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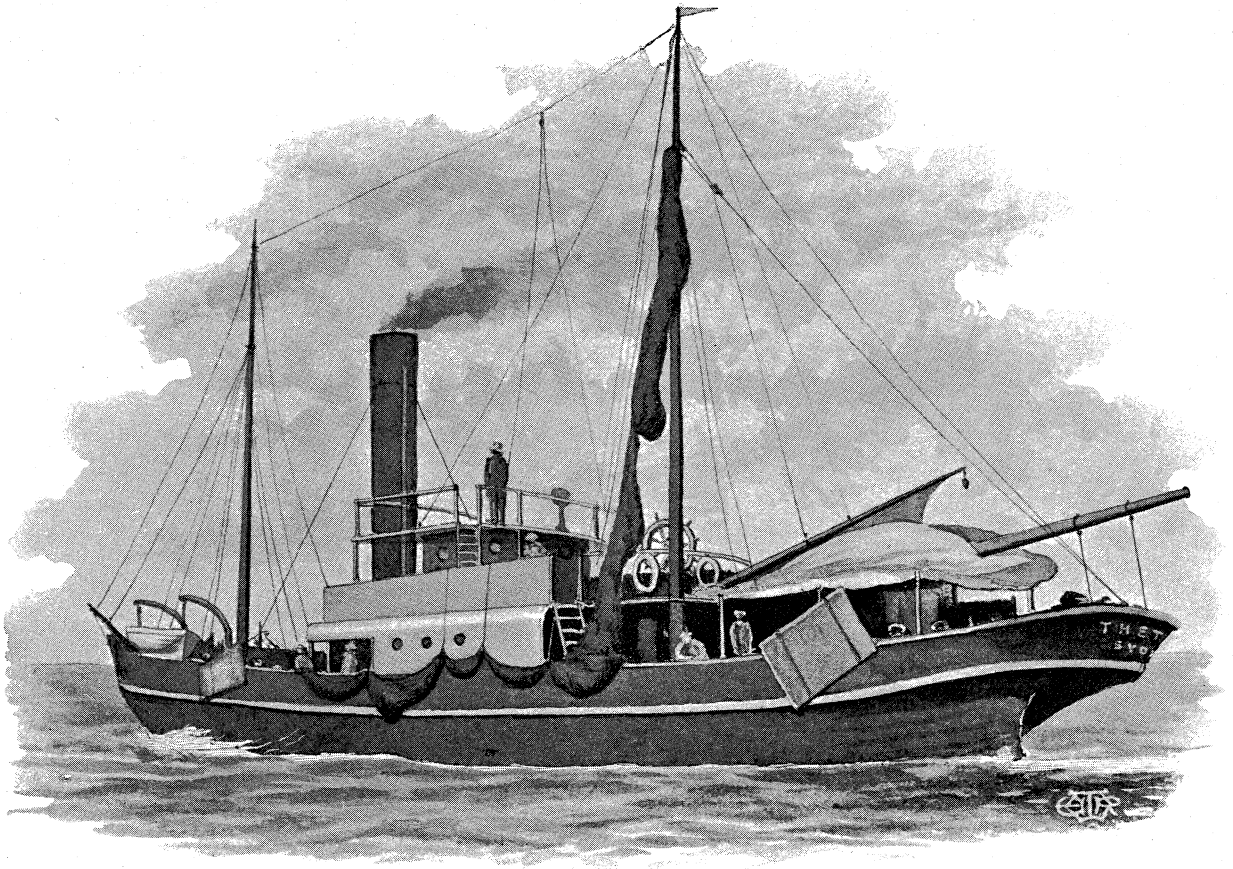
CONTENTS.

PART I.

Frontispiece and 31 Plates.



H. M. C. S. "THETIS."

SCIENTIFIC RESULTS OF THE TRAWLING EXPEDITION OF H.M.C.S. "THETIS."

INTRODUCTION.

By EDGAR R. WAITE, F.L.S.,
Zoologist, Australian Museum.

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South of the equator, few waters, if any, have been as thoroughly investigated as those of Port Jackson, and it has been proved that its fauna is an extremely rich one.

On the other hand, the fauna of the waters which break upon the Australian coasts as a whole has been but little examined, and while the seas of New South Wales have been better searched than those of any other part of the Continent, it needs but the slightest dip into our literature to become aware that such investigations have, for the greater part, been made immediately outside Port Jackson.

The only observations made in our coastal waters for scientific purposes have resulted from the visits of foreign equipped expeditions making Sydney a port of call. All local ventures have had a commercial basis, that is, they have been made in connection with the fishing industry, and even these are very limited in number, and for some reason or other so unsuccessful, that to-day not a single boat is engaged in trawling.

It is constantly remarked that trawling can never be a commercial success here, because either the fish cannot be obtained in payable quantities, or those taken are not of sufficient quality for table use. It is not my purpose to discuss this aspect of the question, but I would pertinently point out that we know practically nothing of the habits of the fish we wish to secure, and that small chance of supplying the deficiency exists until we have established a Biological Research Station with necessary corollaries. Many of the countries of Europe, and America, richly endow such institutions, and one need but look to the publications of their staffs to realise the amount of valuable work accomplished. To those interested I would recommend a perusal of the admirable work by Mr. J. T. Cunningham, M.A., published by the Marine Biological Association.*

Another cause of failure may be traced to the haphazard manner in which the experiments have been conducted. No complete submarine survey has been made, but in September and October,

* Cunningham—Marketable Marine Fishes, 1896.

1892, Staff Commander Fred. Howard, R.N., made four hundred and three soundings off the coast, ranging from 10 to 128 fathoms. Rarely has a trained naturalist been employed, and in the few instances where the services of such has been sought, he has never been consulted as to necessary equipment or permitted any voice in the direction or control of the expedition, but been placed on board to accept matters just as he may have found them.

I have below given a rapid sketch of the marine investigations of the Colony, and some idea of the paucity of such operations will be thereby gained. In very few cases has any scientific or other record been kept, but such as I have traced, while scanning the literature, is chronicled or the necessary references supplied.

Shore collections had been previously made, but one of the earliest investigators to obtain specimens below tide marks was Samuel Stutchbury, afterwards Government Geologist of New South Wales. He was the first to take alive the interesting mollusc *Trigonia*, the species previously obtained in Tasmania by Peron and King being known from the shell only. Stutchbury describes* how certain specimens were attached to *Trigonia*, and, "having seen the living animal," discusses its zoological position. *Trigonia* was probably first taken here in 1826, for on p. 98 of the work quoted, Stutchbury records having in the year 1286 *(sic)* searched near the entrance of Port Jackson and discovered, among other forms, the first living *Clavagella*.

We have evidence that the first *Trigonia* was actually dredged, for A. H. Cooke, dealing with the leaping powers of Mollusca, writes† "Miss Saul has informed me that the first living specimen of *Trigonia* that was ever obtained was lost in a similar way. It was dredged by Mr. Stutchbury in Sydney Harbour and placed on the thwart of a small boat. He had just remarked to a companion that it must be a *Trigonia*, and his companion had laughed at the idea, reminding him that all known *Trigonia* were fossil, when the shell in question baffled their efforts to discover its generic position by suddenly leaping into the sea, and it was three months before Mr. Stutchbury succeeded in obtaining another." This account is an extension of that appearing in the Bridgewater Treatise.‡

The "Astrolabe," flying the French flag, during her voyage in 1826-29 visited New South Wales and made dredgings in Jervis Bay and Port Jackson. Quoy and Gaimard were the naturalists on board, but they did not collect *Trigonia* in Port Jackson. Everyone who afterwards visited Sydney seems to have been determined

* Stutchbury—Zool. Journ., v., 1830, p. 97.

† Cooke—Cambridge Natural History, iii., 1895, p. 65.

‡ Bridgewater Treatise, i., 1835, p. 264, pl. v., fig. 5.

to obtain this pretty shell, and so well did they succeed that it is now almost exterminated from its old haunts; the species, *T. lamarcki*, however, also occurs in deeper water outside the harbour, and examples were obtained by the "Thetis." The collections made by the "Astrolabe" have been fully examined and the results published. Many interesting observations on the fauna of the coast are recorded.*

H.M.S. "Fly," together with her tender the "Bramble," was in Sydney several times between 1842 and 1845 refitting for her surveying cruise. She also put in at Port Stephens, but it is not clear if she dredged in our waters. The specimens obtained may have been collected at low tide. A crustacean, *Xantho deplanatus*, White, is described from Garden Island, Port Jackson.†

The surveying work of the "Fly" was continued by H.M.S. "Rattlesnake," and in the years 1848 and 1849 she also took in supplies at Sydney. Several dredgings were made, principally in Bass and Torres Straits, but specimens are also recorded from Port Jackson and Jervis Bay.‡ At Cape Byron, an immature Gasteropod was taken and afterwards named by Gray *Macgillivrayia pelagica*.§

In 1857 H.M.S. "Herald" visited our waters, and in April of that year dredged off Port Stephens and Cape Three Points in 70-80 fathoms. Of Mollusca obtained may be mentioned *Pleurotoma suavis*, Smith,‖ and of Polyzoa *Lunulites crassa*, Tenison Woods, *L. angulopora*, Tenison Woods, and species of *Selenaria*.¶ I am not aware of any collected results of this early expedition of the "Herald"; the material was scattered, some Mollusca going to London, while the Polyzoa remained at the Macleay Museum in Sydney. It was evidently taken charge of by Mr. W. S. Macleay, who, as is apparent from the latter work quoted, was on board when the dredgings were made.

The following year, or thereabouts, the Austrian frigate "Novara" called at Sydney during her voyage round the world in 1857-9, and made collections in our waters. The results of the expedition were published in Vienna.**

When H.M.S. "Challenger" visited Australia in 1874, the trawl was put down several times off New South Wales, and many

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* Voyage de l' "Astrolabe," iv., 1833, pp. 323-4.

† Voyage H.M.S. "Fly," ii., 1847, p. 337. See also Appendix.

‡ Voyage H.M.S. "Rattlesnake," ii., 1852, App., pp. 368-374.

§ *Loc. cit.*, i., p. 45.

‖ Smith—Ann. Mag. Nat. Hist. (6), ii., 1888, p. 305.

¶ Tenison Woods—Trans. Roy. Soc. S.A., iii., 1880, pp. 5, 7, 9.

** Reise der Osterreichschen Fregatte Novara, 1869.

soundings were taken. On April 4th, while off Twofold Bay (Station 163A.) trawlings were made in 120-150 fathoms with very satisfactory results.* Of this haul Prof. H. N. Moseley wrote:—"For the first time we procured enough fish to allow of our eating them." The "Challenger" remained at Port Jackson from April 6th to June 12th, 1874, and on June 3rd the trawl and dredge were lowered several times in 30-40 fathoms (Station 163B.). During the stay many dredgings were made within the harbour, and the long list of material obtained is published where cited.†

During the voyage of S.M.S. "Gazelle," 1874-76, numerous specimens were obtained on the east coast of Australia, but there the operations appear to have been confined to Queensland waters. The results have not appeared in collected form, but papers on the Madreporaria, ‡ Alcyonaria,§ Pycnogonida,‖ Pteropoda,¶ Echinoidea,** and Mollusca†† have been published.

From January 23rd to April 15th, 1881, H.M.S. "Alert" was refitting in Sydney Harbour, whence she proceeded northward in continuation of her cruise. Although many dredgings were made in Port Jackson, nothing seems to have been done outside until the Queensland coast was reached. The results have been published in book form.‡‡

Of local enterprise there is very little to be said, the experiments are not numerous, and except in a few isolated instances no records have been preserved.

The pioneer of the movement in New South Wales seems to have been Sir William Denison, then Governor of the Colony, and the following account I clip from a letter by Capt. Francis Hickson, R.N., published in the daily press §§:—

"In or about the year 1857 a small fishing craft said to hail from the Mauritius arrived in Sydney Harbour with a trawl on board, and the man in charge reported that they had netted such a quantity of turbot on the coast near Sydney that their net broke. He could not, however, produce a single specimen of this much-prized fish.

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* Challenger Reports—Summary of Results, i., 1895, p. 546.

† Challenger Reports—*loc. cit.*, p. 552-574.

‡ Monatsb. K. Preus. Akad. Wiss. Berlin, 1877, p. 625, and 1878, p. 524.

§ Studer—*l.c.*, 1878, p. 632.

‖ Böhm—*l.c.*, 1879, p. 170.

¶ Pfeffer—*l.c.*, 1879, p. 230.

** Studer—*l.c.*, 1880, p. 861.

†† Martens—Conch. Mittheil, ii., 1881, p. 105; Sitsb. Ges. Nat. Freunde Berlin, 1881, p. 66.

‡‡ Report Zool. Coll. "Alert," 1884.

§§ "*Sydney Morning Herald*," 6th March, 1897.

"The man's report created such interest, however, as to induce His Excellency the late Sir William Denison, Sir Daniel Cooper, and Captain Broomfield, who is still to the fore in any enterprise of the sort, to take the matter up, and two unsuccessful attempts, under the supervision of the last named gentleman, who insisted on being on board the vessel to test the *bona fides* of the affair, were made in the new arrival.

"It became perfectly manifest that our visitor wanted to sell his plant to the best advantage. The scheme failed, however, and he was only enabled to sell his trawl; this was purchased by Sir William and Sir Daniel. After having secured the trawl, which was an ordinary North Sea one, with a beam of about 30ft., the owners, together with Captain Broomfield in the schooner 'Gazelle,' tried Botany Bay and secured a few flounders, but no sign of turbot.

"I now come upon the scene, as I was sent, with a party of men from H.M.S. 'Herald,' to follow the matter up and ascertain whether there was any foundation for the report which had been circulated, and to try the trawling capabilities of the coast generally. We embarked in the schooner 'Catherine Agnes,' accompanied by Captain Broomfield, the owner, who had gratuitously placed his vessel at our disposal. The late Mr. E. S. Hill, a most experienced fisherman and amateur naturalist, also joined the party.

"We trawled in the North Harbour, also in Jervis Bay, and at the most likely spots along the coast between Sydney and the before-mentioned place. We met with various vicissitudes in the way of fouling the trawl, breaking the beam, having to bear up for an anchorage to cut a fresh one, and so on, and we continued our efforts about ten days. We caught a few sole, john dory, and flathead, with plenty of blubber, and other refuse; but there was no sign of turbot, and we were not favourably impressed with the trawling capabilities of the coast."

Nothing further appears to have been done until 1874, when on November 28th Sir (then the Hon.) Wm. Macleay sent the schooner "Peahen" on a dredging expedition to Port Stephens. Beyond the fact that a large Sunfish was found stranded on the beach and removed to Sydney, I have no details; the only published notice seems to be: "Mr. Brazier read an amusing account of a dredging excursion along the coast of New South Wales."*

In November, 1880, the Australian Museum chartered the S.S. "Manly," and instituted a dredging excursion to Port Stephens and Broughton Island. The Invertebrates obtained numbered

* Proc. Linn. Soc. N.S.W., i., 1877, p. 14.

about seven hundred, the Crustacea were determined by Haswell, the Mollusca by Brazier, and a list of the collections will be found in the Report of the Trustees.*

The Fishery Commissioners of New South Wales next commenced operations with a beam trawl. Their first essay was made in the S.S. "Dove," and the ground covered extended from Jervis Bay to Botany Bay. This vessel was in trawling service from October 22nd to 27th, 1883, and a narrative of the expedition may be consulted in the Commissioner's Report † A more technical account was prepared by Macleay,‡ and although not quite correct as to dates is of considerably more interest—two new species of fishes, *Lepidotrigla mulhalli* and *Raja australis* are described, and others mentioned. The Invertebrata obtained do not appear to have been preserved.

In February, 1884, the Commissioners obtained the use of H.M.C.S. "Ajax," and, again with a beam, trawled off the coast. From one of the Inspector's Reports, kindly lent me by Mr. J. A. Brodie, Chief Inspector of Fisheries, I gather that the first trial was made south of Port Jackson in 45 fathoms, but proved a failure; it was next lowered in 50 fathoms, and after a run of ten miles the fish caught were "dory, nannygai, flathead, sting rays, saw fish, and leather jacket."

Steaming northward the trawl was next day shot in 25 fathoms off Cape Three Points, and raised in 30 fathoms over a ten mile course; the fish were similar to the last haul, but in greater quantity. The next essay proved a blank; and of the concluding trial, off Bird Island, in 25 fathoms, the Inspector writes:—"When we hove the trawl up it was torn to ribbons, evidence of it being done by red coral reefs, as pieces of red coral were brought up with the remains of the trawl." This is the only bit of information obtainable of the Invertebrata; what the Inspector mistook for red coral was doubtless the Hydrocoralline, *Stylaster sanguineus*, obtained by the "Thetis," but never before recorded from this Colony, its habitat being vaguely rendered as "Australia."

The waters of Port Jackson and other harbours are largely netted by Italians, chiefly from the Lipari Isles, of whom there is in Sydney a considerable number engaged in either the selling of fruit or catching of fish. Some of the leading members have attempted trawling on the Italian plan. Instead of working either the beam or otter trawl, they use the *Paranza*, dragged by two vessels.

