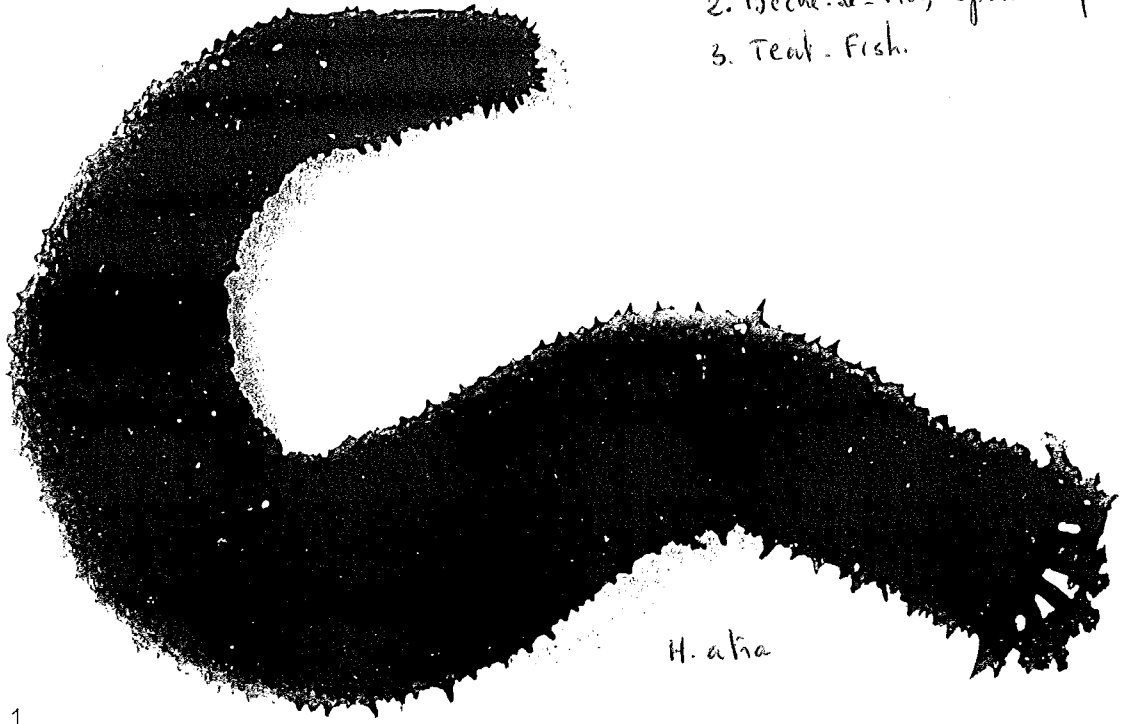
the mud flats near mangroves, and not from the clean-swept reefs affected by its typical black ally. Regulations which had been previously advocated for prohibiting the collection of this small variety of *Bêche-de-mer* would have been misplaced. As so far observed, the young or immature individuals of the commercial species are never collected to an extent demanding the imposition of restrictive legislation.

Respecting the bathymetrical or vertical distribution of commercial *Bêche-de-mer*, red, black, and prickly-fish are reported to occur at a depth of four or five fathoms, and lolly-fish have been observed by divers as deep down as eighteen fathoms. The deep-water examples of the red and black varieties, obtained by diving, are of the largest, and, as indicated in the list hereafter submitted, they fetch a higher price, and are recognised by a distinct title in the market. The question has been discussed by certain of the boat-owners whether *Bêche-de-mer* might be profitably collected with the aid of diving apparatus after the manner of pearl-fish, and it will probably be put to a practical test. Black-fish and sand-fish, and many non-commercial varieties of *Bêche-de-mer*, were taken by the author in some quantities, with the aid of a dredge, at a depth of three or four fathoms in Port Denison, off Bowen; and it would seem possible that this implement might be profitably employed in many localities for the capture of these creatures. The southernmost point at which the *Bêche-de-mer* fisheries have so far been systematically worked is eastward from Mackay, occupying a position of 21° south latitude. Many large-sized species, not yet turned to practical account, however, abound throughout the Australian littoral, while one of the finer commercial types, known as surf-red, has been collected by the author, on the most southern coral-reef on the Barrier system which surrounds Lady Elliot Island.

The features that distinguish the commercial from the non-commercial varieties of *Bêche-de-mer* are at first sight obscure. One characteristic peculiar to some of the non-commercial varieties is the habit they possess, when handled, of ejecting from the vent rope-like masses of white cottony filaments, "Cuvierian organs," which on their first emission adhere with extreme tenacity to every object with which they come in contact. In respect of this peculiarity, the names of "cotton-fish" and "cotton-spinners" have been appropriately bestowed upon this particular group of *Bêche-de-mer*. What renders most of the *Holothuridæ*, or *Bêche-de-mer*, family, including all the European species, useless for the market is the comparatively soft texture of their flesh, which decomposes or assumes a gelatinous condition within a few hours after their removal from the water or on being placed in the boiling-pot. They cannot be cured. It is possible, however, that if immersed in brine, or treated with some strong astringent immediately after collection, certain of these hitherto non-commercial forms might be turned to profitable account.

The quantities and value of the *Bêche-de-mer* that have been annually exported from Queensland within the ten years 1880 to 1889 are herewith appended. The figures will suffice to indi-

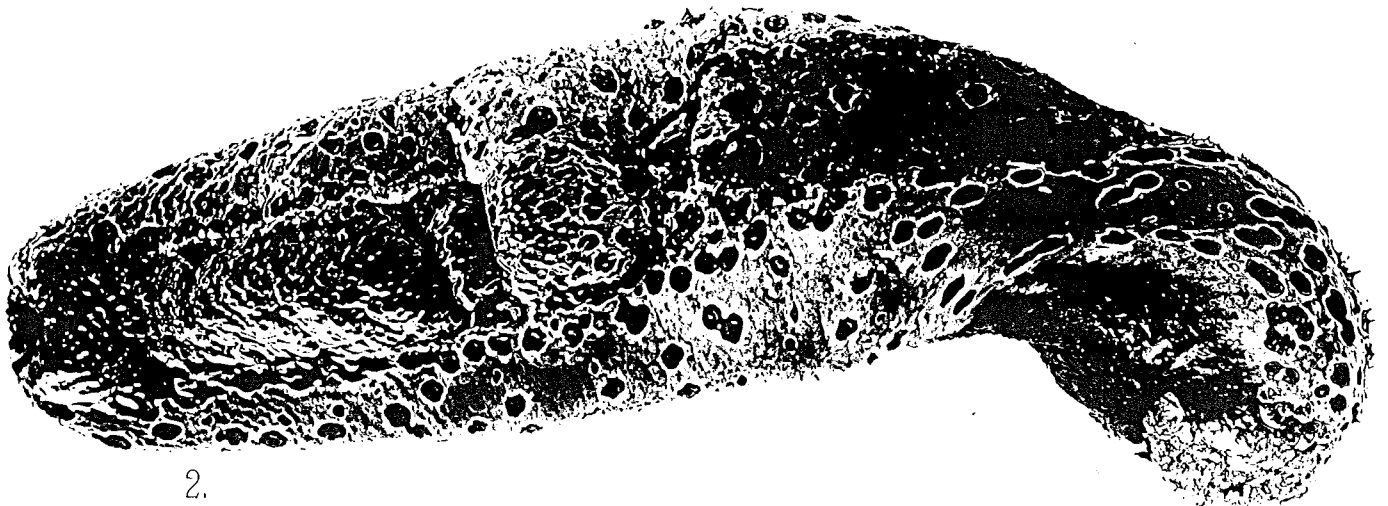
- 1. Bêche-de-mer, Small Lilly-Fish
- 2. Bêche-de-mer, Spotted-fish.
- 3. Tent-Fish.