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* Australian Museum Report for 1881 (1882), pp. 1 and 19.

† Report Commissioners of Fisheries N.S.W. for 1883-4, p. 33.

‡ Macleay—Proc. Linn. Soc. N.S.W., viii., 1884, p. 457.

In 1888 several such attempts were made in the interest of Dr. V. Marano, the Italian Consul, Mr. Oscar Meyer and Mr. Leonardi Porcelli; the dates supplied to me are June 3rd and 4th, 29th and 30th, July 7th and 8th, and 22nd and 23rd. Trials were made between the 25 and 33 fathoms lines, and the net used was one patented by Mr. Porcelli, of which the specification (and an illustration) is published by the Fishery Commissioners* :—

"The net itself is unlike the English beam trawl, being twice as long, and having its other dimensions in proportion; the mouth, instead of being a plain transverse opening, is formed of two extending jaws or wings, which when distended form a shape like the letter V. The net is drawn through the water by two vessels, there being two warps attached to it, one at each side of the mouth; the attachments also are different from those used with the ordinary English trawl." The trials were regarded as very satisfactory, and were conducted off Broken Bay and Port Hacking. One catch is described as being so enormous that the net broke, and the fish escaped.

Operations were renewed by the Italians in 1890, but no industry has resulted from the several praiseworthy attempts made.

In August, 1889, Mr. F. W. Smithers, Inspector of Fisheries, took out a small vessel, and put a trawl over in 17 fathoms off Merimbula, north of Twofold Bay; the Mollusca were sent to the Museum and determined by Brazier, who records seven species, the only one of special interest being *Crassatella kingicola*, Lamk., recorded for the first time from the coast of New South Wales.†

It was a constant practice, extending over many years, for the Australian Museum staff to dredge within the harbour, but operations finally ceased in 1893 when the financial crisis of the Colony occurred. The collections made have afforded material wherewith to furnish the galleries, and have also been used for purposes of exchange.

No account is here taken of the many dredgings in Port Jackson made by both foreign and local effort, and which have provided material for many papers published here and elsewhere. A list of the Mollusca taken in Port Jackson in one day may be consulted in the Annual Reports of the Trustees.‡ While as showing the richness of the fauna, Mr. A. U. Henn, in October, 1893, took an old bottle from a rock pool and found it to contain one hundred and fifty-five species of molluscs represented by one thousand three hundred and seventy-six specimens.§

* Report Commissioners of Fisheries N.S.W., for 1888, p. 19, and plate.

† Brazier—Proc. Linn. Soc. N.S.W. (2), iv., 1889, p. 745.

‡ Australian Museum Report for 1881 (1882), p. 16.

§ Henn & Brazier—Proc. Linn. Soc. N.S.W. (2), ix., 1894, p. 165.

We may thus close a brief notice of trawling and dredging on the coast up to 1898, in which year H.M.C.S. "Thetis" was commissioned. A report on the fishes of the expedition, hurriedly prepared for presentation to Parliament, has already appeared; in the following pages this will be referred to as the "Preliminary Report."*

For the inception and organisation of this expedition credit is due to Mr. Frank Farnell, M.L.A., who, in addition to being an ardent fisherman, enjoyed special facilities by virtue of his position as a member of the Legislative Assembly of New South Wales.

The expedition was financed by the Colonial Government and Mr. Farnell was appointed director; with him was associated Capt. Carl August Nielsen, an experienced North Sea trawler, on whose skill depended the successful working of the appliances.

When all arrangements were virtually completed it was decided to ask the Trustees of the Australian Museum to appoint one of their officers to join the expedition, chiefly to determine the fishes and write a report thereon. On the Curator's recommendation the writer was selected to act in this capacity, and I, in consequence, was aboard the vessel during the whole period and saw the trawl raised on every occasion. A large and valuable collection was preserved, particulars of which will be published as dealt with by members of the Museum Staff in subsequent pages.

Although I may have further need to refer to the following matter, I take this opportunity of emphasing the fact that the expedition was conducted purely in the interests of fishing industries, consequently neither the Trustees of the Museum, nor their representative, were consulted as to the equipment of the vessel or the area to be traversed. On one occasion Mr. Farnell kindly obliged me by re-trawling old ground when I hoped to secure further examples of the new *Chimæra*. Her Majesty's Colonial Steamer "Thetis," under the command of Capt. C. P. Hildebrand, was fitted up for the undertaking, but, as experience showed, was a most unsuitable vessel for the purpose. In addition to rolling heavily in even moderate seas, she carried a lot of top hamper, which left small space wherein to work. The amidships was occupied by the upper engine room, while the after deck was crowded with the donkey engines, the cabin skylight, companion, etc. The only clear space wherein one might have worked with some degree of comfort had been most unfortunately absorbed by the erection of a huge ice-house intended as a store-room for the fish obtained. The port gangway was given over to the working of the trawl, so that the little space that remained

* Sea Fisheries. Report Trawling Operations N.S.W., H. M. C. S. "Thetis," 1898.

was portion of the gangway on the starboard side, and, except when the trawl was being actually towed, this was frequently rendered an untenable position owing to the passage of the warps and ropes from the donkey engines.

Rolling and pitching is a condition inseparable from life at sea, but in a vessel specially equipped for scientific work the inconveniences are reduced to a minimum. In my case work had to be conducted on deck, and having no rackwork, all receptacles had to be lashed to stays and other deck furniture.

I mention these matters in order to show under what adverse conditions my work had to be conducted. On the other hand, I cannot speak too highly of the kindness shown to me by the officers and crew of the vessel, to whom at times my movements must have been troublesome, interfering somewhat with ship management.

Perhaps of all objects those which gave me most trouble were the long fingered Echinoderms (*Luidium*). Soon after being laid on deck these creatures and their long members parted company, and no amount of persuasion would induce them to remain in position. I next found that it was possible to kill the star fishes before separation took place by inverting them in a shallow dish and rapidly flooding them with the strongest spirits. The rhythmical roll of the vessel, however, caused the arms to sway from side to side until they broke away from the centrum as before. The difficulty was finally overcome by the construction of a cabinet containing shelves. After being killed, each specimen was transferred to one of the trays and pinned into position, and thus safely conveyed to port at the first opportunity.

A constant source of annoyance were the Squids; in company with fish and other specimens the net would sometimes yield them by bucketsful; when voiding their secretion (sepia) the whole became a blackened mass. In this connection one matter may be worth mentioning: for the first week, or thereabouts, my hands were black from this cause, and no amount of washing would remove the stain. This disappeared naturally after a time, and thenceforward the sepia had no effect on the hands whatever. Whether this resulted from a counteracting effect of fish mucous or not I cannot say.

TRAWL.

The type used was that known as the Otter Trawl, wherein the mouth of the net is kept distended by means of two large boards —the otters. Our trawler, Captain Nielsen, had introduced some improvements on the usual type of otter trawl, but such need not be referred to here. It may, however, be mentioned

that, in place of the usual single warp, two were used, and the advantage of this was on one occasion clearly demonstrated. At Station 13 the forward warp broke, notwithstanding the fact that it was composed of the best wire-rope, an inch in diameter. Had the net not been held by a second warp, we should have lost everything—an experience not new to me. This double warp does away with the necessity of a bridle, and, had we been able to pay it out over the stern instead of the port side, its advantages would have been still further increased. In working an otter trawl at varying depths some nice adjustment is necessary to ensure the boards always running at the correct angle. In shallow water the warp paid out was about three times the indicated depth, but in deeper water the proportion was lessened in consequence of the greater weight of the warp. If hemp, instead of wire, had been used, much more rope would have been required.

The net being intended for economic and experimental purposes, the mesh was altogether too large to meet the requirements of a naturalist; near the mouth it was about five inches, and in consequence large quantities of fish escaped. Indeed, the first indication of a successful haul, from an economic standpoint, was the large number of Gurnards *(Triglidæ)* rising to the surface, belly upwards, and floating away astern. At the smaller end, the mesh was also large, consequently the smaller organisms among which a zoologist would expect to reap the richest harvest, were, for the most part, not obtained. When mud was freely encountered, our efforts were more successful, and it was on such occasions only that I was able to gather the more minute Invertebrate life. In such cases as much mud as possible was put through the filters of various gauges and a fair unwashed sample retained to be afterwards worked for microscopic forms. On several occasions when mud had without doubt been netted, all but a trace of it had been sifted out as the trawl passed through the water. With a view of retaining some of this mud, a canvas bag was attached to an iron hoop within the bunt end of the net and thus on several occasions the object was effected. As considerable trouble was entailed in securing and removing the bag, I did not care to try the good nature of our trawlers too frequently.

DREDGE.

I had hoped to largely supplement our takings by means of dredges specially designed for arresting the smaller organisms which the trawl was not calculated to retain. In this I was much disappointed. Having no appliances for running out a separate warp, the dredge had to be attached to the bunt or "cod-line" of

the trawl, and unfortunately the first time it was put over, rocks were encountered, and notwithstanding the fact that the frame was constructed of iron bars thicker than a broomstick, the appliance was broken and twisted out of all recognition. (Fig. 2, p. 23.) This in itself was a small matter, and the duplicate on hand could soon have been attached; it was, however, evident that the dredge had contributed so largely to the damage sustained by the trawl on that occasion, that I could not again think of subjecting it to similar undesirable possibilities.

TOW-NET.

Following our usual custom when working within Port Jackson, the tow-net was at first let out astern; owing, however, to the comparatively great speed at which we trawled—2¾ to 3 knots—and especially in a choppy sea, or with the current against us, it was found that two men were required to haul the net in. This extra pressure, bringing the speed up to four, or even more knots, "started" the material, and eventually a net was lost owing to the breakage of the tow-line. In order to avoid this extra pressure, and also to dispense with the services of two ill-spared men, the following plan was tried and succeeded so well that it was ever afterwards adopted. A boom was run out for'ard from the upper deck and the tow-line passed to the quarter, where a tripping-line attached to the rim of the net enabled me to haul it up at any time single handed. (Fig. 1.)

In fine, bright weather, a quarter-hour's run was sufficient to quite fill the bottle with *Salpa*, *Velella*, *Physalia*, *Medusa*, Pteropoda, and other pelagic forms.

When at anchor, I used a cane-rimmed net, much lighter material, and supported the neck of the bottle with corks; it was thus floated away by the current

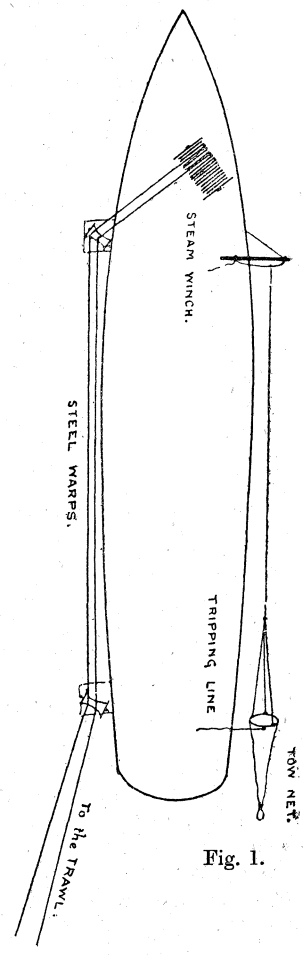

Fig. 1.

or the wind, and although passing a much less quantity of water per minute, did good work.

The tow-net was also occasionally run at night, and the phosphorescent organisms, Copepoda, *Salpa*, etc., quite illuminated the bottle in which they were received. Every ripple on the water was also lighted with them, but not nearly so brilliantly as when concentrated in the bottle of the tow-net.

As the trawl was worked from the port side of the vessel, the tow-net was necessarily run from the starboard. While watching the trawl-warps small animals were often noticed floating by. Many of these were obtained by dropping a captive bucket overboard. In this way I got examples of *Ianthina*, and on one occasion, off Wata Mooli, at 5 p.m., March 12th, secured the only three examples of *Glaucus atlanticus* observed during the cruise.

PELAGIC LIFE.

The harvest of the tow net greatly astonished all on board, to whom pelagic life had an undreamed existence. When it was further pointed out that these surface organisms were directly or indirectly food for the fishes we were endeavouring to catch, those specially interested in the trawling venture viewed the proceedings with even keener attention.

As so little is popularly known on this subject, and as it has such great bearing on the fishing industry, I have been asked to devote a paragraph to pelagic life. Until the gatherings of the tow net have been systematically examined it is not possible to detail the various captures. A very good idea of this pelagic life may, however, be gleaned by periodic visits to our ocean beaches.

Working along the beaches in January, regular collectors note the comparative absence of surface life. In February, under suitable conditions, as the ripples recede from the sand, they leave behind a line of minute animal life; this pelagic life increases in volume until about May, when it reaches its maximum. After July this flux greatly diminishes.

On scooping up a little of this living line and placing it in a bottle of water, it is seen to consist of a great variety and infinite number of minute organisms. In greatest abundance are the jelly-like bodies known as *Salpa*, members of the Tunicata, transparent and almost invisible, while in water, to the human eye. Some of the larger species measure seven or eight inches in length and weigh several ounces. Also common are species of worms, *Sagitta*, likewise transparent. Scattered among these are many different kinds of Crustacea such as Amphipods, allied to the

familiar sand hoppers, Isopods, marine representatives of the garden woodlouse, and Copepods, all eagerly devoured by fishes. Of the shell-fish kind we observe *Ianthina*, *Glaucus*, and the Pteropods and Heteropods, in which the body is transparent and the shell almost obsolete. Numerous small *Medusa*, or jelly fishes, are also washed up, and if these are not actually eaten they form food for other creatures preyed upon by fishes. The *Physalia*, better known as the Portuguese Man-o-'war, is a familiar and abundant animal, dreaded for its stinging properties. Mr. T. Whitelegge tells me that he has often seen small fish in their stomachs and entangled in their tentacles. *Velella* is an allied animal frequently associated with *Physalia*. These are some of the principal pelagic types met with, but hosts of other forms also occur; some of these are quite erratic in their appearance. At times the waters off shore and in the harbour become greatly discoloured, and in places even present the appearance of blood. Mr. Whitelegge, who investigated this matter,* found that it is due to the presence of a small organism, *Glenodinium rubrum*, which swarms to such an extent as to discolour the water for miles and miles.

Organisms belonging to the same group are largely preyed upon by fishes, and there is little doubt that our *Glenodinium* is to be ranked as a bountiful supply directly or indirectly. MM. Pouchet and Guerne, who examined some sardines, found their viscera literally filled with species of *Peridinia*, and estimated that the digestive tract of a single fish contained no less than twenty million individuals.†

It is, however, difficult to give any idea of the wealth of minute life at the surface of the ocean; it is sometimes washed ashore in such profusion that the rocks become dangerously slippery with a thick deposit, whilst the water in the rock pools is thickened by the abundance of *Salpa* and other forms. Associated with them are crowds of Copepods. Every object in the water is peopled with them; shake a piece of seaweed in a bottle and thousands are disturbed; when dead they settle as a thick sediment.

It must be remembered that I am not writing of food in the sea generally, but only of that found at the surface. This surface life is much influenced by the weather; if a shower disturbs the surface the minute organisms sink, and then cease to be washed ashore. The sudden disappearance of a shoal of fish might be thus accounted for.

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* Whitelegge—Rec. Aust. Mus., i., 1891, pp. 144 and 179.

† Pouchet and Guerne—Comptes Rendus, 1887, p. 712.

The warm current of water which sets down the Australian coast from the north brings in its wake many forms not properly belonging to the fauna of our temperate shores. This current from the tropics is extremely rich in minute forms of animal life, consequently fishes are attracted to, and journey along with it. This current brings to us many tropical fishes such as *Nomeus*, *Schedophilus*, *Psenes*, *Monacanthus nitens*, and *M. fiilicauda*. A hitherto unrecorded equatorial species, may now be chronicled, Mr. Whitelegge having at Maroubra Bay secured examples of *Chætodon citrinellus*, Brouss. One sign of this approaching flood is given by the gulls which flock down to and pick up the food, as pigeons do wheat. Life on the beach, although plentiful enough, is nothing when compared with that of the open ocean, to realise which one must see the tow net after ten minutes run on a sunny afternoon.

Vegetable life is also richly developed on the surface of the ocean. Mr. Henry Tryon, in an interesting paper entitled "The Sea Scum and its Nature,"* describes how, at times, the sea is covered with a greenish-coloured film, which on investigation proved to be due to the presence of a minute alga or plant of the group Nostocaceæ. The Red Sea is said to owe its name to the occasional presence of such a scum produced by the allied form *Trichodesmium erythræum*.