1.

H. alia

B. argus



2.



3.

H. mobilis

cate the important position this fishery occupies among the industries of the colony, and to emphasise the desirability that exists for according it every reasonable encouragement and support. It is worthy of remark that the monetary value of the total annual output closely corresponds with, but is somewhat in excess of, that of the oysters so extensively exported from the southern district of Queensland to the neighbouring colonies. China represents the market to which, with the exception of a few hundredweights, all the Australian Bêche-de-mer is consigned; in which market that shipped from Cooktown, and known as Barrier fish, enjoys a higher reputation and realises better prices than the article derives from any other locality on the face of the globe. As shown in the following schedule, "teat-fish," with a value of from £140 to £150 per ton, occupies the premier position. As much, however, as £160 per ton has been occasionally realised for exceptionally well-cured red-fish. The prices of all varieties are subject to considerable fluctuation, which is intimately associated with the current value of gold in the Chinese market.

RETURN SHOWING QUANTITIES AND VALUE OF BÊCHE-DE-MER EXPORTED FROM QUEENSLAND WITHIN THE TEN YEARS 1880 TO 1889.

Queensland.		Foreign (New Guinea, shipped from Queensland).		Total.	
Weight.	Value.	Weight.	Value.	Weight.	Value.
Cwt.	£	Cwt.	£	Cwt.	£
1880.—3,199	14,614	775	3,729	3,974	18,343
1881.—4,971	23,336	1,264	5,950	6,235	29,286
1882.—5,093	25,032	1,249	5,882	6,342	30,914
1883.—4,299	21,208	2,542	10,373	6,841	31,581
1884.—4,314	18,474	1,380	6,393	5,694	24,867
1885.—4,028	19,209	1,156	4,571	5,174	23,780
1886.—3,945	15,551	1,188	3,959	5,133	19,510
1887.—3,255	12,959	502	1,570	3,757	14,529
1888.—4,418	18,379	419	1,669	4,837	20,048
1889.—4,190	18,349	1,445	4,391	5,635	22,740

The foregoing return shows that the most flourishing epoch of the Queensland Bêche-de-mer trade was between the years 1881 and 1883, when the value of the total annual exports approximated to, or even exceeded, £30,000. The most unremunerative period was the year 1887, when the total export value fell to £15,000. Since then there has been a tendency towards improvement, which is apparently still in progress, the licenses for boats taken out for the past few years having been on an increasing ratio. The returns in this direction show that 62 boats are now licensed from Port Kennedy, in Thursday Island, and 27 from Cooktown. To these are to be added some half-dozen which have taken out licenses at Townsville, Cairns, and Ingham. This gives a total of over one hundred craft engaged in the fishery.

THE GREAT BARRIER REEF.

The current prices of the individual commercial varieties of Queensland Bêche-de-mer, as recently quoted in the Cooktown market, and supplied to the author by a prominent member of the trade, are as follows. The Chinese names, furnished by a leading Chinese merchant, are also added, and were obtained through the instrumentality of Mr. H. Birkett, the Sub-Collector of Customs at Cooktown.—

Local Name.	Chinese Name.	Value per Ton.
Teat-fish, black and ordinary	Se-Ok-Sum	£ £
„ white	Ma-See-Up	140 to 150
Red-fish, ordinary and deep water	Hung-Hur	40
„ surf	Ba-Doy-Hur	100 to 110
Black-fish, deep water (also, crape black?)	Chao-Sah-Oo	80 to 90
„ ordinary and Caledonian	Woo-Sum	110
Large Lolly-fish	Chong-Sum	80 to 90
Prickly-fish, or prickly-red	Chee-Sum	35
Sand-fish (no present demand)	(not named)	30 to 40
		20 to 30

Up to the present date, the vast quantities of Bêche-de-mer collected in the Great Barrier Reef fishing grounds, with the exception of a very insignificant proportion, have been shipped to China, where, as previously mentioned, they occupy a forefront position with relation to the same class of material derived from all other sources. The small proportion that does not reach the Chinese market is consumed in Australia, and is yearly becoming more considerable. Bêche-de-mer soup, skilfully prepared, is regarded by many connoisseurs to be equal to turtle, and is already a favourite in the *menus* of the leading clubs and hotels in all the Australian capitals. It will doubtless eventually find its way into the European market. It offers the enterprising *chef* undreamt of possibilities, linked with such euphonious (Chinese) titles as “Se-Ok-Sum,” “Woo-Sum,” and “Ma-See-Up.”