Of pelagic fauna Professor A. Agassiz writes:—"One must have sailed through miles of Salpæ, with the associated crustacean, annelid, and mollusk larvæ, the acalephs, especially the oceanic siphonophores, the pteropods and heteropods, with the radiolarians, globigerinæ, and algæ, to form an idea of how rich a field still remains to be explored." Of this wealth of life as food the same author continues:—"A number of the marine animals ultimately depend for their food upon the pelagic fauna. The fishes feed upon the hosts of free swimming crustacea, many of which develop with immense rapidity; these in their turn depend for their food upon smaller creatures floating in the water, and found everywhere in the track of currents. There can be no better evidence of the mass of food contained in the sea than is afforded by the examination of the contents of a tow-net any night. Pour the contents into a glass jar, and note the edge of the vessel exposed to the light,—it is covered with crustacea, annelids, and mollusks; and examine also the residue at the bottom,—a true broth, consisting of the carcases of all the minute shore and pelagic animals, and a mass of spores of all sorts of marine plants. This broth is used in the Newport Laboratory to feed young fishes and other embryos kept in confinement."

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* Tyron—Proc. Roy. Soc. Qd., ii., 1885, p. 18.

To all interested in this subject, I would recommend a perusal of the delightful and readable work from which the foregoing are extracts.*

TEMPERATURES.

As part of the equipment I had thermometers for registering the temperature of the air, the surface of the water, and a deep-sea instrument for recording the bottom temperature. Observations were made whenever I could find time, but these I regret to say are of little or no value. After our final return to port it was discovered that the deep-sea instrument was damaged, but at what stage such occurred it is not possible to say.

THE SOUNDINGS.

In shallow water these were made with the ordinary hand-line, but the deeper ones were taken by means of a self-registering instrument. In the Preliminary Report certain differences appear in the depths as recorded by Mr. Farnell and myself. I should not consider it necessary to mention this here had not such discrepancy been noticed in print. Mr. J. D. Ogilby misquotes my figures† in giving the range of *Callanthias*, and remarks that such is doubtless a printer's error, in support of which he refers to Mr. Farnell's portion of the report. A reference to my table giving the particulars of stations, shows that the figures are consistent. This apparent discrepancy may be thus explained. The lead was heaved twice, thrice, or even four times, when the net was cast, and again when it was hauled, so that sometimes three or more readings were obtained, varying by a fathom or two. As Mr. Farnell's observations and my own were made quite independently, it sometimes happened that we did not record the same figures, as in the instance cited. In all cases I adopted the extreme readings.

While trawling the twelfth station on Feb. 22nd, and passing southward off Cape Three Points, one of the seamen drew my attention to what he described as a mass of seaweed floating just beneath the surface about thirty yards to seaward. On viewing the object with a glass, it was evidently not seaweed, and I believed it to be a collection of floating spawn. We were unfortunately towing the trawl at the time, and I had no means of obtaining any of the material. The sailor told me that he had previously seen such masses on the coast, and having once dipped up some in a bucket found it to be "a sort of jelly seaweed."

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* Agassiz—Three Cruises of the "Blake." Bull. Mus. Comp. Zool., xiv., 1888.

† Ogilby—Proc. Linn. Soc. N.S.W., xxiv., 1899, p. 172.

At times we encountered heavy weather, and on several occasions had to run for shelter. Once we were driven from our anchorage, and had to ride out the storm in the open seaway. Time was also lost by our encountering wreckage, river drift, or large boulders. On such occasions the net was usually more or less damaged, but in every instance the repairs were effected by those engaged on board.

Whenever rocks were encountered the fishes obtained were few in number, but on such occasions we reaped a rich harvest of Invertebrates, comprising Sponges, Gorgonias, Echinoderms, Crustaceans and Ascidians. We frequently obtained Feather-stars *(Comatula)*, while in eighty fathoms off Botany Bay, between two and three hundred examples of the rare Echinoderm, *Phormosoma hoplacantha*, Wy. Thompson, were hauled on board. This find was specially interesting, as the animal had previously been taken only by the "Challenger" at the minimum depth of 410 fathoms.

When first removed from the water, these Echinoderms presented a globular form and heaved with a panting or pulsating action. Water oozed from them until they became quite flat; if one of globular form was pricked with a knife the fluid ran out, the larger examples supplying quite a pint.

We placed a number of these Echinoderms in a large tin, stacking them to the height of about two feet; in a short time they had shrunk down to a layer of not more than six inches in depth, and were covered by the water which exuded from them. We found wounds from their spines to be very painful.

At first the trawl was also worked at night, apparently without any variation in the results, but as such gave double work and prevented sleep, night work was soon abandoned. On these occasions, however, a most beautiful spectacle was presented by the phosphorescent appearance of the fish as they darted hither and thither within the net, or lay on the deck a glowing mass. At night also it was only a moving streak of phosphorescent light that indicated the presence of a shark silently accompanying the vessel.

AREA TRAVERSED.

Although popularly styled a "deep-sea" venture, it is to be noted that this phrase is to be understood as of fishermen and not of naturalists. At no time was the 100-fathom line exceeded.

The following lines by W. H. Dall* bear on this subject:—"Formerly when dredging . . . . one hundred fathoms was considered extremely deep, and specimens from even half that depth were considered as having come from deep water. This was proper enough when the collections were compared with those from the shore between tides. . . . But when naturalists began to investigate at much greater depths, the old terms lost their meaning."

It was originally intended to work the whole of the coast line of the Colony, but in consequence of the time available being reduced and the desire to more thoroughly explore the immediate neighbourhood of the metropolis, this was not possible.

As will be seen by reference to the accompanying chart, the greatest number of hauls was made off Botany Bay and Port Hacking. Many trials were conducted off Broken Bay, at the mouth of the River Hawkesbury, while the well-known fishing grounds, the Newcastle and Shoalhaven Bights, also received considerable attention; more or less isolated attempts extended the area traversed from Jervis Bay to the Manning River.

The actual operations extended from February 19th to March 25th, and during this period the trawl was lowered sixty-one times. On two occasions, when the net was fouled, it was raised and at once dropped over the same spot, so that the number of stations is reckoned at fifty-nine.

The first thirty-three, together with the last haul, were made north of Port Jackson and extended to the Manning River, the depths tested being from 10 to 90 fathoms. Not usually working more than about eight miles from the shore, one essay was made at nineteen, and another twenty-six miles distant.

The remaining hauls as represented by Stations 34 to 58 took place between Port Jackson, southward to Jervis Bay, at depths varying between 10 and 80 fathoms.

A tabulated list of stations will be found on the following pages, and a chart at the end of the volume. Detailed accounts of each day's operations cannot be supplied until all the collections have been examined, when such may be fittingly published as a general summary to the work.

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* Dall—Bull. Mus. Comp. Zool., xii., 1885-6, p. 178.

Station.	Date.	Hour.	Locality.	Direction trawled.	Distance from shore in miles.	Depth in fathoms.	Nature of bottom.
	1898.						
1	19 Feb.	7·14 a.m. to 9·30 a.m.	Off Barranjoey Head.....	E.N.E.	2½ to 4½	20 to 32	Gravel and sand.
2	19 ,,	11·20 a.m. to 1·20 p.m.	Off Cape Three Points.....	N.E. by E.	4½ ,, 6	32 ,, 40	Sand.
3	21 ,,	7 a.m. to 9 a.m.	Off Barranjoey.....	E.	6 ,, 9	31 ,, 55	Mud and shell.
4	21 ,,	9·30 a.m. to 11·30 a.m.	do	W. to S.E.	9 ,, 8½	55 ,, 84	Sand, shell, mud.
5	21 ,,	12·45 p.m. to 2·30 p.m.	Off Narrabine.....	S.E.	8½ ,, 12⅓	84 ,, 64	Soft mud.
6	21 ,,	3·10 p.m. to 6·30 p.m.	Off Long Point.....	S.E.	12½ ,, 19	67 ,, 80	Mud to sand.
7	21 ,,	7 p.m. to 10·40 p.m....	Off Port Jackson.....	W. to S.W.	19 ,, 9	80 ,, 62	Sand and gravel.
8	22 ,,	6·15 a.m. to 9 a.m.....	Off Barranjoey.....	N.	4¼ ,, 1½	25 ,, 28	do
9	22 ,,	9·45 a.m. to 12 noon....	Off Cape Three Points.....	S.E. to N.	1½ ,, 2	28 ,, 28	Brown sand.
10	22 ,,	1·30 p.m. to 5 p.m.....	Off Broken Head.....	N.E. by N.	2 ,, 4½	28 ,, 28	Fine sand.
11	22 ,,	6·5 p.m. to 11 p.m.....	Off Tuggerah Lakes....	N.E. by N. to S.W. by S.	4½ ,, 6	28 ,, 34	Sand.
12	22 ,,	12·30 a.m. to 5·30 a.m.	Off Cape Three Points	S.S.W.	6 ,, 5	34 ,, 23	do
13	25 ,,	7 p.m. to 9 p.m.....	do do	N.E.	5½ ,, 7½	41 ,, 50	Sticky mud and shell.
14	27 ,,	7·15 a.m. to 9·45 a.m...	Off Norah Head....	N.E. by N.	4 ,, 5	25 ,, 32	Sand and shell.
15	27 ,,	10·20 a.m. to 12 noon.	do	E.S.E.	5 ,, 8½	32 ,, 48	Rocky.
16	27 ,,	3 p.m. to 6 p.m.	Off Bird Island.....	E.S.E.	17½ ,, 26	72 ,, 90	Fine sand and shell.
17	28 ,,	6 a.m. to 8·45 a.m.....	Off Broughton Island.....	S. by W.	3	29 ,, 48	Sand and shell to rock,
18	28 ,,	2·15 p.m. to 2·45 p.m.	N. off Port Stephens	S.S.W.	7 to 5	32 ,, 48	Rock.
19	1 Mar.	10·10 a.m. to 12·30 p.m.	S. of Port Stephens' Light..	S.S.W.	1½ ,, 4	32 ,, 52	Mud to stones.
20	1 ,,	1 p.m. to 2 p.m.....	Off Morna Point	S.W.	1½ ,, 3½	23 ,, 30	Sand and pebbles.

PARTICULARS OF STATIONS—*(continued)*.

Station.	Date.	Hour.	Locality.	Direction trawled.	Distance from shore in miles.	Depth in fathoms.	Nature of bottom.
	1898.						
21	2 Mar.	8 a.m. to 10 a.m.	Newcastle Bight	S.W. by S.	4 to 6	28 to 40	Fine grey sand.
22	2 ,,	10·30 a.m. to 1·15 p.m.	do	W.S.W.	6 ,, 5	40 ,, 26	Grey sand to mud and shell
23	2 ,,	2 p.m. to 3·45 p.m.	do	N.N.E.	2½ ,, 4	19 ,, 16	Mud and sand to pebbles.
24	4 ,,	7 a.m. to 9 a.m.	Off Newcastle	E.S.E.	5 ,, 8	21 ,, 48	Sand and mud.
25	4 ,,	9·30 a.m. to 10·15 a.m.	do	S.W. by W.	8 ,, 6¼	48 ,, 42	Soft mud.
26	4 ,,	1 p.m. to 3 p.m.	do to Red Head.	W.S.W.	4½ ,, 3	32 ,, 20	Soft mud to fine sand.
27	5 ,,	7·30 a.m. to 9·35 a.m.	Off Manning River	S. by W.	2 ,, 4	22 ,, 23	Fine grey sand.
28	5 ,,	10 a.m. to 12 noon	do	S.E.	4 ,, 6½	22 ,, 22	do
29	5 ,,	1 p.m. to 1·5 p.m. 2 p.m. to 2·15 p.m.	In Manning Bight	S.W.	4¼ ,, 3	18 ,, 17	Mud and rock.
30	6 ,,	8 a.m. to 8·10 a.m.	Off Point Halliday	S.S.W.	7	35 ,, 35	Rock.
31	6 ,,	8·30 a.m. to 11 a.m.	Off Cape Hawke	S.S.W.	1½	28 ,, 25	Sand, shell, and rock.
32	6 ,,	11·15 a.m. to 2 p.m.	do	S. by W.	¾ to 1¼	10 ,, 12	Sand to gravel.
33	7 ,,	8 a.m. to 10·15 a.m.	Newcastle Bight (N. end)	S.W.	1¾ ,, 3½	27 ,, 24	Sand and pebbles.
34	10 ,,	4·15 p.m. to 5·15 p.m.	Off Port Jackson	S. by W.	3½ ,, 2⅔	39 ,, 36	Sand and mud.
35	10 ,,	9·20 p.m. to 11·15 p.m.	Off Port Hacking	S.E. to S.W.	1¼ ,, 2	22 ,, 38	Sandy.
36	11 ,,	8·55 a.m. to 9 a.m.	Off Botany Bay	.....	1	23 ,, 20	Sand to rock.
37	11 ,,	5·30 p.m. to 7·30 p.m.	do	S.S.W.	2 to 2½	50 ,, 52	Mud.
38	12 ,,	7 a.m. to 9 a.m.	Off Jibbon	S.S W.	3 ,, 2¾	46 ,, 55	Sand to mud.
39	12 ,,	9·30 a.m. to 12 noon	Off Wata Mooli	S.S.W.	2¼ ,, 2¾	50 ,, 50	Sand and shell.

PARTICULARS OF STATIONS—*(continued)*.

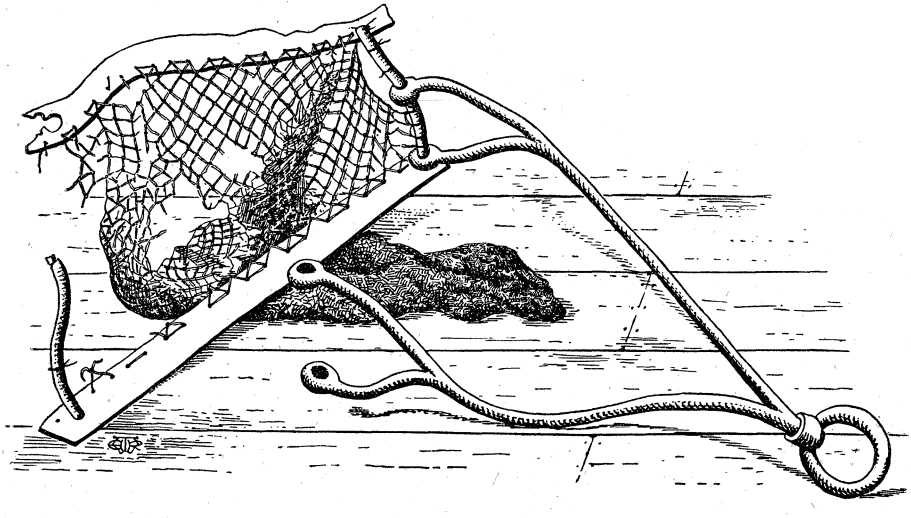
Station.	Date.	Hour.	Locality.	Direction trawled.	Distance from shore in miles.	Depth in fathoms.	Nature of bottom.
	1898.						
40	12 Mar	1·15 p.m. to 1·20 p.m. / 3 p.m. to 3·5 p.m.	Off Wata Mooli	S.	3	52	Sand and boulders.
41	13 ,,	7 a.m. to 9 a.m.	do	S.S.E.	2½ to 5¼	52 to 71	Soft mud.
42	13 ,,	9·30 a.m. to 12 noon.	do	S. by W.	6 ,, 8½	70 ,, 78	Coarse sand.
43	13 ,,	2 p.m. to 4·15 p.m.	Off Botany Bay	S.	1½ ,, 3½	43 ,, 66	Soft ooze.
44	15 ,,	4·20 p.m. to 5·10 p.m.	Off Coogee	S.S.E.	5 ,, 6	49 ,, 50	Fine sand.
45	16 ,,	6·50 a.m. to 8·50 a.m.	Off Botany Bay	S. by W.	2½ ,, 4½	55 ,, 66	Soft mud.
46	16 ,,	9·15 a.m. to 11·10 a.m.	Off Jibbon	N.	4½ ,, 3	66 ,, 50	Mud and Abattoir refuse.
47	16 ,,	3·50 p.m. to 5 p.m.	Off Bulgo	S. by E.	6 ,, 8½	63 ,, 57	do do
48	18 ,,	7·25 a.m. to 8·30 a.m.	Off Wollongong	S. by W.	7 ,, 8	55 ,, 56	Sand and mud to rock.
49	18 ,,	10·25 p.m. to 12·30 p.m.	Off Port Kembla	S.W. by S.	8 ,, 5	75 ,, 63	Mud and pebbles.
50	19 ,,	7·30 a.m. to 9·30 a.m.	In Shoalhaven Bight	S.S.W.	2	18 ,, 15	Sand.
51	19 ,,	9·45 a.m. to 11·45 a.m.	Off Shoalhaven River	.....	1½ to 2	15	do
52	19 ,,	12·45 p.m. to 2·15 p.m.	In Shoalhaven Bight	S. by E.	2½ ,, 3	19 to 20	Sand to mud.
53	19 ,,	3 p.m. to 3·5 p.m.	Off Crookhaven River	.....	4	23	Rock.
54	20 ,,	6·30 a.m. to 8·35 a.m.	Jervis Bay (within)	N.	.....	10 to 11	Seaweed and sand.
55	20 ,,	5·15 p.m. to 5·45 p.m.	Off Crookhaven River	N.E. to N.W.	1	15 ,, 11	Sand to rock.
56	22 ,,	7·50 a.m. to 10 a.m.	Off Botany Bay	S. by W.	8	79 ,, 80	Sand and stones.
57	22 ,,	11·30 p.m. to 1·50 p.m.	Off Wata Mooli	S.S.W.	3½ to 4	59 ,, 54	All mud.
58	22 ,,	3·10 p.m. to 5 p.m.	do	S.S.W.	1½ ,, 2	28 ,, 42	Fine sand to mud.
59	25 ,,	4·30 p.m. to 6·15 p.m.	Off Narrabine	N. to N.E.	4 ,, 5½	30 ,, 32	Coarse to fine grey sand.

On March 25th the "Thetis" left Sydney for Lord Howe Island, it being intended to test the trawling character of the ground around its shores. In consequence of the extremely rough weather this proved to be impossible. After a passage of seventy hours, as against the usual thirty-six, we were landed on the island, and there left for eleven days, the "Thetis" being blown to sea in the gale, returning to Sydney for coal and supplies before taking us off.

During the first few days on the island the weather was too boisterous and the sea too high to permit of any marine work. Afterwards we were enabled to get on to the reef, and also to draw the seine in the lagoon.

In conjunction with the Curator (Mr. Robert Etheridge, Junr.), who accompanied us on this occasion, I made collections of land animals, but as the "Thetis" had nearly all our collecting apparatus and preservatives on board we laboured under difficulties. Notwithstanding this we did some successful reef collecting, and were fortunate in securing additional remains of the extinct Chelonian, *Meiolania*.

It is possible that the Lord Howe Island collections may be examined and the results published as a supplement to the present work.



FISHES.

By EDGAR R. WAITE, F.L.S.,
Zoologist, Australian Museum.

FISHES.

By Edgar R. Waite, F.L.S.,

Zoologist, Australian Museum.

(Plates i.-xxx.)

The fauna of any place collected in 50 fathoms and under, will be best known by its fishes, as such are sought for economic purposes. The greatest results, as measured by the number of new species and rare forms, will obtain among the less-worked Invertebrata.

The least depth tested was 10 fathoms, and although the trawl once reached 90 fathoms (Station 16) it is to be noted that on this occasion fishes were not taken, due to an accident in shooting the net. The extreme productive depth was 84 fathoms, twice reached (Stations 4 and 5), but no species were there taken not known in shallower water. At three Stations, 6, 7 and 56, 80 fathoms was reached, but at the first named the net was again rendered almost inoperative, and at the other two no fishes peculiar to that depth were obtained. It is not necessary to carry the observations further, for it will be sufficiently apparent that no claim can be made to scientific deep sea trawling. It is further to be observed that the few new forms afterwards recorded were secured within the depths commonly attained by line fishermen: the number of new or rare species is therefore in excess of what was expected. It will be apparent, and this I suspect will be much more evident among the Invertebrata, that those forms previously known only from more southern or colder latitudes in shallow water are here taken in greater depths.

The following Stations were barren as far as fishes are concerned:—3, 14, 16, 19, 45; mainly due to the net becoming twisted, or otherwise getting out of order, while being lowered. At Stations 6, 18, 29, 30, 31, 36, very few fish were taken, the net or otter boards having fouled obstructions, such as rocks or wreckage.

One hundred and seven species were taken, representing ninety-five genera, including a new one, namely, *Paratrachichthys*, proposed for *Trachichthys trailli*.

Pterygotrigla is a new generic name substituted for *Hoplonotus*, which is preoccupied. Nine new species are described; these are :—

Dasyatis thetidis.
Chimœra ogilbyi.
Anthias pulchellus.
Monacanthus setosus.
Sebastes thetidis.
Lepidotrigla modesta.
Parapercis ocularis.
Histiopterus farnelli.
Paralichthys tenuirastrum.

The following nine known species are for the first time recorded for the Colony, and those marked with an asterisk have not before been recognised from Australia :—

**Narcine tasmaniensis*, Richardson.
Exocœtus evolans, Linnæus.
Macrorhamphosus scolopax, Linnæus.
Trachichthys elongatus, Günther.
**Paratrachichthys trailli*, Hutton.
Lagocephalus lunaris, Bloch.
Amblyrhynchotus oblongus, Bloch.
Chilomycterus jaculifera, Cuvier.
**Ichythyscopus inermis*, Cuvier and Valenciennes.

There are also a number of species not obtained since first recorded; among these may be mentioned :—

Creedia clathrisquamis, Ogilby.
Trachichthys elongatus, Günther.
Apogonops anomalus, Ogilby.
Epinephelus septemfasciatus, Thunberg.
Novaculichthys jacksoniensis, Ramsay.
Monacanthus mosaicus, Ramsay and Ogilby.
Centropercis nudivittis, Ogilby.
Synaptura fasciata, Macleay.

Several others collected, although perhaps not recorded, are known from additional specimens received at the Museum, and are therefore excluded from the above list.

All the new species have been figured, with the exception of *Dasyatis thetidis*, Ogil., of which adult examples are not available, and the type non-existent. My plan has been to illustrate all species obtained, not previously figured; this has been departed from only in a few instances and where the specimens obtained were immature or otherwise unsuited for delineation. On the other hand, some figures are published of species not obtained;

these are introduced for contrast with allied forms, and some species, whose illustrations were poor or in outline only, have been refigured.

The interest of the results is, however, not exhausted by an enumeration of the new or rare species; the expedition has been the means of materially extending the known range, both geographically and vertically, of several of our common food fishes. The breeding season of one or two species has been ascertained, and a little has also been learned of their habits. The following may be adduced as examples:—The Morwong (*Dactylosparus carponemus*) had been previously known only from adult specimens; we netted young individuals in from 50 to 75 fathoms, proving that the fish breeds with us, possibly in deep water. The Dory (*Zeus australis*), always a scarce fish in the market, and commanding a high price, was freely taken; it should, therefore, at some future date, take its place as one of our regular food fishes at a reasonable figure. Although our observations, both positive and negative, on the two common species of Whiting (*Sillago*) may need verifying, it would appear that, whereas the Sand Whiting (*S. ciliata*) is a shallow water form breeding on the sand banks of the bays and estuaries, the Trumpeter Whiting (*S. maculata*) is an inhabitat of greater depths, and sheds its ova in such position.

Of two somewhat similar Flounders, one (*Paralichthys novæcambriæ*) is shown to inhabit shallow water, frequenting the sand and mud banks close in shore and the estuaries of our rivers; the other (*P. tenuirastrum*) is confined to deeper water, and was previously overlooked.

Our knowledge of the habits of the Soles has also been extended, especially in the case of the Narrow-banded Sole (*Aseraggodes macleayana*). This splendid table fish was previously known only from that portion of the coast lying between Port Hacking and Lake Macquarie, and its breeding season was unknown. We took it nearly up to the limits of the operations, and discovered the breeding season to be March and April. The Black Sole (*Synaptura nigra*), hitherto known only from the estuaries, was taken off the coast.

Several obscure species have been redescribed, and specific characters of others have been emphasised, as in the case of *Monocentris*, represented by two species. These, one from Japan, and the other from our own coast, have been compared side by side.

The changes made in the nomenclature are simply such as appeared necessary when studying the relationship of the various species enumerated.

SELACHII.

Family HETERODONTIDÆ.

HETERODONTUS, *Blainville.*

HETERODONTUS PHILLIPI, *Lacépède.*

PORT JACKSON SHARK.

(Plate i.—*Gyropleurodus galeatus*, Günth.)

Le Squale Philipp, Lacép., Hist. Nat. Poiss., i., 1798, p. 218.
Heterodontus phillipi, McCoy, Prod. Zool. Vict., Dec. xii, 1886, pl. cxiii.

Stations 10, 15, 20, 21, 22, 23, 24, 25, 26, 32, 34, 50, 51, 52.

We did not obtain this species in water deeper than 48 fathoms; it is not included in the captures of the Challenger Expedition off Twofold Bay (Station 163A, 120-150 fathoms), and no observations on its vertical range have been made. We took it in 10 fathoms, while it is very common in 6 or 7 fathoms within the harbour of Port Jackson.

Geographically it extends to Southern Australia, being common in Hobson's Bay. It occurs also in Tasmania and is recorded from New Zealand, where, however, it must be extremely rare. Apparently its inclusion rests on the evidence of two specimens presented to the British Museum by Professor Owen and said to have been obtained in New Zealand. Hutton includes it in his Catalogue* on this authority, but writes:—"I have seen no specimens." It is mentioned by Saville Kent,† as being occasionally taken in Moreton Bay, Queensland, but it does not seem to have been recorded on our own coast northward of Broken Bay. We took it off Cape Hawke (Station 32), thence southward to Shoalhaven Bight (Stations 50, 51 and 52). It had been previously obtained in Jervis Bay, and from my own experience I should say it is as common there as on any part of the coast. Jervis Bay is a favourite breeding resort, and the empty egg-cases may be found in large numbers washed on to the beach or wedged in among the rocks: here also in 20 fathoms and under, living eggs may be freely obtained. Not being the proper season, we secured only empty cases; these were twice obtained, namely, in Jervis Bay (Station 54) and in Newcastle Bight (Station 22).

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* Hutton—Fishes of New Zealand, 1872, p. 80.

† Saville Kent—Oyster and Oyster Fisheries, Queensland, 1891, p. 11.

I have previously described the egg-case of this species* and also that of *Gyropleurodus galeatus*, Günther, and although all the Port Jackson Sharks netted were critically eyed, neither the crested species nor its egg-case were taken.

When ashore at Wollongong and Kiama I noticed egg-cases exhibited as curiosities in the shop windows; all so shown were of *G. galeatus*. The known range of this latter species may be thus extended southward; it had been previously obtained as far north as Port Stephens.

Ogilby recently† described a pair of Cestrationt jaws taken some years previously off Manly Beach, to the north of Port Jackson, and while admitting a general likeness to those of *G. galeatus*, inclined to the belief that they might prove to belong to an unknown species. With a view to elucidating this matter, Mr. Ogilby and myself compared the jaws with those of *G. galeatus* preserved in the Museum. They proved to be in every way identical. Günther has not mentioned the teeth in his description of this species, and Macleay's figure does not represent them. I supplement Ogilby's description above referred to, by a figure of the jaws kindly lent for the purpose; but the question remains, to what species did the jaws figured by Macleay belong?

Family SCYLLIORHINIDÆ.

CATULUS, *A. Smith.*

CATULUS ANALIS, *Ogilby.*

SPOTTED CAT-SHARK.

(Plate ii., fig. 1.)

Scyllium anale, Ogilby, Proc. Linn. Soc. N.S.W., x., 1885, pp. 445, 464.

Stations 2, 10, 12, 13.

Ogilby remarks that this species seems to be common in the neighbourhood of Port Jackson, within the harbour of which the type was obtained. We did not find it to be very common outside, the four stations not yielding more than a dozen individuals. All were obtained within the very limited portion of the coast lying between Broken Bay and Tuggerah Lakes. This species was taken in depths ranging from 23 to 50 fathoms; the largest example measured 570 mm. or $22\frac{1}{2}$ inches, just the length of the

* Waite—Journ. Linn. Soc., xxv., 1896, p. 325, pl. xii.

† Ogilby—Proc. Linn. Soc. N.S.W., xxii., 1897, p. 245.

type specimen. The markings are not quite so regularly arranged as in the specimen originally described. The example figured is a female.

PARASCYLLIUM, *Gill.*

PARASCYLLIUM COLLARE, *Ramsay & Ogilby.*

COLLARED CAT-SHARK.

(Plate ii., fig. 2.)

Parascyllium collare, Rams. & Ogil., Proc. Linn. Soc. N.S.W., (2) iii., 1889, p. 1310.

Stations 1, 8, 10, 11, 13.

In the original description the colour is stated to be rich brown with six broad darker transverse bands, the lower parts dull white. The general colour would be better expressed as yellowish, tinged with brown, and there are eight bands, two of which are situated on the tail. The under parts are yellow.

At each of the five Stations above named this handsome species was freely taken. It was previously recorded only from outside Port Jackson in 70 fathoms, but has also been taken off Port Hacking. We never took it in depths greater than 50 fathoms, the shallowest Station showing 20 fathoms. It would appear to be very locally distributed, as with Dog-fishes in general, for it was obtained only off the coast between Broken Bay and Tuggerah Lakes, to the north of Port Jackson. Our largest example measures 825 mm. or $33\frac{1}{4}$ inches, which is perhaps the maximum of growth. This specimen, a male, is figured.

Family ORECTOLOBIDÆ.

ORECTOLOBUS, *Bonaparte.*

ORECTOLOBUS BARBATUS, *Gmelin.*

WOBBEGONG.

Squalus barbatus, Gmel., Syst. Nat., i., 1788, p. 1493.
Crossorhinus barbatus, McCoy, Prod. Zool. Vict., Dec. v., 1880, pl. xliii., fig. 1.

Station 24.

Obtained so freely by means of the trawl in Port Jackson, and occurring throughout the whole coast line of the Colony, it is a

little remarkable that we secured but a single example. This, a small specimen, was taken off Newcastle in 21-48 fathoms.

Family GALEIDÆ.

GALEUS, *Rafinesque.*

GALEUS ANTARCTICUS, *Günther.*

GUMMY.

Mustelus antarcticus, Günth., Cat. Fish. Brit. Mus., viii., 1870, p. 387. McCoy, Prod. Zool. Vict., Dec. ix., 1884, pl. lxxxvii., fig. 1.

Stations 11, 12, 21, 37, 48, 49, 52.

Günther's original specimen, having doubtless become discoloured, was described as "uniform greyish." McCoy correctly described the colour as follows:—"Back and sides ashy-grey with a slight pinkish-brown tinge on side of head and body: with, from nape to second dorsal, very small lighter spots on back and sides above lateral line"; he further says:—"Whole under surface of body and under side of pectorals and ventrals milk-white." This refers, however, only to the basal portion and the margins, the larger portion of these fins being coloured alike above and below. In our examples the hind edge of the dorsal and the tip of the caudal are not darker than the other portions. While the small milk-white spots are present in most of our specimens, no trace of such exist in others. On the side next the body the claspers *(Pterygopodia)* are of grey colour, but below are whitish like the whole ventral surface of the shark. The growth of the claspers is well illustrated in our series and may be thus briefly noticed.

In fœtal stages the claspers do not reach to the margin of the ventral fin, but attain to that point shortly after birth. They do not, as a rule, appear to be developed further until much older, and in an example measuring 585 mm. (23 inches) they have barely outgrown the fin. On the other hand, a smaller specimen measuring 530 mm. (20¾ inches) has them nearly twice as long as the inner posterior margin of the fin. No specimen of such dimensions has any rigid skeletal development in the claspers. The smallest example in which such appears is 625 mm. (24¾ inches) in length.

Parker has described* how, in this species, the embryo is attached to the uterus with a placenta: it is therefore referable to

* Parker—Trans. N.Z. Inst., xv., 1883, p. 219, pl. xxx.

the genus *Galeus*, where now placed. If future research should suggest the necessity of uniting the genera *Mustelus*, Cuvier, and *Galeus*, Rafinesque, the latter, being the older name, would still have priority.

GALEORHINUS, *Blainville.*

GALEORHINUS AUSTRALIS, *Macleay.*

SCHOOL SHARK.

Galeus australis, Macl., Proc. Linn. Soc. N.S.W., vi., 1881, p. 354.
McCoy, Prod. Zool. Vict., Dec. vii., 1882, pl. lxiv., fig. 2.

Stations 20, 21.

An example of this species measuring three and a half feet in length was taken in the trawl in 23-30 fathoms, off Morna Point, to the south of Port Stephens, the most northerly recorded habitat. A second specimen, but thirteen inches in length, was obtained a little further south in the Newcastle Bight at a depth of 28-40 fathoms.

Family SPHYRNIDÆ.

SPHYRNA, *Rafinesque.*

SPHYRNA LEWINI, *Lord.*

HAMMER-HEADED SHARK.

Zygæna lewini, Lord in Griffith, Ann. King., x., 1834, p. 640, pl. L.
Zygæna malleus, McCoy, Prod. Zool. Vict., Dec. vi., 1881, pl. lvi., fig. 1.

Station 51.

In 15 fathoms off Shoalhaven Bight we netted a large number of these sharks. They were, however, all of small size, ranging from one to four feet in length. Curiously enough, this was the only occasion on which they entered the trawl.

The Hammer-headed Shark was the species most frequently seen, and when "Shark, oh," was called, it was generally to observe one of these brutes swimming alongside the "Thetis." The largest example noticed (off Seal Rocks) was computed to be about twelve feet in length. On one occasion one of the sailors, having strung some skate, hung them over the stern in order to wash off

some sepia from the cuttle-fish. Small thought was given to the shark cruising alongside, until it was discovered that the skate had been eaten off and the shark was anxious for more. At night, also, sharks kept pace with us, as indicated by the phosphorescent glow which accompanied their movements.