In addition to the nine leading varieties of Queensland Bêche-de-mer mentioned in the foregoing list that find most favour in the Chinese market, there are several supplementary species which go to swell the general bulk exported to the Flowery Land. These supplementary types of Bêche-de-mer are, however, not dealt with as distinct ones, but are utilised more often as “judicious blends” to swell the mass of the finer sorts. In this manner the Bêche-de-mer merchants may be said to reciprocate the delicate attentions paid by the Celestials, in their desire to save the European palate from becoming palled by too uniformly pure a course of unadulterated Kaisow or Moning. Among the more prominent species of Barrier Bêche-de-mer that are thus utilised as “blends,” the large cream-coloured “Stone-fish,” the “Sand-fish,” the “Spotted” or “Leopard-fish,” and the “Small Lolly-fish,” are most noteworthy. The last-named two species have already (p. 56) been referred to. Of the small Lolly-fish, *Holothuria sanguinolenta*, n.sp., it may be further mentioned that in order to cure it

successfully, the precaution is taken, by experts, to slit open and eviscerate the fish before boiling. If, on the contrary, the boiling process is, as customary with the better sorts, first practised, the organism shrinks up to a mere hollow skin. A similar plan of treatment would not improbably be found efficacious for the curing of many additional species of Bêche-de-mer. Regarding the "Sand-fish," which occupies the lowest position on the commercial list, the most detrimental thing about it is the thick encrustment of minute calcareous spicules with which its integument is filled. These are so abundantly developed that it is possible to utilise the dried bodies, like chalk, for marking purposes. When mixing the Sand-fish with other more valuable types, the subterfuge is not unfrequently resorted to of dyeing their bodies a deep red-brown in a decoction of the bark of the red mangrove, *Rhizophora mucronata*. Thus treated, they are not easily detected, when mixed in bulk, from the poorer descriptions of ordinary red-fish.

Spirit-preserved specimens of all of the leading varieties of Barrier Reef Bêche-de-mer were brought to England by the author, and have been contributed by him to the British (Natural History) Museum collections. At that institution the series has been carefully worked through by Professor F. Jeffrey Bell, the specialist in charge of the Echinoderm Department, so that it is possible in these pages to publish a complete list of their scientific as well as their vernacular designations. The Bêche-de-mer contained in the collection examined and identified by Professor Bell number no fewer than fourteen distinct species. To these, several supplementary forms, either previously identified by the author, or represented by photographs or sketches in his note-books, are here added, swelling the series of edible Barrier species, and their near allies, to twenty. The list in its complete form is herewith subjoined.—

GREAT BARRIER REEF BÊCHE-DE-MER.

	POPULAR NAME.	TECHNICAL NAME.
1	Red Prickly-fish	<i>Stichopus variegatus</i>
2	Green Prickly	„ <i>chloronotus</i>
3	Yellow Prickly	„ <i>lutea</i> , n.sp.
4	Stone-fish	<i>Actinopyga lecanora</i>
5	Ordinary Red-fish	„ <i>obesa</i>
6	Surf-red	„ <i>mauritiana</i>
7	Deep-water red	„ <i>echinites</i>
8	Black-fish	„ <i>polymorpha</i> , n.sp.
9	Black or Ordinary Teat-fish	<i>Holothuria mammifera</i> , n.sp.
10	White Teat-fish	„ <i>marmorata</i> , n.sp.
11	Grey Sand-fish	„ <i>fusco-cinerea</i>
12	White Sand-fish	„ <i>edulis</i>
13	Brown Sand-fish	„ <i>impatiens</i>

THE GREAT BARRIER REEF.

	POPULAR NAME.	TECHNICAL NAME.
14	Spotted or Leopard-fish	<i>Holothuria argus</i>
15	Large Lolly-fish	„ <i>vagabunda</i>
16	Small Lolly-fish	„ <i>sanguinolenta</i> , n.sp.
17	Black Cotton-fish	„ <i>atra</i>
18	Snake-like, or Yellow-plumed Bêche-de-mer ...	„ <i>coluber</i>
19	Yellow Cotton-fish	„ <i>vitiensis</i>
20	Corrugated Bêche-de-mer	„ <i>botellus</i>

The above list comprises four species that Professor Bell has pronounced to be new to science. These include two of the most valuable commercial varieties—*i.e.*, the so-called Black-fish and the ordinary Teat-fish—here associated with the titles of *Actinopyga polymorpha* and *Holothuria mammifera*; these names (in anticipation of their proving to be new species) were provisionally conferred on them in a brief diagnosis of the external characters of some half-a-dozen of the leading commercial varieties included in the author's Report on the Barrier Reef Bêche-de-mer fisheries, compiled for, and published by, the Queensland Government in the year 1890.

Pending the production of a systematic catalogue of the Queensland Bêche-de-mer, a brief synopsis of the living, external, features of the species included in the foregoing list is herewith submitted. Being drawn up from notes, sketches made, and photographs of living specimens taken by the author at the various Barrier fishing stations, it may prove of practical use in the comparison and determination of species obtained from other Bêche-de-mer-producing districts of the Australian coast-line.

DESCRIPTIVE SYNOPSIS OF COMMERCIAL SPECIES OF QUEENSLAND
BÊCHE-DE-MER.

GENUS STICHOPUS.

Spicules absent or represented by simple granules; the integument usually associated with conspicuously protruding, simple, or branched, papillæ.

No 1. Red Prickly-fish or Prickly-red, *Stichopus variegatus* (Plate XXXV.B).—Body in extension elongate subcylindrical, somewhat depressed, the entire dorsal and lateral surfaces ornamented with large aculeate conical papillæ of various patterns; the papillæ at the two extremities for the most part simple, those of the sides usually bidentate or tridentate, and those throughout the central dorsal region presenting an irregular stellate outline; locomotive acetabula large, forming a single continuous series throughout the ventral surface; slender tactile suckers interspersed among and upon the stellate papillæ of the dorsal region; ground colour, tawny-yellow; the papillæ and ventral acetabula more usually light-red; short irregular transverse lines

of a blackish hue distributed among the papillæ on the dorsal and lateral surfaces; and the whole of this area, including the papillæ, thickly sprinkled with minute orange specks; colour of oral tentacula light buff. Attaining to a length, when extended, of three or four feet, with a diameter of four or five inches. Usually collected, by diving, in deep water on the more remote reefs. Of considerable commercial value.

2. Green Prickly-fish, *Stichopus chloronotus* (Chromo XII., Fig. 3).—Body in extension elongate, sub-quadrate, its surface beset with prominent simple sharp-pointed conical papillæ; ground colour clear bottle-green throughout, the extreme tips of the papillæ orange or scarlet; the expanded tentacles ash-grey or a lighter tint of the body-colour. Usual length, when extended, nine to twelve inches. Occurs abundantly on the grassy (*Zostera*) flats adjoining the coral-reefs from Torres Strait to the central Barrier district. No commercial use, dissolving into a glutinous mass within a few hours after removal from the water.

3. Yellow Prickly-fish, *Stichopus lutea*, n.sp.—Body in extension elongate-ovate, slightly sub-quadrate; short, sharp-pointed, conical papillæ sparsely scattered throughout the surface of the integument, which is also slightly corrugated; colour of the upper surface of the body golden- or mustard-yellow, the papillæ usually of a blue-black hue; the under surface of the body bright yellow, the three distinct rows of pedicels slate-grey; the expanded tentacles light-brown. Length of extended body, twelve to fourteen inches. Tolerably plentiful throughout the Barrier district. Of little or no commercial value, its substance rapidly disintegrating.