This species is here accorded specific rank on account of the following peculiarity. Writers on *S. zygæna* (= *Zygæna malleus*) describe that species as having the nasal groove running along nearly the whole front margin of the head. In our specimens, as above described, the groove is much less extensive. I at first thought that this condition might be characteristic of immaturity, but a comparison with two examples in the Museum, one of which measures fifteen and a half feet in length, shows that in these the nasal groove is also comparatively short, relatively shorter than in the young.

The "Zoological Record," 1882, supplies the following reference, "*Zygæna leewini*, Griff., is distinct from *Z. malleus*, Rochebrune, Act. Soc. L. Bord., vi., p. 56." I have not access to this paper, but Rochebrune's conclusions have not been accepted by Jordan & Evermann, who in their latest work* continue to place *Z. lewini* as a synonym of *S. malleus*. The following is a description of our examples :—

Head hammer-shaped, rather more than three times as wide as its length at the eye; the anterior margin is rounded, the space between the nostrils, which are situated near the eyes, formed of three lobes, one median and two lateral, the former the larger; a pronounced groove passes from the nostril along the anterior margin of each lateral lobe and is deflected slightly inwards at its junction with the median lobe. Each groove is less than one-third the width of the head measured between the preocular prominences. As in *S. tudes*, the grooves are preceded by a line of pores. On the under side of the head several patches also occur, the most noticeable of which occupies a triangular depression in the centre of its anterior margin; another series arises from the juncture of the lateral and median lobes and passes obliquely inwards and backwards towards a position in front of the mouth; this is succeeded by a less marked line continued inwards to meet the base of the last named series. A row of more widely spaced pores passes outwards towards the orbit, which has an irregular patch at the posterior border. Finally a series of pores is found on the free skinny portion at the hinder part of the head on each side. At its external angle this membrane is produced backwards.

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* Fishes of North America. U.S. Nat. Mus., Bull. 47, 1896, p. 45.

Teeth in two alternate rows in each jaw, placed obliquely, notched externally, otherwise entire. The fifth gill opening is smaller than the others, all are equally spaced, and the last two are situated above the base of the pectoral. The space between the origin of the first dorsal and the front of the head is slightly more than the width of the latter; this fin arises wholly behind the pectoral, its base is contained two-thirds in its height, which equals half the width of the head, it is posteriorly produced. The second dorsal, situated over the posterior third of the anal, is small and produced backwards into a long acuminate lobe. The ventral arises midway between the origin of the pectoral and the base of the caudal. The anal is larger than the posterior dorsal, deeply excavated behind and produced like that fin. The caudal is contained three and a half times in the total length, the lower lobe two and a half times in the upper; the notch is small.

Colour.—The general colour above, the under part of the membrane behind the head, and the membraneous portions of all the fins is of a dull lead colour. All other portions of the under surface are yellowish-white.

Family CARCHARIIDÆ.

CARCHARIAS, *Rafinesque.*

CARCHARIAS TAURUS, *Rafinesque.*

GREY NURSE.

Carcharias taurus, Rafin., Caratt. d' Alc. Nuov. Gen., 1810, p. 10, pl. xiv., fig. 1.

Odontaspis taurus, McCoy, Prod. Zool. Vict., Dec. vii., 1882, pl. lxiv., fig. 1.

Station 23.

On raising the trawl off Newcastle, from the depth of 16 to 19 fathoms, some little excitement was caused on discovering that we had a shark in the net; on being hauled aboard it swept the fish right and left until despatched. It was of this species and measured eight feet in length. A somewhat larger example was hooked in Broken Bay. Sharks were specially attracted to the "Thetis" on account of the amount of food thrown over, comprising mainly the inedible species, such as sting-rays, fiddlers, dogfishes, etc., together with the waste parts of the fishes preserved for consumption. There has been no previous authentic record of the Grey Nurse having been taken north of Port Jackson.

Family PRISTIOPHORIDÆ.

PRISTIOPHORUS, *Müller & Henle.*

PRISTIOPHORUS CIRRATUS, *Latham.*

SAW SHARK.

Pristis cirratus, Lath., Trans. Linn. Soc., ii., 1794, p. 281, pls. xxvi. (fig. 5), and xxvii.

Stations 1, 4, 10, 13, 15, 20, 21, 24, 25, 26, 34, 37, 38, 40, 46, 57, 58.

Extremely common all along the coast, this species was taken from the minimum and maximum depths of 20 and 84 fathoms, both records being off Broken Bay, the former two and a half and the latter nine miles from shore.

It proved a source of considerable trouble to the trawlers by becoming entangled in the meshes of the net. The sharp teeth not only rendered extrication difficult, but necessitated cautious handling. In this respect little examples, not exceeding a foot in length, were equally annoying with the adults. The largest specimen taken measured 1272 mm. (=50 inches), which is probably the maximum of growth. The most northern Station (20) whence the species was obtained was off Morna Point, south of Port Stephens. Southward it was not taken beyond Port Hacking. According to McCoy* and Castelnau,† *Pristiophorus nudipinnis*, Günth., is the common Saw Fish of Hobson's Bay, while the latter remarks that he had not seen *P. cirratus* from Victoria, although it is known from Tasmania.

Family SQUATINIDÆ.

SQUATINA, *Duméril.*

SQUATINA SQUATINA, *Linnæus.*

ANGEL FISH.

Squalus squatina, Linn., Syst. Nat., Ed. x., 1758, p. 233.
Rhina squatina, McCoy, Prod. Zool. Vict., Dec. iv., 1879, pl. xxxiv.

Stations 5, 7, 24, 32, 34, 35, 43, 46, 48, 50, 52, 54, 57.

This widely distributed species was taken freely all along the coast line visited with the exception of the small portion between

* McCoy—Prod. Zool. Vict., Dec. vi., 1881, pl. lvi., fig. 2.

† Castelnau—Proc. Zool. Soc. Vict., i., 1872, p. 220.

Cape Hawke and Crowdy Head. The former is the most northern point at which the species has been taken on our coast. For the most part the specimens were small, but a few really large examples were netted, chiefly females; nearly all these gave birth to many living young while on deck. While some of the young ones were of uniform tint, either grey or brown, others were mottled and spotted in a very pretty manner, the markings being brighter and more defined than in any of the adults.

Family RHINOBATIDÆ.

RHINOBATUS, *Bloch & Schneider.*

RHINOBATUS BANKSII, *Müller & Henle.*

SHOVEL-NOSED RAY.

(Plate iii.)

Rhinobatus banksii, Müll. & Henle, Plagiost., 1838, pp. 123 and 192.

Stations 1, 10, 11, 22, 24, 25, 26, 32, 51, 59.

In his "Notes on the distribution of some Australian Sharks and Rays," Ogilby* identified our common Shovel-nosed Ray with *Rhinobatus bougainvillii*, remarking:—"This is the common *Rhinobatus* of the New South Wales coast, and is found at least as far north as Cape York." He has since mentioned to me that our species more nearly agrees with the description of *R. banksii*, Müll. & Henle, an opinion in which I concur. The authors of this species state that the description is from a drawing (zeichnung) by Banks in the British Museum, while they give its synonymy as "*Raja rostrata*, Banks, M.S. 45." It is scarcely clear therefore whether the description supplied is from Banks' M.S. or a drawing only. The habitat of *R. bougainvillii* is unknown, while that of *R. banksii* is rendered as New Holland.

In order to better establish the species, I have supplied both a description and figure from examples collected. We took it off Cape Hawke (Station 32), thence southward to Shoalhaven Bight (Station 51) and vertically from 10 to 48 fathoms.

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* Ogilby—Proc. Linn. Soc. N.S.W., x., 1886, p. 464.

Disc long and narrow, the snout much produced and acute, its length 2·3 in that of the disc, interorbital width 5·8 in the length of the snout. Rostral ridges convergent, meeting at less than half the distance to the tip of the process and traceable as a shallow groove on the upper surface. Nostrils large, the distance between their outer angles less than half the snout, the distance between their inner angles a little greater than the width of each nostril. The anterior valve is produced as a fold slightly towards the median line. Mouth bow-shaped, its width twice that of the interorbital space, which is slightly concave, no fimbriate appendage on the snout of the female. Vent equally distant from the tip of the snout and the base of the caudal, or a trifle nearer the latter. Dorsal fins similar. Skin finely shagreened. Two very small spines near the tip of the snout, two conical spines in front and two behind each eye. Twenty-one low spines on the dorsal line to the first fin and three or four between the fins, two pairs on the shoulder girdle on each side of the dorsal line and five rows of minute dermal elevations at each outer angle of the disc.

Colour.—Olive-yellow above, the fins grey with yellowish margins. Bluish-grey to yellowish beneath, a dark patch towards the tip of the snout extending backwards along the rostral process. Length of specimen described, 555 mm.; width nearly three times in the total length; tail rather more than twice; snout to the mouth 4·6 times in the same.

TRYGONORHINA, *Müller & Henle.*

TRYGONORHINA FASCIATA, *Müller & Henle.*

Fiddler.

Trygonorhina fasciata, Müll. & Henle, Plagiost., 1838, p. 124, pl. xliii.

Stations 1, 2, 21, 22, 23, 24, 25, 27, 28, 50, 54, 55, 57, 59.

Although very common in Port Jackson, thence southward to Tasmania and South Australia, it does not appear that observations have been recorded as to the northern range of the species, a remark applicable also to many other forms. We took it at the northern limit of our operations, namely, in the Manning Bight, south of Crowdy Head (Station 27). Vertically it is found from a few fathoms in the harbour to at least 59 fathoms, at which depth we obtained it.

Family RAJIDÆ.

RAJA (*Artedi*), *Linnæus.*

RAJA AUSTRALIS, *Macleay.*

SKATE.

(Plate iv.)

Raja australis, Macl., Proc. Linn. Soc. N.S.W., viii., 1884, p. 461.

Stations 4, 5, 7, 10, 11, 12, 13, 17, 20, 21, 22, 23, 24, 25, 26, 27, 28, 31, 32, 34, 35, 37, 38, 39, 42, 43, 46, 48, 49, 53, 56, 57, 58.

First recorded from examples taken off Botany Bay in 40-55 fathoms, the known distribution of the species does not seem to have been since extended. It was freely obtained by the "Thetis" along the whole of the coast line traversed, and it doubtless occurs to the limits of the colony, and beyond, more especially as it proves to inhabit deep water. It has a considerable vertical range, having been secured at all depths between 10 and 84 fathoms. The largest example previously recorded measured 15 inches in length; some of ours attain to 19 inches (485 mm.).

The following notes are in elaboration of Macleay's description: Disc broader than long; the setous spines above the snout are directed forward, those below backward. The mouth is described as being straight; this is not correct, it being of the usual bow-shape. In the male the median teeth of both jaws are acutely spinous, the lateral ones acute only. In the female the teeth are nowhere spiny. The disc of the male is much more spiny than in the female; its anterior margin has a series of fine spines which extend neither to the snout nor the angle; between this series and the eye is a patch of twelve strong recurved spines, and further back and nearer to the margin is another similar patch. At the angle, but some distance from its margin, are twenty-four slender spines arranged anteriorly in two rows directed obliquely inwards and backwards. The tail is armed with a median row of strong spines, the alternate ones towards the hinder portion becoming almost obsolete; a single spine is placed between the fins. Six similar spines are placed on each side of this series, the first pair being situated behind the third spine and the last an equal distance in advance of the terminal one. Posteriorly the sides of the tail are covered with minute spines; a few occur also on the fins. The spines around the eye form a semicircular series embracing the anterior and inner border, the central spine being minute. A short spine occupies a median position between the

posterior margin of the eyes and the shoulder girdle. On the under side, the spinous rostral portion extends to the nostrils and is continued for some distance along the margin of the disc, and as a band on each side to the level of the mouth.

In the female the two large patches of spines between the eye and the margin of the disc, and also those at the angle, are absent; on the under side the spines extend for some distance along the margin, but are not continued towards the nostrils. There are five rows of spines on the tail instead of three only, as in the male; of these the outer row is the shortest and is composed of nine or ten pairs. The sides and the fins are spiniferous as in the male and similarly a spine exists between the fins.

Colour.—Above, the colour is uniform olive-brown, lighter on the snout and at the margin of the disc; beneath it is lighter, with scattered brown spots and with yellow marks at the bases of the discs and on the ventral fins. The numerous pores on the under side of the snout and head are also black.

Family NARCOBATIDÆ.

NARCINE, *Henle.*

NARCINE TASMANIENSIS, *Richardson.*

TASMANIAN NUMBFISH.

Narcine tasmaniensis, Rich., Proc. Zool. Soc., 1840, p. 29, and Trans. Zool. Soc., iii., 1849, p. 178, pl. xi., fig. 2.

Station 42.

All the specimens seen by Richardson were females. Our single example is a male. This does not appear to differ from the description excepting in the sexual characters and the nature of the teeth. While agreeing in their general character and disposition, the teeth of the male are spiniferous, a very common sexual distinction in the Rays; the dental lamellæ are very flexible, and the mouth is small and protractile. The fleshy portion of the tail is broader towards its extremity than in Richardson's figure (2*a*), or in other words, its tapering is much more obtuse. The claspers are blunt and short, not longer than the distance of the eye from the anterior margin of the disc. The colour above is a warm brown, much redder than in the figure quoted; the sides of the tail and the inferior anterior margin of the disc are yellowish, the under side, including the claspers, above and below, white. Length of specimen, 343 mm. (13½ inches).

Richardson remarks that he is not aware if the electrical powers of this fish has attracted the attention of the colonists. I was able to practically demonstrate that its electrical properties are quite manifest to the human system, but in so small a species (or at least of the size of our example) the shock is not unpleasantly strong. It is to be borne in mind, however, that in consequence of the handling to which it had been subjected in the trawl, it may have largely exhausted the batteries in electrifying its fellow captives.

This interesting addition to our fauna was taken off Wata Mooli (south of Port Hacking), in 70-78 fathoms. Not previously known outside the waters of Tasmania, this is an admirable example of how southern forms seek the deeper waters of milder zones. Although the immediate area around Port Hacking has been systematically fished for years, the *Narcine* has probably never before been taken, doubtless owing to the fact that operations are always conducted in water shallower than suits it in these warmer latitudes. Another signal instance is that of the large mollusc *Voluta mamilla*, taken in the waters of New South Wales by the "Thetis," and hitherto regarded as a characteristically Tasmanian species.

HYPNOS, *Duméril.*

HYPNOS SUBNIGRUM, *Duméril.*

NUMBFISH.

Hypnos subnigrum, Duméril, Rev. Zool., 1852, p. 279, pl. xii.

Stations 21, 24, 25, 52, 55.

Duméril describes this species as being of intense blackish-brown colour. Such would apply to all small examples, but the adults taken were of much lighter tint, being rich yellowish-brown.

It was provocative of considerable amusement whenever it appeared on board; the uninitiated, however, shortly learned to recognise it and respect its peculiar qualities, so that soon no one could be persuaded to touch it even with an iron prodder.

At Station 55 I unwittingly placed my hand on one as it lay on deck partly concealed by overlying fishes. As was afterwards found, it was the largest example obtained, and measured 690 mm. (2 feet 3 inches) in length. The shock I so unexpectedly received was very intense, and it is quite conceivable that the one from such a fish, not previously harassed, would be sufficient to disable a man. When compared with *Narcine*, the mouth of *Hypnos* is very large, and a medium sized

example of *Beryx affinis* was removed from the gullet of the specimen referred to.

The Numbfish was taken only in two situations, namely, off Newcastle (Stations 21, 24 and 25) and in Shoalhaven Bight (Stations 52 and 55), the depths ranging from 11 to 48 fathoms.

Family DASYATIDÆ.

In my note on *Lepidotrigla* I refer to the impossibility of personally examining every individual of the genus obtained, and the same remark is applicable equally to the members of the family *Dasyatidæ*.

There is no difficulty as to the genus *Dasyatis*, the few specimens received are correctly chronicled; the difficulty is mainly with the two species *Urolophus cruciatus* and *Trygonoptera testacea*. Although these are referred to different genera, the only observation one could make "in the field" was as to the absence or presence of a dorsal fin, and that a very small one. Although no fin is present in *Urolophus* a small scar is observable in *U. cruciatus* in advance of the spine just where the fin would be situated if present. In young examples, at least in the fœtal stage, a small fin is distinctly present; it is therefore questionable if the genera are worthy of separate recognition.

Urolophus cruciatus is found in the deeper water all along the whole coast line, while *Trygonoptera testacea* is more common in the estuaries.

The following is a complete list of the Stations at which the two species were taken; individual localities are recorded under the respective species:—

Stations 1, 4, 7, 8, 9, 10, 11, 12, 13, 17, 20, 21, 24, 25, 26, 27, 28, 32, 33, 34, 35, 37, 38, 39, 42, 43, 47, 48, 49, 50, 51, 52, 54, 55, 57, 58, 59.

UROLOPHUS, *Müller & Henle.*

UROLOPHUS CRUCIATUS, *Lacépède.*

Banded Stingaree.

Raja cruciatus, Lacép, Ann. Mus., iv., 1804, pp. 201, 210, pl. lv., fig. 2.