GENUS ACTINOPYGA.

Integument enclosing minute calcareous spicules of definite patterns; vent pentagonal, associated with five, externally conspicuous, calcareous ossicles.

4. Stone-fish, *Actinopyga lecanora*.—Body in extension simply ovate or elongate, usually broadest anteriorly; its surface smooth; the general ground-colour cream or stone-colour, with the exception of, more usually, a few irregularly scattered patches of minute, closely approximated, dark brown speckles, certain of which are almost invariably developed in a circle round, but at a little distance from, the ventral aperture; extended tentacles and pedicels cream-colour or light brown. Length, twelve to sixteen inches. Not common. Of but little commercial value.

5. Ordinary or Sand Red-fish, *Actinopyga obesa* (Chromo XII., Figs. 1 and 2).—Body in extension elongate subcylindrical, somewhat depressed; when contracted the entire dorsal surface coarsely corrugated transversely, fine reticulating lines uniting the transverse rugæ; locomotive or ventral acetabula forming three distinct rows; slender, tactile, pedicels thickly developed throughout the dorsal surface of the body; vent pentagonal, with five distinct anal ossicles; ground colour deep golden-brown, oral tentacles somewhat lighter; under surface yellowish-brown. Length, when extended, fifteen to twenty-four inches. Habitat: Reefs exposed at spring-tides throughout the Barrier district not concealing itself within rock crevices. One of

the most valuable commercial varieties. (This species was provisionally associated by the author, in his Queensland Government Report, with the name of *Holothuria rugosa*).

6. Surf Red-fish, *Actinopyga mauritiana*.—Body elongate-ovate subcylindrical, not distinctly corrugated; ground colour red-brown, with conspicuous white patches of various size and number, interspersed with smaller spots and speckles of the same hue, usually developed along each side, and forming a circum-anal patch; smaller white specklings often developed on the dorsal surface, but scarcely two individuals marked alike; under surface brick-red. Length twelve to fifteen inches. Abundant among the surf on the outer edge of the reefs in the central Barrier district. Of high commercial value.

7. Deep-water Red-fish, *Actinopyga echinites*.—Closely resembling ordinary Red-fish, but having a smoother integument, and inhabiting deep water. A critical examination of living examples of this species has not been made by the author, a single specimen only having been taken with the dredge in Port Denison, and immediately transferred to spirit. Of high commercial value.

8. Ordinary Black-fish, *Actinopyga polymorpha*, n.sp. (Chromo XII., Fig. 6).—Body highly plastic or polymorphic, varying in extension from elongate subcylindrical to an obtusely ovate or nearly globular shape; skin smooth in both extension and contraction; locomotive acetabula disposed in three distinct rows; slender tactile suckers developed throughout the surface of the body; vent pentagonal with five conspicuous red-brown anal ossicles; general ground colour of the body, dark seal-brown, or nearly black; oral tentacles tufted, slightly lighter in colour. Average length, in extension, twelve to fifteen inches. Habitat: Reefs exposed at spring-tides, usually secreting itself in fissures of the coral-rocks and creeping out with the rising tide. Of high commercial value.

GENUS HOLOTHURIA.

Integument spiculiferous; vent circular, devoid of conspicuous calcareous ossicles.

9. Black or ordinary Teat-fish, *Holothuria mammifera*, n.sp. (Plate XXXIV., Fig. 3).—Body in extension elongate, somewhat flattened, obtusely rounded at each extremity, with usually from four to six large, conical protuberances developed at even intervals along each lateral border. Surface of the skin smooth in extension and contraction; locomotive suckers of the ventral region forming three distinct rows anteriorly, merging with one another posteriorly; small isolated tactile suckers developed throughout the dorsal surface; vent circular, devoid of ossicles; general ground colour of the body, dark grey to black, often irregularly mottled; oral tentacles tufted, light slate-grey; ventral acetabular disks, whitish. Average length when extended, twelve to eighteen inches. Habitat: Usually obtained from deep water on the reefs. The most valuable of the Great Barrier commercial species.

10. White Teat-fish, *Holothuria marmorata*, n.sp.—Body in extension elongate, somewhat depressed, pointed posteriorly, with about six, somewhat acutely-pointed, conical protuberances

on each side; tactile suckers abundant throughout the dorsal region; colour, cream, or light stone-colour, with golden-brown patches or mottlings of various shapes and dimensions, throughout the dorsal and lateral surfaces, no two individuals being marked precisely alike; tactile suckers and tentacles, light brown; length eight to twelve inches; not abundant. Of small commercial value.

11. Grey-fish, or Grey Sand-fish, *Holothuria fusco-cinerea*.—Body elongate-ovate or sub-cylindrical, somewhat depressed, very slightly flexible, corrugated transversely when contracted; locomotive acetabula sparsely and irregularly scattered along the ventral surface; slender tactile papillæ similarly developed on the dorsal aspect; vent funicular, subcylindrical, its free edge fimbriate; colour varying from light to dark ashen-grey, the ventral region of similar colour, or only slightly lighter, short irregular transverse blackish bands, to the number of ten or twelve, commonly present on the dorsal surface; oral tentacles light grey or buff. Length in extension ten to fifteen inches. Habitat: Common on sandy shores and reefs exposed by the ordinary tides. Of little commercial value, owing to the abundance of spicules developed in the integument, which impart to it, when cured, a distinctly chalky aspect and consistence.

12. White-fish, or White Sand-fish, *Holothuria edulis*.—Closely resembling the last species, but with a simple, non-funicular, ventral aperture, and nearly pure white beneath. Of small commercial value, owing to the abundance of spicular elements.

13. Brown Sand-fish, *Holothuria impatiens*.—Closely resembling *Holothuria edulis*, but of a light brown hue throughout. Of small commercial value.

14. Spotted or Leopard-fish, *Holothuria argus* (Chromo XII., Fig. 7).—Body in extension elongate-ovate, rounded at each extremity, its surface smooth; ground colour, lilac, diversified with oval or rounded golden-brown spots which are usually partly disposed in longitudinal chain-like series, and partly irregularly scattered throughout the dorsal and lateral surfaces, no two individuals being precisely alike in this respect; each golden-brown spot contains a centrally-located, dark brown, tactile acetabulum, and its circumference is defined by an inner dark brown and an outer pure white line; oral tentacles light brown. Length twelve to eighteen inches. Emits cotton-like, Cuvierian filaments very plentifully. Abundant on the reefs at ordinary low tides. Of little commercial value, but sometimes mixed with the better kinds.