Urolophus cruciatus, Rich., Zool. Ereb. & Terr., Ichth., 1844, p. 35, pl. xxiv.

Stations 4, 7, 8, 10, 11, 12, 13, 17, 20, 21, 24, 25, 26, 27, 28, 34, 35, 37, 38, 39, 42, 43, 47, 48, 49, 57, 58 59.

This was one of the most unwelcome species met with, in consequence of its ubiquity and profusion. Although of small size

the barbed spine in its tail suggests cautious handling. The odium in which it was held on board could be well gauged by observing the viciousness with which the men employed impaled it with the iron prodders provided before whirling it over the bulwarks.

It was taken along nearly the whole area traversed where the trawl reached a depth of 20 fathoms or more. In shallower water it was not obtained, and was consequently not represented in our gatherings from Shoalhaven Bight and Jervis Bay. It was netted freely in 84 fathoms, but was not secured at Station 16, twenty-six miles from land, where the depth of 90 fathoms was attained. As previously mentioned, however, no fishes were there taken, due to an accident to the gear.

Fœtal specimens possess a small dorsal fin in advance of the spine; this is not present in the adult and its position is indicated only by a small scar.

TRYGONOPTERA, *Müller & Henle.*

TRYGONOPTERA TESTACEA, *Müller & Henle.*

COMMON STINGAREE.

Trygonoptera testacea, Müll. & Henle, Plagiost., 1838, p. 174, pl. lvii.

Stations 1, 8, 9, 26, 32, 33, 50, 51, 52, 54, 55.

Unlike the preceding, this species was taken only in comparatively shallow water, never exceeding 32 fathoms, and more plentiful shoreward, being common on the 10-fathom line, within which we did not venture. This is the form so freely taken within the harbour and along the shore line.

TRYGONOPTERA BUCCULENTA, *Macleay.*

GREAT STINGAREE.

(Plate v. and fig. 3.)

Urolophus bucculentus, Macl., Proc. Linn. Soc. N.S.W., ix., 1885, p. 172.

Stations 11, 24, 25.

Only thrice recognised; the observations made upon this species are necessarily scanty, more especially as the specimens

are absent from the collection, having, it is supposed, been inadvertently returned to the water by some of the seamen. Medium sized examples: they were obtained at the extremes of 21 and 48 fathoms. Hitherto we had known only large specimens; it would, therefore, appear that this is a deep water form, only the largest individuals trending shoreward. The type specimens were taken in 40 to 60 fathoms outside Port Jackson; as this was previously the only known habitat we are able to extend its range slightly to the northward; Stations 24 and 25 being off Newcastle, while Station 11 is intermediate between that area and Port Jackson.

The following description and figure, together with the plate, are taken from the type specimen. As this is a skin only, the productions are not wholly satisfactory.

Disc angular, its breadth equals its length to the extremity of the ventrals, the anterior margins rather straight, forming an obtuse angle. Snout to the middle of the eyes three times the width of the interorbital space. Spiracle rather larger than the eye, width of jaws half the length of the snout in front of them. Caudal shorter than the disc, its spine very large, equal to the length of the snout below, the edges closely beset with retrose spinules, the extreme tip and basal portion excepted, its insertion nearer the extremity of the tail than the axis of the pectoral. Dorsal fin comparatively large. Caudal membrane deep. Teeth obtuse, in about 18 rows in the upper jaw. Skin quite smooth. Colour above, and the margins of the disc below, uniform dark brown, other parts yellow.

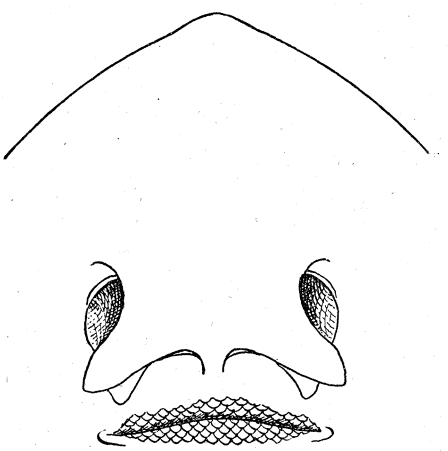

Fig. 3.

Macleay has pointed out the main distinction between this species and *T. testaceus*, and the accompanying figure (fig. 3) shows the great comparative size of the dental lamellæ; other features are the broader and more angular disc, shorter tail, larger dorsal and rounder and broader caudal.

DASYATIS, *Rafinesque.*

DASYATIS THETIDIS, sp.nov.

BLACK STING RAY.

Dasyatis thetidis, Ogilby, MS.

Stations 21, 22, 23, 58.

"Disc subquadrangular rather more than one-fourth wider than long. Anterior border sinuous, convex near the slightly protuberant snout and the rounded angle, concave between; posterior and inner borders conspicuously convex, the hinder angle obtuse. Skin smooth, a row of strong, rounded or oval, stellate tubercles along the median line of the back and tail, each tubercle armed with a stout depressed spine directed backwards; scapular region with one or two similar tubercles. Mouth rather feebly crescentic, its width two-fifths of the preoral length and four-fifths of the distance between the anterior angles of the nostrils; buccal papillæ five, the outer pair small and remote from the inner three.

"Teeth arranged quincuncially, in 16 series in the upper and 21 in the lower jaw, the crown of each tooth hollowed mesially. Hinder border of ventral fins feebly convex, the angles rounded. Tail depressed before, cylindrical behind the spine, rounded and keelless above, a low cutaneous expansion below, armed on all sides with stout spines.

"Dark olivaceous-brown, teeth flesh-coloured, with a median transverse orange band.

"This is the common 'Black Sting-Ray' of Sydney, and is probably the species spoken of by Dr. Günther and his followers as *Trygon tuberculata*. The length of the disc in the specimen described was 1,000, its width 1,275 millimeters; the tail was broken off some distance behind the spine."

The specimen above described was one of three, taken in consecutive hauls in Newcastle Bight, the depths ranging from 16 to 40 fathoms. These rays weighed respectively 160lb., 220lb., and 140lb. A fourth example weighing 180lb. was taken south of Port Hacking in 28-42 fathoms. The ray above described was forwarded by me to the Museum, but having been much damaged in transit was not preserved. Mr. J. D. Ogilby, who happened to be in the institution at the time it was received, made the foregoing description at the request of the Curator, and has since handed it to me for publication.

A young *Dasyatis*, obtained likewise at Station 22 and preserved, agrees in all essential points with the description. In

common with most juveniles of the genus it is quite smooth; the tail measures more than twice the length of the disc. Dark olive-brown above, the under surface and the lower base of the tail is whitish, the margins of the disc brown. The absence of a membraneous expansion above the tail places the species in the subgenus *Hemitrygon*, Müll. and Henle.

Family MYLIOBATIDÆ.

MYLIOBATIS, *Duméril.*

MYLIOBATIS AUSTRALIS, *Macleay.*

EAGLE RAY.

Myliobatis australis, Macl., Proc. Linn. Soc. N.S.W., vi., 1881, p. 380. McCoy, Prod. Zool. Vict., Dec. vii., 1882, pl. lxiii.

Stations 1, 10, 20, 21, 22, 23, 24, 25, 26, 50, 51, 52, 53, 54, 58.

McCoy has compared this species with *Myliobatis nieuhofi*, Bl. Schn., and remarked that among other features it differs therefrom by the spotted instead of striped disposition of the blue colour. This colouration is variable, and is much affected by age, the younger examples being, as Günther remarks,* more ornamental in colouration. All the specimens brought home are small, measuring less than two feet across the disc; in such, the markings are very distinct and in the form of lines and spots, the anterior lines are the first to break up, and the posterior ones are much more persistent. In some larger examples obtained, beyond the general disposition of the spots—lines did not occur—such resembled the markings as figured by McCoy.

Another character emphasised by this author is that of the teeth, and he compares the width of the median lamellæ with their length, remarking that whereas the proportions in *M. nieuhofi* are 3 or $3\frac{1}{2}$ to 1, in *M. australis* the figures are $7\frac{1}{2}$ to 1. This again does not appear to be a very stable character, for as Günther also remarks:—"The young differ much from the adult, having no median series of larger teeth, but all the teeth of equal size and regularly sexangular." The proportions in our examples are about 5 to 1, or midway between those of the two species mentioned. The width of the disc is also intermediate, being proportionately less than in *M. nieuhofi*, and more than in *M. australis*.

Under these circumstances I strongly incline to regard these species as identical, *M. nieuhofi* having priority; but in the absence

* Günther—Study of Fishes, 1880, p. 345.

of a verified example for comparison or the necessary literature, hesitate to take the extreme step.

Our records show in a very marked and interesting manner the character of the ground frequented by this Ray. It will be noticed that it was taken in consecutive hauls from Station 20 to 26, and not again was it met with until the trawl was shot at Station 50, whence it was again uninterruptedly taken to Station 54. The first series was on the sand and mud flats of Newcastle Bight, and the second similar ground in the Shoalhaven Bight and Jervis Bay. Of fifteen Stations, only three were outside this area—namely, Station 1, on the sand banks at the mouth of the Hawkesbury River; Station 10, a little further north, where the soundings showed a sandy run; and Station 58, on the muddy ground off Port Hacking.

Its geographical range on our coast, as far as ascertained, is from Jervis Bay in the south, nearly to Port Stephens in the north, and its vertical range from 10 to 48 fathoms. It is, however, commonly taken in 7 fathoms or under within the harbour of Port Jackson.

HOLOCEPHALI.

Family CHIMÆRIDÆ.

CHIMÆRA, *Linnæus.*

CHIMÆRA OGILBYI, *Waite.*

GHOST SHARK.

(Plate vi.)

Chimæra ogilbyi, Waite, "Thetis" Prelim. Report, 1898, p. 56.

Stations 35, 37, 46.

When the trawl was raised at 10 p.m. on March 10th the kerosene flares revealed the presence of two Chimeras. This haul (Station 35) was made within two miles of land, just outside Bate Bay, and directly off Port Hacking, in from 22 to 38 fathoms of water. Both these specimens were females, and as I much wanted to secure a male, Mr. Farnell kindly consented, on the following day, to run over the same ground; rock was, unfortunately, encountered as soon as the trawl was lowered, and on hauling it up it was found that the only fish taken were three Dories. After mending the net in Botany Bay another haul (Station 37) was made, this time further out, in 50-52 fathoms,

and I was extremely pleased to find four more Chimeras in the trawl—again all females. No more examples were met with until March 16th, when at Station 46, off the old ground, in the deeper waters of 66-50 fathoms, a seventh specimen was secured, which, strangely enough, proved to be another female.

This addition to our fauna is of peculiar interest, inasmuch as it is the first record of a member of the genus occurring south of the equator in the eastern hemisphere.

Although allied to a deep-water North Atlantic form, our Chimæra is sufficiently distinct to merit specific recognition, and in proposing the name *Chimæra ogilbyi* I have in mind the numerous and valuable contributions to Australian Ichthyology of Mr. James Douglas Ogilby of this city. The species may be described as follows:—

Length of head 4·19, greatest height of body (in front of the pectorals) 5·4 in the total length, measured to the end of the dorsal fin. First dorsal fin subcontinuous with the second, the connecting membrane very low, the respective length of their bases 14 : 37; combined they are 1·31 of the total length. The spine, which measures one-fifth less than the length of the head, is sub-acute at the base, thence laterally compressed, and keeled in front for the greater part of its length distally; behind it is grooved, the lateral borders of the distal half are beset with curved spines directed backward and downwards; the first dorsal ray is somewhat longer than the spine; the anterior rays coalesce, but the two posterior ones are distinct. The second dorsal fin is low, rounded behind, and clearly separated from the caudal. The pectoral is falcate, with the inner angle rounded and deeply notched at its insertion with the fleshy base below; the total length of the fin is one-half, and its membraneous portion one-seventh longer than the head; it reaches beyond the insertion of the ventrals. The ventrals originate midway between the tip of the snout and the end of the dorsal fin. They are truncated behind and are shorter than the head, being contained 1·7 times in its length. In the median line behind the ventrals is a fatty organ longitudinally grooved. There is no distinct anal fin, its membrane being continuous with that of the caudal and extending rather further than the upper membrane: caudal produced into a rayless filament. The lateral line posterior to its cephalic subdivision makes two sharp angles, thence passes in small regular undulations, but on the tail becomes straight; it takes a median course until just in advance of the termination of the dorsal fin, when it abruptly passes to the lower side and is thus continued along the filament. The course of the lines on the head, together with the position of the main mucous pores, is shown in the accompanying figure.

Teeth.—The anterior lamellæ in the upper jaw have a sinuous margin and each is formed of six to eight enamel rods, the columnar structure being plainly visible. The palatine pair have their outer edges roughly denticular and their flat surfaces each raised into three tubercles, one before and two behind; the tubercles are white and enamel-like; the rest horn-colour. The lamellæ in the lower jaw have the margin incised by three deep clefts, one median and two lateral, leaving four rounded prominences, of which the submedian pair are smaller and more acute. The columnar structure is not so evident as in the upper series, and is traceable only in the above named cusps. A long, low white enamel elevation runs backward from behind each of the outer or posterior cusps.

Colour.—Silvery above and on the sides, yellowish below. Membrane of the fins bluish-black; the bases of the pectorals and ventrals horn-colour; tip of the snout black; eye yellow; lateral line raised, brown; caudal filament yellow. The markings take the form of narrow bands passing obliquely from behind forwards and downwards; they are confined to the head and the anterior part of the body, and are formed of brown splashes which below become rings; they extend across the chin and the base of the pectoral fins. Above the lateral line the whole body is marked with narrow transverse broken lines, about 25 in number; those on the tail oblique.

Length to end of dorsal fin 670 mm., to end of caudal filament 860 mm. (the filament is, however, incomplete.)

This new species differs, first, from *C. monstrosa*, Linn., by having shorter pectorals, no distinct anal fin, the snout more produced, the hinder margin of the second dorsal rounded, and the tail fins less developed; second, from *C. affinis*, Capello, by its sub-continuous dorsal fins and longer pectorals, by having the tail produced into a long filament and the fins much lower; also by the truncated character of the ventral fins and probably in the form of the dorsal spine. It also differs in hue, being of a beautiful silvery colour, adorned with splashes and circles; *C. affinis* being described as uniformly plumbeous. It is further to be remarked that whereas *C. ogilbyi* occurs in shallow water, *C. affinis* is the only Elasmobranch known from depths exceeding 1000 fathoms.

The chief interest of this record is not that of a new species, but rather the extension of the geographical range of a genus in itself of great interest.

The earliest described species, *C. monstrosa*, is known from the coasts of Europe, West and South Africa, the Azores, and Cuba, and also from Japan. It is taken only in deep water. *C. affinis*, first described from Portuguese specimens, was afterwards taken

off the American coast, northward of Cape Cod, where it is not uncommon in 200-1200 fathoms.

We now record *C. ogilbyi* from the coast of New South Wales in shallow water (22-66 fathoms). Into what depths this fish may journey, or what unconjectured forms may exist in the abyssmal regions off our shores, remains for the future to reveal.

The genus *Hydrolagus* is represented by the single species *H. colliei*, Bennett; it is found only on the Pacific coast of North America, and is abundant about Puget Sound and South-eastern Alaska. This species swims at the surface, and is common about wharfs, while there is no evidence that it descends to very considerable depths.

Two species of *Harriotta* have been described, namely, *H. raleighana*, Goode and Bean, from the eastern coast of North America, in depths ranging from 707 to 1,081 fathoms, and *H. pacifica*, Mitsukuri, from Japan.

Of *Callorhynchus*, hitherto the only representative of the family in Australian waters, two species also are known, *C. antarcticus*, Lacép, from the Antarctic basin and the South Pacific, and *C. argenteus*, Philippi, recently described from the coast of Chili.

In my Preliminary Report I wrote a paragraph on the errors and misprints of the literature of the family *Chimæridæ*, and reproduce the same below.

In "Oceanic Ichthyology," one of the most recent and pretentious publications on fishes, an extremely good figure of *Chimæra colliei* in the "Voyage of the Blossom" has been copied, but in some unaccountable way has been named *Callorhynchus antarcticus*, and so printed in the table of contents, notwithstanding the fact that it is correctly described in the text. By a typographical error *Hydrolagus* appears as *Hydbolagus colliei*. In the description of *Chimæra affinis* the following conflicting statements occur:—"The pectorals extending to the outer axil of the ventrals." And, again, "the pectoral terminating much in advance of the ventral.

In a French edition of "Cuvier's Animal Kingdom," the fishes by Valenciennes, an extraordinary figure is given on pl. 113, purporting to be of *Chimæra monstrosa*, and said to be drawn from nature, the locality given being the seas of Iceland. The peculiarity is that, though the figure, as a whole, represents *Callorhynchus*, the snout lacks the characteristic appendages. As *Callorhynchus* is a southern type, how came the artist to represent this genus from a specimen taken in the seas of Iceland? Is *Callorhynchus* a bipolar form, or had he access to southern material?