15. Large Lolly-fish, *Holothuria vagabunda*.—Body in extension elongate cylindrical, its surface conspicuously corrugated. Intense velvety black throughout, with the exception of a thin red or orange line around the aperture of the vent; oral tentacles and ventral and tactile pedicels, black; the terminal acetabula of the latter grey. Abundant on the outlying reefs of the Barrier system. Of low commercial value.

16. Small Lolly-fish, *Holothuria sanguinolenta*, n.sp. (Plate XXXIV., No. 1).—Body in extension elongate subcylindrical, tapering towards each extremity, highly flexible; locomotive acetabula

forming a single series; slender tactile papillæ developed abundantly throughout the dorsal aspect; vent cylindrical, devoid of anal ossicles; colour, purple black; a dark red fluid exuding from the surface of the skin when the animal is handled roughly; oral tentacles and ventral acetabula, black. Length when extended, twelve to eighteen inches. Habitat: Common on the outlying reefs of the Great Barrier system. Of but little commercial value. The muscular and connective tissues of this species are of much less firm consistence than those of the black, red, or teat varieties, and when cured the individual bodies are comparatively hollow and of light weight.

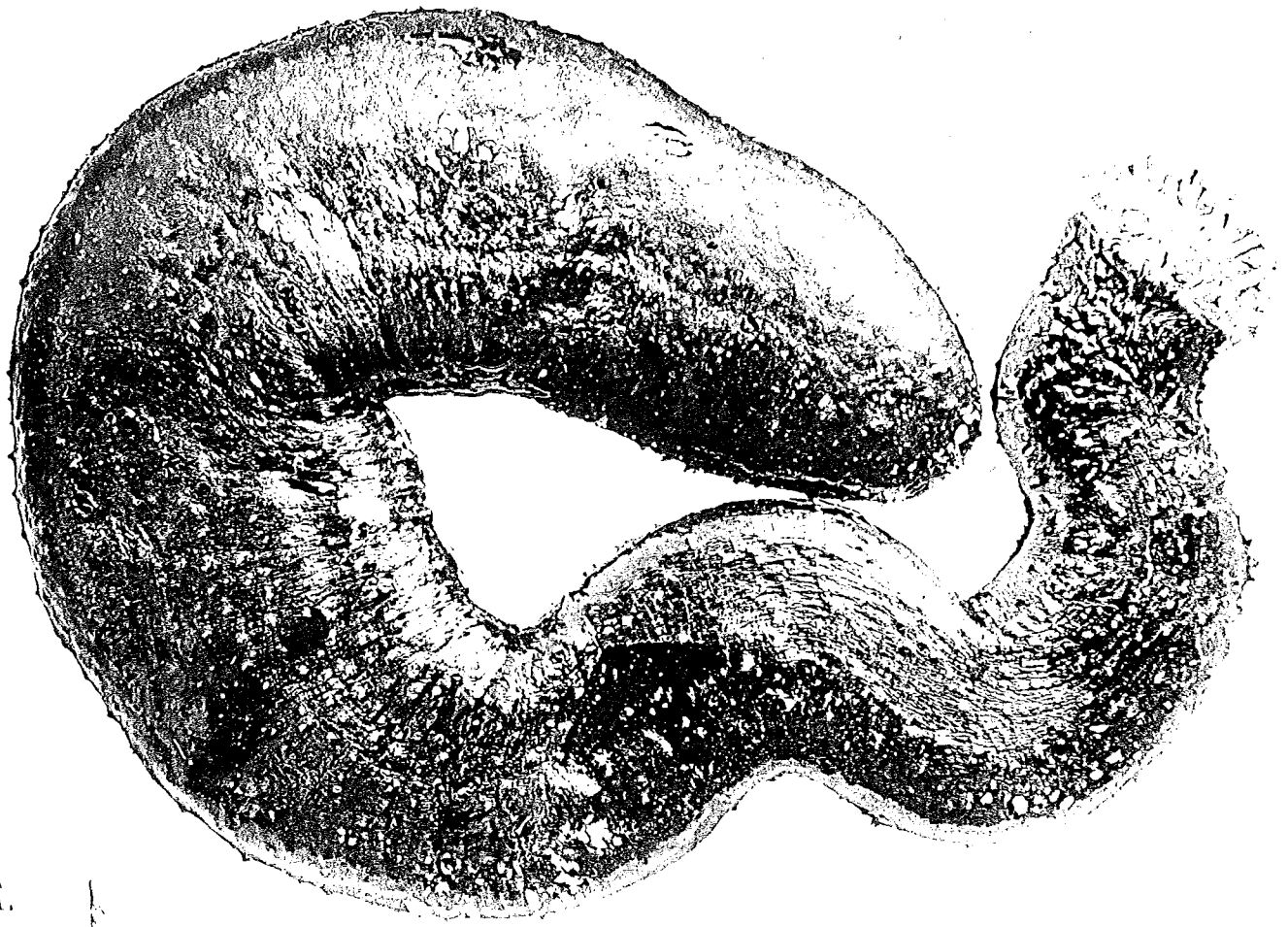
17. Black Cotton-fish, *Holothuria atra* (Plate XXXIII.B).—Body in extension elongate cylindrical, most slender anteriorly; profusely papillose throughout, through the presence of the thickly-developed, slightly protruding bases of the acetabula; oral tentacles and ventral acetabula dark brown or black. Length fifteen to eighteen inches. Emitting large quantities of cotton-like Cuvierian filaments. Common on all inshore reefs; usually, when extended, having a portion of the hinder region of its body retained within a crevice of the reef. Of no commercial value.

18. Snake-like or Yellow-plumed Bêche-de-mer, *Holothuria coluber* (Plate XXXV.A and Chromo XII., Fig. 5).—Body in extension elongate cylindrical, tapering anteriorly; closely resembling that of the last species, but the surface of the integument harsher, somewhat coriaceous; general ground colour purple-black, ventral pedicels and points of tactile acetabula orange or yellow, the oral tentacula primrose-yellow. Length eighteen to twenty inches, not emitting cottony Cuvierian filaments. Common on inshore reefs in company with *H. atra*, but more often crawling freely on the surface of the reef. Of little or no commercial value.

19. Yellow Cotton-fish, *Holothuria vitiensis*.—Body in extension elongate-ovate, depressed, its surface smooth; aperture of the vent distinctly stellate; ground colour throughout tawny-yellow; the oral tentacles and tactile acetabula grey-brown. Length ten to fourteen inches. Emitting vast masses of tenacious, cotton-like Cuvierian filaments, abundant on the level surfaces of the reefs, and among the grassy (*Zostera*) flats. Of no commercial use.