Lastly, an amusing misprint occurs in Macleay's "Fishes of Australia." This reads:—"Ventral organs confluent into two pairs of laminæ in the upper jaw and into one pair in the lower." The passage becomes clear when "Dental organs" is read.

TELEOSTOMI.

Family LEPTOCEPHALIDÆ.

CONGERMURÆNA, *Kaup.*

CONGERMURÆNA HABENATA, *Richardson.*

Congrus habenatus, Rich., Voy. Ereb. & Terr., Ichth., 1844, p. 109, pl. l., figs. 1-5.

Station 9.

A small example, measuring 150 mm., was obtained to the north of Broken Bay, where the trawl was dragged in 28 fathoms. This eel bears traces of having been in the stomach of some other fish, a dory possibly, as many were secured in this haul. It is a rare form on our coast, and is characterised by having a tail longer than the trunk, for which Ramsay and Ogilby have proposed the name *Congromuræna longicauda.** In other respects it cannot be said to differ from Richardson's species.

OPHISURUS, *Lacépède.*

OPHISURUS SERPENS, *Linnæus.*

Muræna serpens, Linn., Syst. Nat., ed. xii., i. 1766, p. 425.
Ophisurus serpens, Schleg., Fauna Japon., Pisces, 1850, p. 264, pl. cxv., fig. 1.

Although previously determined from Australia, with Port Jackson as a definite locality (Macleay), this species is very rare in our waters. Throwing a line off the jetty at Port Stephens I landed an example measuring 770 mm. (= 30 inches), which so well resembles the above quoted figure that it might have been the model; the relationship the body bears to the tail is 29 : 49. Richardson remarks† :—"The *Ophisurus rostratus* or *Ophisure long museau* of Quoy and Gaimard, Voy. du Freycinet, pl. 51, fig. 1, seems to be allied to *serpens*." If the former species is correctly represented it must be very distinct; while the head bears some resemblance, the free portion of the tail is much longer and the short stout body is not comparable with the snake-like form of *O. serpens*. This latter species is the only recognised member of the genus *Ophisurus* as now restricted.

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* Ramsay & Ogilby—Proc. Linn. Soc. N.S.W., xii., 1888, p. 1022.

† Richardson—Voy. Ereb. & Terr., Ichth., 1844, p. 106.

Family CLUPEIDÆ.

CLUPANODON, *Lacépède.*

CLUPANODON NEOPILCHARDUS, *Steindachner.*

PILCHARD.

Clupanodon neopilchardus, Steind., Denk. K. Akad. Wein. Wiss. xli., p. 12.

Station 26.

As we have not the above quoted work in our library I am unable to refer to the description of this species; for the same reason I am debarred from consulting many other papers by Dr. Steindachner.

The only Pilchard obtained by the "Thetis" was a partially digested example ejected by a dory.

Family SYNODONTIDÆ.

TRACHINOCEPHALUS, *Gill.*

TRACHINOCEPHALUS MYOPS, *Forster.*

Salmo myops, Forst. MS. Bloch and Schneider, Syst. Ichth. 1801, p. 421.

Saurus trachinus, Schleg., Fauna Japon., Pisces, 1850, p. 231, pl. cvi., fig. 2.

Station 23.

By no means uncommon in and around Port Jackson, this species appears not to have been recorded from elsewhere in Australian waters. Considering its wide distribution, it should be found on the eastern, northern and western seaboards. The only example taken in the trawl of the "Thetis" was netted in 16-19 fathoms off Newcastle.

SYNODUS (*Gronow*), *Bloch & Schneider.*

SYNODUS TUMBIL, *Bloch.*

Salmo tumbil, Bloch, Ichth. iv. 1797, p. 112, t. 430.

Saurus undosquamis, Rich., Voy. Ereb. and Terr., Ichth. 1844, p. 138, pl. li., figs. 1-6.

Station 21.

Our example was trawled in Newcastle Bight in 28-40 fathoms and measured 456 mm. (18 inches) in length. To the already

long synonomy must, I think, be added *Saurida australis*, Cast.,* and *Saurida truculenta*, Macl.,† both described from specimens taken in Port Jackson.

Family AULOPIDÆ.

AULOPUS, *Cuvier.*

AULOPUS PURPURISSATUS, *Richardson.*

SERGEANT BAKER.

Aulopus purpurissatus, Rich., Icon. Pisc., 1843, p. 6, pl. ii., fig. 3; McCoy, Prod. Zool. Vict., Dec. vi., 1881, pls. 54, 55.

Stations 7, 12.

The two Stations at which this fish was trawled were off Port Jackson, in 62-69, and off Broken Bay, in 23-34 fathoms respectively. It was also taken with the line at three other places, namely:—Schnapper Rock, south of the Manning River; off Broughton Islands, north of Port Stephens; and southward, off Shoalhaven Bight. Although doubtless well known from the first-named localities, I am inclined to think that it has not been absolutely recorded so far north before.

CHLOROPTHALMUS, *Bonaparte.*

CHLOROPTHALMUS NIGRIPINNIS, *Günther.*

CUCUMBER FISH.

(Fig. 4).

Chloropthalmus nigripinnis, Günth., Ann. Mag. Nat. Hist., (5), ii. 1878, p. 182, and Chall. Report, Zool., xxii., 1887, p. 193, pl. li., fig. A.

Stations 4, 13, 37, 38, 41, 42, 43, 46, 47, 48, 49, 56.

Since the Challenger expedition obtained two examples in 120 fathoms off Twofold Bay, numbers of this species have once or twice been taken in the trawl outside Port Jackson in about 70 fathoms. We found it to be very common indeed, especially to the southward of Botany Bay, where the trawl was lowered thirteen or fourteen times. It was not taken far northward of Broken Bay (Station 13) nor southward of Wollongong (Station 49), and never in less than 41 fathoms, while it was most numerously obtained at the deepest trials.

* Castelnau—Proc. Linn. Soc. N.S.W., iii., 1879, p. 393.

† Macleay—Proc. Linn. Soc. N.S.W., vi., 1882, p. 219.

It may be pointed out that few of the northern stations indicate depths greater than 40 fathoms, while none of the southern ones (50-55) exceeded 20 fathoms. *Chloropthalmus* was, therefore, trawled at nearly all Stations registering a depth inhabited by it, as ascertained by our observations, and it is pretty certain that it is extremely common all along our coast line to the northern limit of its range.

As to its vertical range, Günther remarks:—"This fish shows nothing to indicate its bathybial life beyond the excessively large eye; and it is not likely that it descends to any more considerable depth than that from which it was obtained" (*loc. cit.*, p. 194). This deduction receives considerable support from our own experiences which would suggest that the range of the species is from 40 to 150, rather than from 120 to 500 fathoms.

Günther's description was made from rather small examples which, judging from the figure, were imperfect. The following is drawn up from a specimen measuring to the end of the central caudal rays 210 mm. ($=8\frac{1}{4}$ inches).

B. vii. D. 11. A. 9. V. 9. P. 16. C. 9+8. L. lat. 48.
L. tr. 4+6.

Length of head 3·66, height of body 4·75, in total length (caudal excluded). Diameter of eye 2·6 in the length of the head. Interorbital space flat, but bounded by two supraorbital keels, and one-third the diameter of the eye. Snout shorter than the eye contained 1·66 times in its diameter. Head low, triangular, with obtuse snout and three enamel-like keels above, one median, from the snout to between the orbits, and one above each eye, not, however, as long as their diameter; there is a scale-like process in front of the eye immediately behind the nostril, and directed upwards and backwards. Anterior portion of snout slightly tumid. Nostrils close together, a little nearer the eye than the end of the snout, the anterior small, protected by a valvular flap which covers it from behind, posterior nostril larger and simple. Cleft of mouth slightly oblique, lower jaw the longer, the maxillary reaches nearly to beneath the centre of the eye, its distal extremity equal to the interorbital space. Opercles entire.

Teeth.—Bands of villiform teeth in the jaws, on the vomer, palatines and tongue, and a patch within the symphysis of the lower jaw.

The first dorsal ray is slender, little more than half the length of the second, which is stouter; both are undivided. The second ray is the longest of the fin, and equals the head in length; the remainder are regularly reduced so that when the fin is raised its hind margin is straight; the last ray is inserted exactly midway between the end of the snout and the base of the caudal rays, and the whole base is rather more than half the

length of the head. The pectoral reaches to below the base of the last dorsal ray, is 1·24 in the length of the head, and equal to the ventral, which reaches to below the tip of the second dorsal ray when depressed; the inner ray extends almost to the vent, placed midway between the end of the lower jaw and the tips of the central caudal rays. The anal arises below the centre of the space marked by the bases of the last dorsal and the caudal rays; its first ray is simple, and shorter than the second, which measures but slightly more than the second dorsal, and is a fifth higher than the base of the anal. Adipose fin situated immediately but wholly behind the vertical from the last anal ray. Caudal deeply cleft, the upper lobe a third longer than the lower, the longest rays equal in length to the pectoral: pedicel almost round, its height two-thirds that of the second anal ray.

Scales cycloid, thin and nearly smooth, with radiating and concentric striæ, those of the lateral line, which runs evenly along the central line of the body, with a simple tubercle more apparent in the region of the caudal. Cheeks and upper part of opercle scaly, head otherwise naked; rows of minute scales occur along the outside of the ventral rays, at the base of which fin is an elongate axillary scale. Caudal covered with small scales.

Colours.—Above green, below silvery-yellow, the opercles brilliant silver, snout and eyes dark green, upper lip sky-blue, distal portion of the second to fourth dorsal rays black, a clouded patch near the end of the ventrals. Upper lobe of caudal narrowly, lower lobe broadly, edged with black.

As in one or two particulars Günther's figure does not well represent our fishes, such discrepancies may be mentioned. The profile from the eye to the dorsal is convex, not concave as drawn; the upper angle of the distal portion of the maxillary is acute, not rounded as shown, and is a little longer. The adipose fin is situated wholly behind the base of the anal; in the figure it is represented well within the margin. Lastly, the tail is far from correctly shown: the accompanying sketch (Fig. 4), drawn from the example above described and of the actual size, illustrates the true outline. The upper lobe is very much longer than the lower and less margined with black; the inner margins of the fin are rounded: in the figure criticised the lobes are represented of equal size, are coloured alike, and are acutely pointed.

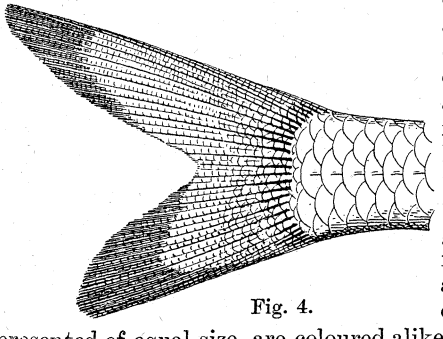

Fig. 4.

In Goode's genus *Hyphalonedrus** (since regarded as synonymous with *Chloropthalmus*), the tongue is stated to be entirely smooth. With reference to this Günther writes:—"The only point in which Dr. Goode's diagnosis apparently differs from that given by me in Fish., Vol. v., p. 403, is that he denies the presence of lingual teeth. However, these teeth are so minute in *Chloropthalmus agassizii* as to require a magnifying glass to find them, and therefore may easily be overlooked" (*loc. cit.*, p. 192). In our examples of *Chloropthalmus nigripinnis*, the lingual teeth are very noticeable, and can be seen by the unaided eye: they occur in a narrow band which embraces the front and sides, leaving the central portion naked.

Family EXOCŒTIDÆ.

EXOCŒTUS, *Linnæus.*

EXOCŒTUS EVOLANS, *Linnæus.*

FLYING FISH.

Exocœtus evolans, Linn., Syst. Nat., ed. xii., 1766, p. 521. Day, Fishes of India, 1878, p. 519, pl. cxx., fig. 5.

During the gale we encountered off Wollongong on March 16th two Flying Fishes were blown aboard, and in a similar manner we obtained another on our way to Lord Howe Island. They are of the same species and belong to the genus *Exocœtus*, characterised by the small size and forward position of the ventral fins. As *E. evolans*, the type of Linnæus, and *E. volitans*, are the same species, *Exocœtus* and not *Halocypselus*, Weinland, is the correct name of the genus. The larger example, measuring 150 mm., in no wise differs from the figures and descriptions; the smaller one, which is but 45 mm. in length, possesses the barbel common to immature specimens, and has a black blotch at the base of the rays of each ventral fin. It has also two dark bands towards the caudal, and the general colour of the body, instead of being of uniform tint, is represented by dots only, another indication of immaturity and a feature common to very many fishes.

Flying fishes were met with all along the area traversed; sometimes shoals were seen in the distance, when they appeared like glittering specs passing through the air, generally all in one direction; at other times they rose from beneath our bows, evidently disturbed by the passage of the vessel, and scattered all ways.

* Goode—Proc. U.S. Nat. Mus., 1881, p. 483.

They reminded me of nothing so much as a flock of little birds scudding over the surface. They did not rise over the water more than four or five feet, which elevation was quickly attained. The course was not at all a trajectory, but quite horizontal, and after very careful watching I came to the conclusion that the length of "flight" was not less than 250 yards, but sometimes individuals would not travel more than a few feet. The method of returning to the water was very sudden, being accompanied by a splash, and the whole passage of the fish was extremely rapid.

That this power of "flight" is not denied to young individuals is shown by the fact that our smaller example, measuring but one and three-quarter inches in length, was accompanying the flock when cast on deck.

Under the heading "Flying-fish, *Exocœtus volitans*," White wrote*:—"This fish is so well known to naturalists, and is so frequently seen in every voyage, that it is unnecessary to give a particular description of it." Whether this fish, of which a recognisable figure is given, was obtained off this coast or not, is by no means clear, and the species has not therefore been included in the fish literature of the Colony.

Family FISTULARIIDÆ.

FISTULARIA, *Linnæus.*

FISTULARIA SERRATA, *Cuvier.*

ROUGH-BILLED PIPE FISH.

Fistularia serrata, Cuv., Règne Anim. (after Bloch). Günth., Chall. Report, Zool., i., 1880, p. 68, pl. xxxii., fig. c.

Station 17.

In describing this species as common in Port Jackson, Ogilby† voiced the general impression conveyed by the literature of the subject. A careful study of the collection in the Museum shows that whereas *F. depressa*, Günth., is well represented, we have but few examples of *F. serrata*, under which name nearly all the specimens had been registered. All remarks in Australian literature should, therefore, probably apply to *F. depressa*. This latter species was taken by the "Challenger" in the Sulu Archipelago. The trawl had been down to 250 fathoms, but

* White—Voyage to New South Wales, 1790, p. 295, pl. lii., fig. 2.
† Ogilby—Cat. Fish, N.S.W., 1886, p. 42.

Dr. Günther writes :—(*loc. cit.*) "I am inclined to doubt the occurrence of this shore fish at so great a depth as 250 fathoms, and it does not seem to me to be improbable that this specimen got into the trawl when near to the surface of the water."

Off Broughton Island the "Thetis" trawled a fine example of *F. serrata* in 29-48 fathoms : on the other hand, we have received from Mr. Henry Newcombe, this species, taken with hook and line at Coogee, on the coast, a few miles south of Port Jackson. Both these specimens were of a beautiful terra-cotta colour when first obtained.

Family MACRORHAMPHOSIDÆ.

MACRORHAMPHOSUS, *Lacépède.*

MACRORHAMPHOSUS SCOLOPAX, *Linnæus.*

var. ELEVATUS, nov.

BELLOWS FISH.

(Plate vii., fig. 1.)

Centriscus scolopax, Linn., Syst. Nat. ed. xii., 1766, i., p. 415. Day, Fishes of Great Britain and Ireland, i., 1880-84, p. 249, pl. lxix.

Macrorhamphosus scolopax, Goode & Bean, Ocean. Ichth., sp. Bull. U.S. Nat. Mus., 1895, p. 483, pl. cxvii., fig. 396.

Stations 2, 4, 9, 13, 17, 20, 21, 25, 37, 38, 41.

This species proves to be quite common off the coast of the colony, although not previously recorded. It was obtained at eleven stations, and altogether about fifty specimens were taken. Its distribution on the New South Wales coast, as determined by our observations, is from south of Port Hacking to Broughton Island; and its vertical range from 23 to 84 fathoms. Allport (MS.) recorded it from Tasmania, but Johnston * remarked: "It is questionable whether the Tasmanian species may not be *C. humerosus*, Rich. I have not yet examined any local specimens." Under *C. gracilis*, Macleay wrote †: "*C. scolopax* I have never seen here. Mr. Johnston's *scolopax* is probably this species." Johnston, however, later, set the question at rest as follows ‡ :

* Johnston—Proc. Roy. Soc., Tas., 1882, p. 123.

† Macleay—Proc. Linn. Soc., N.S.W., ix., 1894, p. 42.

‡ Johnston—Proc. Roy. Soc., Tas., 1884, p. 255.

"I was fortunate in obtaining a fine specimen of *Centriscus scolopax* . . . . captured at Port Sorell. All my doubts about its existence in Tasmania are now set at rest."