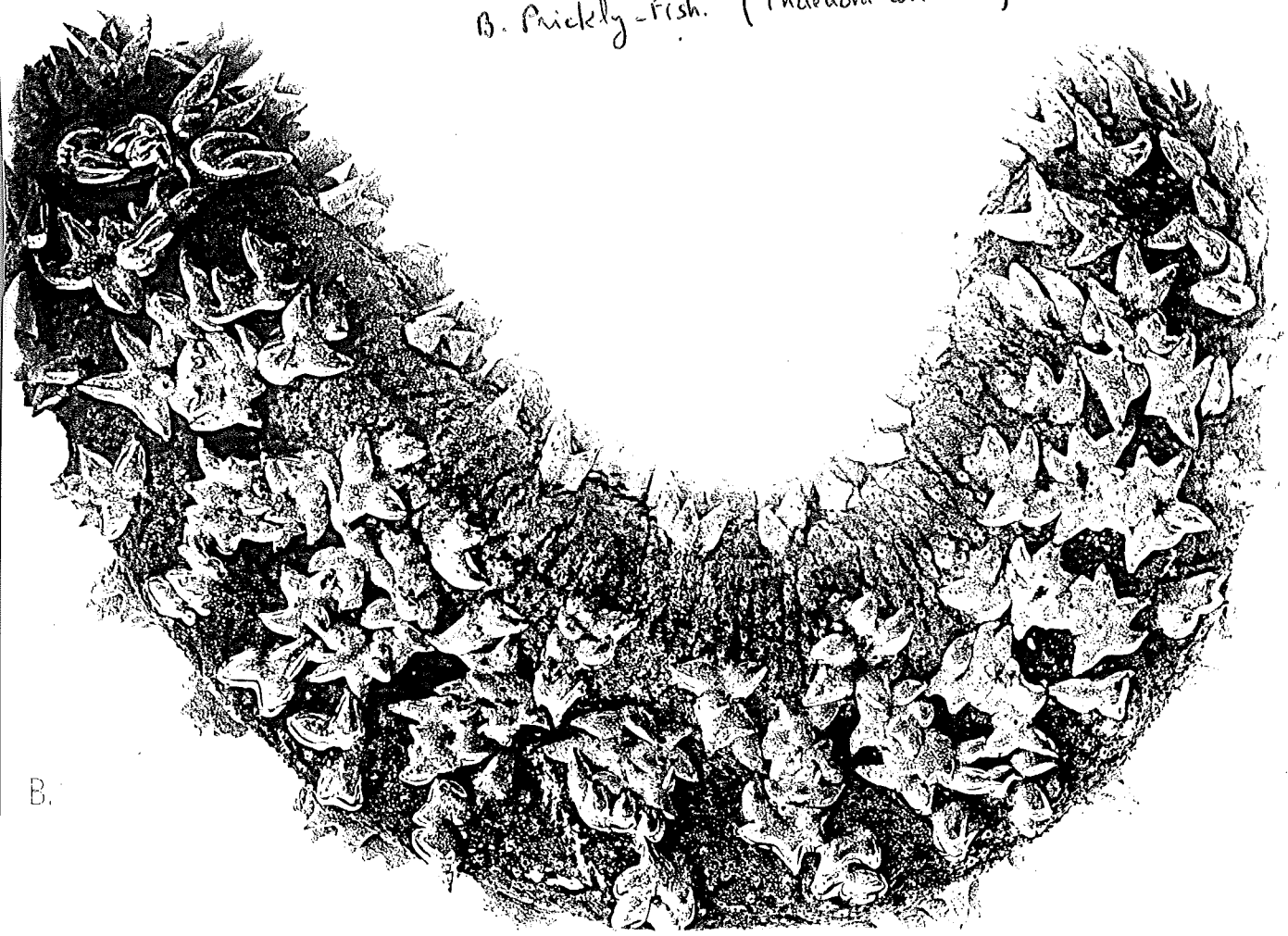
20. Corrugated Bêche-de-mer, *Holothuria botellus*.—Body in extension elongate sub-cylindrical, tapering anteriorly; thickly beset with wart-like elevations that represent the bases of the tactile acetabula; colour of the general surface of the body grey, that of the wart-like papillæ light yellow; oral tentacles, ventral pedicels, and tactile acetabula light yellow. Not emitting Cuvierian filaments. Common under rocks or coral boulders on the foreshore reefs. Of no commercial utility.

The descriptions of Bêche-de-mer included in the foregoing list and diagnostic synopses comprise all the commercially valuable species of the Great Barrier district, and also the conspicuously large varieties, which are liable to be mistaken by "new-chum" explorers for commercial species. In addition to these there are a considerable number of *Holothuridæ* of smaller size or possessing features which render them easily distinguishable from the edible



A.

A. Snake-like Beche-de-Mer (*H. coluber*)
B. Prickly-Fish. (*Thalassoma ananas*)



B.

types. A few of these will receive attention in subsequent pages, as there are one or two points of more immediate interest concerning the commercial forms and their near allies. It is worthy of note, among other matters, that the form described under the title of Red Prickly-fish, *Stichopus variegatus*, some ten years ago realised the highest market price, selling for as much as from £130 to £150 per ton. Its present low position on the list (£30 to £40 per ton only) is due to the fact that a consignment of this variety was sent to China that had been boiled, previously to curing, without any suspicion of danger, in a copper boiler, the result being that a number of Chinese were poisoned. Poisonous properties were immediately attributed to this particular species of Bêche-de-mer, and for a time its sale was altogether interdicted. It is only now slowly recovering its position in the market. The accuracy of this explanation of the depreciated value of Red Prickly-fish has been vouched for to the author by the station-owner who unwittingly cured and despatched the fatal consignment. Through the same informant the author has been made aware of the exceedingly acrid properties of the essential juices of Bêche-de-mer, which, if collected and left in bulk for any time in a copper-riveted boat, eats like an acid into, and destroys, the metal.

In a work entitled *Coral Lands* by H. Stonehewer Cooper, it is stated (p. 266) that the cottony filaments, or Cuvierian organs, exuded in quantity by Polynesian species apparently allied to, if not identical with, *Holothuria argus*, produce a painful inflammation on any part of the human skin with which they may come in contact; also, that the water and associated juices ejected abundantly from other species, when handled, possesses highly inflammatory properties, causing, if it should fall on a surface abrasion of the skin, intense pain, or, if it should come in contact with the eyes, possible loss of sight. No such deleterious properties are associated with the Barrier Reef species, all of which have been handled with impunity, and with, more frequently than otherwise, abraded hands, by the author; nor has the slightest hint of such an undesirable quality been brought under the author's notice, for, if existing, it would have undoubtedly come in the course of his investigations. Mr. Cooper writes only of four kinds belonging to the Polynesian region, the three others being evidently nearly related to the ordinary teat and black and red varieties. As is well-known, fish which are good eating in one region may be poisonous in others, and the same principle may hold good with reference to allied, if not identical, species of Bêche-de-mer.

The remarkable phenomenon of the ejection of the "Cuvierian" filaments in many of the species of Bêche-de-mer is a subject which has attracted a considerable amount of attention, but has not yet been fully explained. In such a form as the yellow Cotton-fish, *Holothuria vitiensis*, these filaments are poured forth, on handling the animal, in copious streams, resembling snow-white hanks of darning-cotton, that appear to be almost inexhaustible. There is a European species, *Holothuria nigra*, occurring on the Cornish coast and locally known as the "Cotton Spinner," that ejects its Cuvierian organs in the same manner, though to a less conspicuous extent. Mr.

E. A. Minchin, who has recently investigated the phenomenon as exhibited by this species—(*Annals and Magazine of Natural History*, October, 1892, p. 273)—has found that the organs normally attached to the external wall of the intestine when first discharged pierce the walls of the cloaca, and are then shot out through the rectum after the manner of a rocket. Each individual organ or filament, when first released, possesses an inflated head, which becomes gradually diminished in size as the thread elongates, and until it reaches, so to say, the extreme length of its tether. The actual or determining cause of the lengthening process remains, as yet, undiscovered—an inherent automatic power of elongation—the unreeling of an enclosed spiral thread—the action of water pressure forced in from the cloaca,—have been respectively advocated by authorities as furnishing a probably correct interpretation. Having regard to the extreme tenacity and plasticity of the Cuvierian filaments, and their development in many of the Great Barrier species in such copious masses, the suggestion arises whether the substance could not be turned to economic use as a substitute for caoutchouc. Its tenacious, glue-like consistence, when first extended, and its flexible and elastic properties when subsequently dried, appear to lend some support to the anticipation of latent possibilities in this direction.

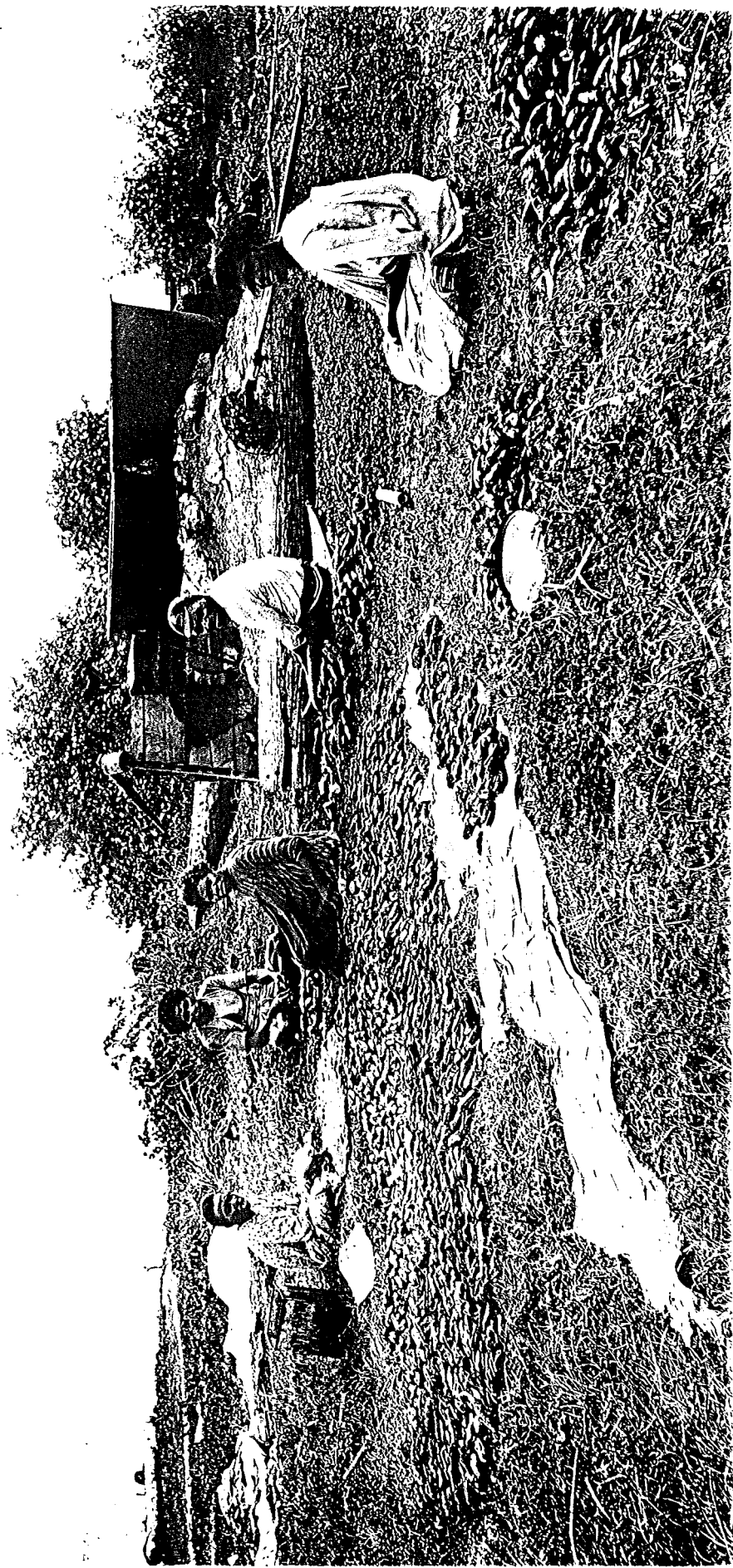
In the coloured plate, Chromo XII., illustrating various representatives of the Bêche-de-mer tribe, there are one or two figures which would appear at first sight to possess no legitimate claim for admission among this class of organisms. The first of these, Fig 3A, is a species of flat, large-scaled worm, closely allied to the familiar *Polynoe setosa* of European seas; but, in place of lurking under stones on the seashore, as does that species, this form is invariably associated with the bottle-green-tinted Bêche-de-mer, *Stichopus chloronotus*, figured immediately beneath it. Clinging closely to the integument of the Holothurian, in the interspaces betwixt the projecting papillæ, it can, in life, be scarcely detected, the colours in the two animals perfectly harmonising. By way of comparison with the ordinary representatives of the genus *Polynoe*, the parapodial appendages of this commensal type are specially modified to the form suckers which enable it to cling to its elected host. A corresponding commensal annelid has been found by the author associated with the species of Bêche-de-mer, *Actinopyga mauritiana*, previously described under the title of Surf-red. In this instance it has also adapted itself to the colour of its host; being of a clear red-brown hue. There are some species of Bêche-de-mer that entertain guests on much more intimate terms than those of mere outside "hangers-on," such as are these annelids. The fish, for example (a species of *Fierasfer*), delineated in Fig. 10 of Chromo XII.—inhabits the body cavity of the large teat-fish, *Holothuria mammifera*, in the same manner as the two species of *Amphiprion* (figured in Chromos I. and II.) lodge with their associated anemones. Among the Bêche-de-mer fishers, these commensal fish are popularly known by the name of "Glass Eels." So far as the author has been able to ascertain, the above-named species of *Holothuria* is the only one among the many known varieties that shelters a *Fierasfer*.

On the pearl-shelling grounds of Western Australia, a fish of the same genus lodges within the mantle-folds of the large mother-of-pearl shell, *Meleagrina margaritifera*. An interesting example is exhibited in the shell gallery of the British (Natural History) Museum, in which a Fierasfer, having apparently died in this position, has been enclosed by the mollusc within a pearly sarcophagus.

Figures 8 and 9 of the Chromotype plate No. XII., delineate organisms that do not precisely coincide in aspect and structure with the typical Bêche-de-mer, most abundantly represented in this plate. These are technically known as Synaptæ, and belong to a generic group, whose members, while allied to the ordinary Holothuriæ, differ from them in the composition of their oral tentacles. These organs are fewer in number (ten only) and pinnate, like the fronds of a fern, while the animals themselves are altogether devoid of the characteristic locomotor tubules and acetabula so conspicuously associated with the more familiar forms. In lieu of these, the surfaces of the integument of the Synaptæ are roughened by the presence of countless myriads of minute calcareous spicules, often wonderfully like anchors in shape, by means of which these animals hook on to, and literally "warp" themselves over, the surface of the ground they elect to traverse. There is one allied genus, *Chirodota* (more abundantly represented, however, on the South Australian coast-line), which presents the remarkable phenomenon of an animal beset, as it were, by wheels, the armature in that type being represented by the most exquisitely-fashioned, six-rayed, wheel-like spicules. The species of Synapta, *S. Beselii*, depicted in Fig. 8 of the Chromo plate XII., is the largest known member of its tribe, not unfrequently stretching out on the reef-flats covered with the *Zostera*-like grass, *Posidonia australis*, to a length of five or six feet. It is also remarkable for the symmetrically nodular, quadrangular, pattern of the plications of its integument shown in the figure. Under the condition of fullest extension, however, these nodular rugæ may become entirely, or locally, obliterated, reappearing again when the animal contracts into its normal condition of repose. Its skin, in common with that of other members of the genus, is excessively thin and semi-transparent, almost permitting a vision of the enclosed viscera. This handsome species, was found most abundantly on the extensive Warrior Island reefs in the north of Torres Strait, and also, more sparingly, as far south as Rocky Island, off Cape Flattery. Different individuals, as with many of the ordinary Holothuriæ, vary considerably in their colour-patterns, some being brighter, others darker, or more variegated than the example figured.

A characteristic illustration of the colour variation to which the members of this group are subject, is afforded by the cluster of a smaller, smooth-skinned species of Synapta (Fig. 9), delineated to the right of *S. Beselii* (Fig. 8). No two of these individuals are alike, being either self-coloured, striped or diversely speckled. All five, with other additional specimens, were brought up by the dredge, in a tangled mass, in Cleveland Bay, off Townsville. A more typical, brilliantly-tinted species of Holothuria, *Colochirus anceps*, is represented by Fig. 4 of this same plate. This

gaily-decorated, bright yellow and rose-coloured type, was dredged from a depth of six or seven fathoms, in the centre of the most prolific pearl-shelling ground at the Western end of Torres Strait. The tentacles in this form differ essentially from those of the typical reef-feeding varieties. In the latter they are mop-like, and specially adapted for sweeping food particles off the rock or mud-surfaces on which the animals feed. In *Colochirus*, as in the British genera *Psolus* and *Cucumaria*, the tentacles are subdivided into minute filamentous ramifications, and are utilised more after the manner of a set-net, to intercept floating organisms in the surrounding water. In both instances, and also in *Synapta*, the process of food ingestion is identical, the pabulum being transported to the gullet by the complete inversion of the food-laden tentacles, in consecutive and almost rhythmical succession.



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W. Saville-Kent, Photo.

NATIVES OF WARRIOR ISLAND, TORRES STRAIT, PREPARING BÊCHE-DE-MER FOR THE CHINESE MARKET.

CHROMO PLATE XII.

GREAT BARRIER REEF HOLOTHURIAE OR BÊCHE-DE-MER.

- Figs. 1 and 2.—Commercial Bêche-de-mer, "Red Fish," *Actinopyga obesa*, p. 236. Fig. 1, illustrating ventral and oral regions, with expanded tentacles; and Fig. 2, dorsal view of posterior extremity with vent. Life size and colours.
- Fig. 3.—"Green Prickly-Fish," *Stichopus chloronotus*, p. 235. Non-commercial; with extended tentacles, life size and colour; 3A, Polynoe-like annelid, that lives as an external commensal on the body of *Stichopus*.
- Fig. 4.—*Colochirus anceps*, p. 242. Non-commercial; life size and colour.
- Fig. 5.—Snake-like Bêche-de-mer, *Holothuria coluber*, p. 238. The anterior moiety of the animal, with expanded tentacular crown, is alone visible; natural size.
- Fig. 6.—Commercial Bêche-de-mer, "Black Fish," *Actinopyga polymorpha*, n.sp. p. 236. The anterior region only, with expanded tentacles.
- Fig. 7.—"Leopard" or "Spotted Fish," *Holothuria argus*, p. 238. The posterior moiety, with vent; natural size.
- Fig. 8.—Giant Synapta, *Synapta Beselii*, p. 242. Life size and colour.
- Fig. 9.—*Synapta* sp., p. 242. Group of variously-coloured individuals, life size and colour.
- Fig. 10.—Fish "Glass Eel," *Fierasfer* sp., p. 241, that lives as a commensal within the body-cavity of the large teat-fish, *Holothuria mammifera*; natural size.