It seems possible that *M. gracilis*, Houtt., is more pelagic in habit than *M. scolopax*. The former species has been at odd times taken in Port Jackson and on the beach at Maroubra Bay by my colleague, Mr. T. Whitelegge; it has never been taken in deep water. *M. scolopax*, on the other hand, is known on our coast in not less than 23 fathoms, as recorded above. While, as also shown, it was freely taken in 84 fathoms. It would certainly be found at much greater depths if trials were made, for on the Banc d' Arguin the members of a French exploring expedition obtained it from 130 fathoms. In this connection it is mentioned as surprising that "as many as ten individuals were caught."

Gunther* draws attention to the variability of the relative length of the second dorsal spine. Our examples are characterised by the extreme length of the spine and the greater height of the body as compared with European specimens. In the latter the height of the body is rendered as half the length of the head, or four-sevenths to three-fifths of the distance from the operculum to the base of the caudal. Similarly the length of the dorsal spine is given as three-fifths to three-eighths of the same.

In Australian representatives the height of the body is 1·42 in the length of the head and 1·55, or fully two-thirds, in that of the body as above measured. A greater disproportion is exhibited by the spine; whereas in the Old World form its length is three-fifths to three-eighths the length of the body, in ours it is 1·3 or about five-sixths of the length; when adpressed it extends to or beyond the caudal rays.

As it is easier to grasp proportions as projected in an illustration than the numerical proportions not so projected, the accompanying figure (Pl. vii., fig. 1) may be compared with those rendered by, say Day† and Goode & Bean.‡

Our race, with extreme development, perhaps bears the same relationship to *M. scolopax* that *M. gracilis* does to *M. japonicus*, and as the latter has received a name since regarded as varietal, I propose for the Australian representative of *M. scolopax* the term *elevatus*.

The radial formula is :—

D. 5/12. A. 19. V. 1/5. P. 14. C. 6 + 9 + 6.

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* Günther—Cat. Fish. Brit. Mus., iii., 1861, p. 520.

† Day—Fishes of Great Britain and Ireland, i., 1880-84, pl. lxix.

‡ Goode & Bean—Oceanic Ichth., sp. Bull. U.S. Nat. Mus., 1895, pl. cxviii., fig. 396.

It will be noticed that the ventral rays are preceded by a spine; this is more than half the length of the rays. It may have been overlooked in European examples, and also in *M. gracilis*, in which, as I have ascertained, from specimens collected on our coast, it is likewise present. Richardson has also duly noted it in *M. humerosus*.*

The maximum length of the "Thetis" examples is 140 mm.

As no illustration of *M. gracilis* (available to Australian students) has ever been published, I figure the species on pl. vii., fig. 2, from an example obtained by Mr. T. Whitelegge at Maroubra Bay in April, 1897.

Family SYNGNATHIDÆ.

SOLENOGNATHUS, *Swainson.*

SOLENOGNATHUS SPINOSISSIMUS, *Günther.*

SPINY SEA-HORSE.

Solenognathus spinosissimus, Günth., Cat. Fish., Brit. Mus., viii., 1870, p. 195. Waite, Proc. Linn. Soc. N.S.W. (2), ix., 1894, p. 222, pl. xvii., figs. 5 and 8.

(Fig. 5).

Stations 46, 49, 56.

We have hitherto known the members of this genus only from solitary examples cast on the beaches after stormy weather, a circumstance which sufficiently indicates that they are inhabitants of deep water. The "Challenger" obtained *S. fasciatus* off Twofold Bay in 120 fathoms, and we netted four examples of *S. spinosissimus* at depths ranging from 50 to 80 fathoms. At the latter depth (Station 56) a male was trawled bearing ova; these were fully ripe, and from the anterior part of the specialised area the young had escaped, and the flaccid skin was resuming its normal condition. Further back, however, the ova still remained to the number of thirty-eight. In some instances the enclosed young broke through the integument and escaped into the vessel in

* Richardson—Voy. Ereb. & Terr., Ichth., 1844, p. 56.

which the parent was placed, and killed in formol. Reaching Sydney a few days later it was found that all the ova had become detached, the form and condition of the *pseudo-marsupium* (if I may so term it) was, however, perfectly preserved. I am now able to add to my previous note; I there remarked that during the breeding season this ova-bearing space becomes flaccid and thrown into ridges, forming shallow pits. These pits are, however, not so shallow as I had imagined, and embrace rather more than one-half of the ovum. Anteriorly the pits are arranged in six transverse series, while posteriorly the series is four; sixteen body scutes are involved, and altogether about eighty cells are developed. The appearance produced is quite that of the honeycomb; the cells are about the size of a worker-bee cell, but not so deep. When charged with ova the surface was tolerably even, and the upper edge of each ovum, projecting from the cell, was glued to its fellows.

Each ovum in its ripe condition is of ovoid shape, and measures 6 mm. × 4 mm.: the enclosing membrane is quite transparent, and the young is seen to be coiled around the yolk sac, while the dark markings on the body form a conspicuous feature (Fig. 5B). When alive the young ones frequently changed their position within the egg; one which ruptured the membrane and became free may now be examined. It measures 35 mm. in length, and the head is fixed at right angles to the long and slender body. This with the short snout at once recalls the condition in *Hippocampus*.

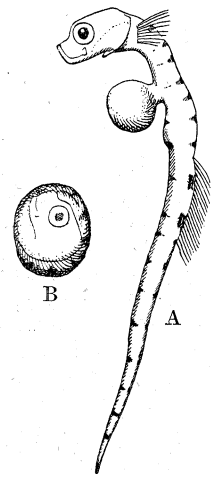

Fig. 5.

The snout is not longer than the diameter of the eye. The bony plates are already developed, but do not yet bear spines. The yoke sac is attached, but 3 mm. behind the head; the seven bars so noticeable in the adult are quite distinct, while on the sides and the lower surface other markings exist, of which one only—that in the preanal region—persists in after life (Fig. 5A).

The example previously referred to as having been obtained at Maroubra Bay was taken on March 4th, 1894. Our specimen was trawled on March 22nd, 1898, off Botany Bay, and supports the opinion there expressed that autumn is the breeding season.

The fish taken at Station 42 was of the slender form I had thought characteristic of *S. fasciatus*, and I so named it in the Preliminary Report. A closer inspection, more especially as to the nature of the spines, shows that it is none other than the commoner *S. spinosissimus*.

Family CREEDIADÆ.

CREEDIA, *Ogilby.*

(Fig. 6).

Creedia clathrisquamis, Ogilby, Proc. Linn. Soc. N.S.W., xxiii., 1898, p. 299.

Station 33.

Of this species, previously known only from the type specimen, we secured a single example; it was taken on the sandy stretches of the Newcastle Bight in 24-27 fathoms. It is larger than the type and measures 52 mm. in length, but differs otherwise only by having the lower jaw the longer, possibly a sexual difference, and being of more pronounced colour; the smaller fish is colourless, with a few minute black spots along the base of the anal fin; my example is brown, with a circular mass of spots on the occiput and a row of spots near the margin of each scale.

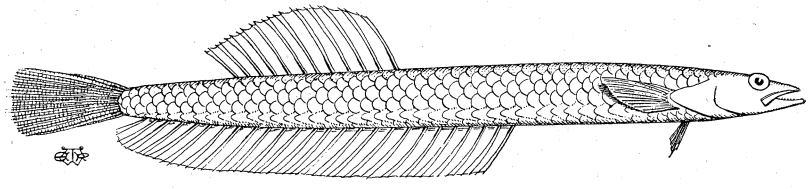

Fig. 6.

This specimen gives me the opportunity of figuring the species (the accompanying cut, Fig. 6, being twice the natural size), and of more fully describing the individual scales. The ordinary scale of the body does not present any peculiarity, being of the usual cycloid type; it is shown at Fig. 6A. The scales of the lateral line are very peculiar, each has a broad insertion and is much narrowed at the free margin, the lower edge is straight but the median third is serrated, the teeth averaging about seven in number. The upper margin of the scale is irregular and towards its free or posterior half, deeply excavated; the space thus formed is partially occupied with

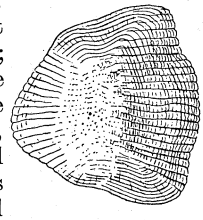

Fig. 6A.

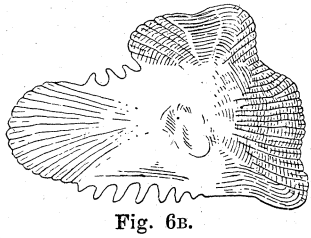

Fig. 6B.

ERRATUM.

Page 63, for CREEDIADÆ read CREEDIIDÆ.

denticles, much less numerous than those of the lower margin and generally three in number. In *situ* the narrowed portion of the scale, including the denticles both above and below, is visible, but the broadened anterior portion is hidden by adjacent scales. Fig. 6B shows the exact condition of a scale removed from the middle of the lateral line, greatly enlarged.

Family TRACHICHTHYIDÆ.

TRACHICHTHYS, *Shaw.*

TRACHICHTHYS ELONGATUS, *Günther.*

LONG ROUGHY.

Trachichthys elongatus, Günth., Cat. Fish. Brit. Mus., i., 1859, p. 10. Chall. Report, Zool., xxii., 1887, p. 22, pl. v. fig. c.

Station 8.

In the Deep Sea Fishes of the "Challenger," Günther wrote:—"The two typical specimens, of which one, 4 inches long, was found near the Great Barrier Island (New Zealand), seem still to be the only ones known." The habitat of the smaller example is vaguely stated as Australia. On Feb. 22nd, we were fortunate in netting two examples off Barranjoey. They were obtained in 25-28 fathoms, and the largest specimen measures 130 mm. (=5⅛ inches), or one-fourth longer than the larger of the British Museum types.

The black bands along the caudal lobes mentioned by Günther, but not shown in his figure, are prominent features of our examples, which, however, do not bear the bands mentioned in the "Challenger" Report as existing in front of the soft dorsal and anal fins. This latter character is not mentioned in the original description. As ascertained by fresh specimens the marks consist of a pale brown dorsal band which extends from the head to the caudal, sharply defined from the lower silvery part at half the distance of the lateral line from the dorsal profile; the opercles, otherwise silvery, are blotched with brown. The brown bands on the caudal lobes are connected at their bases by a recurved dark line showing through the scales.

PARATRACHICHTHYS, gen. nov.

This new genus is formed for the reception of *Trachichthys trailli*, Hutton, and is characterised by the circumstance of the vent being situated in front of, instead of behind the abdominal scutes, as in members of the genus *Trachichthys* as now restricted.

PARATRACHICHTHYS TRAILLI, *Hutton.*

Trachichthys trailli, Hutton, Trans. N.Z. Inst., viii., 1887, p. 212.
Günther, Chall. Report, Zool., xxii., p. 23, pl. lv., fig. A.
Trachichthys macleayi, Johnston, Proc. Roy. Soc. Tas., 1880, p. 56.

Station 25.

The single specimen obtained differs only from the descriptions of this species by having thirteen in place of eleven abdominal scutes. If this could be regarded as of specific value the name would be *T. macleayi* as above. It may be noted that the first scute is provided with two spines, which lie one on each side of the first median series, a character not shown in the figure quoted, nor mentioned in Johnston's description. With regard to the discrepancy in the number of scales along the lateral line, it may be mentioned that they are by no means easy to count. Our fish exhibits fifty-five pierced scales; Hutton counted ninety-five in the type, and Johnston "about fifty" in *T. macleayi*. The total number of scales along the line is one hundred and eighteen, exactly Hutton's rendering. None of these are larger than those on the rest of the body as described by Johnston.

Regarding the position of the vent, which is placed between the ventral fins, in front of the series of abdominal scutes, Günther considered it as probably abnormal. Such an opinion can no longer be held, as the condition is maintained by our specimen. I therefore propose generic recognition in the name *Paratrachichthys.*

If we accept Johnston's fish as referable to *P. trailli*, five examples are now known, the distribution of the species being ascertainable as follows:—

The type was obtained near Stewart Island, New Zealand; other two, also from New Zealand, were described and figured by Arthur* from specimens taken in Otago Harbour; the type of *M. macleayi* was described from a Tasmanian example taken in the estuary of the River Derwent.

The "Thetis" individual, which adds a new species to the Australian fauna, was obtained off Newcastle on March 4th, in 42-48 fathoms on a soft muddy bottom. It may have been taken in the neighbourhood of wreckage, as the anchor, planks and other material of the ship "Alhambra," sunk there twelve years previously, were also hauled aboard. It is of interest to note that it is the second species only taken *in situ*; all others, with the exception of *T. intermedius*, have been obtained floating on the

* Arthur—Trans. N.Z. Inst., xvii., 1885, p. 162, pl. xiv., fig. 2.

water. When brought to the surface the membranes about the eyes were inflated and the stomach had been forced into the mouth, a condition common to fishes taken from considerable depths.

The claims of *Hoplostethus* to generic separation from *Trachichthys* are based mainly on the absence of vomerine teeth; in *T. trailli* the patch could be covered by a pin's head. Goode and Bean* have made the distinction apparently greater by erroneously crediting *Trachichthys* with but two instead of three anal spines.

Family BERYCIDÆ.

BERYX, *Cuvier.*

BERYX AFFINIS, *Günther.*

NANNYGAI.

Beryx affinis, Günth., Cat. Fish., Brit. Mus., i., 1859, p. 13; Tenison Woods, Fish., N.S. Wales, 1882, p. 51, pl xv.

Stations 7, 11, 12, 13, 21, 22, 23, 24, 25, 35, 42, 48.

Goode and Bean write:† "*Beryx lineatus* and *B. affinis* of Günther belong to the Australian fauna, and are said to occur in water of no very considerable depth." In what shallow water *B. affinis* may on occasions be taken, however, would be scarcely imagined. Some data on this subject may therefore be of interest.

During the expedition we did not obtain it in less than 16-19 fathoms (Station 23), but it is commonly caught off the coast by the line fishermen in 10-12 fathoms. While trawling in Port Jackson itself with the Museum gear, we have secured it in 7 or 8 fathoms, at which depth it has also been taken on the line, so that it is quite a surface species.

We have no information as to the depths to which it may descend. It was taken by us freely at 80 fathoms and doubtless inhabits the deeper water between our coast and New Zealand, where it also occurs, thence ranging to Tasmania.

While trawling on sandy bottom we obtained only small examples, but when the soundings showed rock we netted larger individuals. The northern range of this species on our coast is unknown; we failed to secure it northward of Newcastle Bight.

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* Goode and Bean—Oceanic Ichth., Sp. Bull. U.S. Nat. Mus., 1895, p. 187.

† Goode and Bean—*loc. cit.*, p. 175.

Family MONOCENTRIDÆ.

MONOCENTRIS, *Schneider.*

MONOCENTRIS GLORIA-MARIS, *De Vis.*

KNIGHT FISH.

(Plate viii., figs. 1 and 2.)

Cleidopus gloria-maris, De Vis, Proc. Linn. Soc. N.S.W., vii., 1882, p. 368.
Monocentris gloria-maris, Ogil., Proc. Linn. Soc. N.S.W., xxiv., 1899, p. 159.

Stations 5, 10, 28, 29.

At each of the above mentioned stations we obtained an example of this fish. It was taken northward of Port Jackson at depths varying from 17 to 84 fathoms. In life the mandibulary luminous organs were of bright crimson colour with a brilliant white line along the upper edge: in spirits the discs of two examples have turned brick-red, in the other two a pearly-grey; all four exhibit the white line. These discs are situated externally one on each side of the mandible, are fully exposed when the mouth is open, but completely concealed by the maxillary when closed. The organ is subreniform in shape and measures 6 mm. in length and 3 mm. in depth in examples 200 mm. in length.

The dorsal spines are normally six in number, but one, two, or even three of the posterior ones may be undeveloped and represented only by the rugose portion found at the base of each spine. They are markedly heterocanth in character and are subject to variation as follows. While in some examples the first spine is directed to the right, the second to the left, and so on throughout the series, in others the condition is reversed, the first spine tending to the left, the second to the right, and so on alternately; in other words, we might say they are either right or left handed. All the spines are joined to each other by a low but very strong membrane.

The ventral spines, when erected, have an almost horizontal aspect, and can be securely locked at right angles to the body; the mechanism by which this locking is effected has been fully described in *M. japonicus* by Thilo in his admirable treatise.* These spines are of enormous size and strength, and in a specimen measuring 190 mm. in total length the pair when erected compass 130 mm. from tip to tip.

* Otto Thilo—Morph. Jahrb., xxiv., 1896, p. 336.

In the paper above quoted, Ogilby has reinstated De Vis' species, but as some of the contrasted characters are ill-founded I will first deal with these. I have before me two small examples of *M. japonicus*, obtained from Japanese seas, so that my comparisons are actual, and herein I have the advantage, as Ogilby had not seen Japanese material.

The characters relied upon as specific were the nature of the teeth, the presence of luminous organs in Australian specimens, and the condition of the armament.

Teeth.—With the exception of a rather different contour, consequent on the varied shape of the jaws, to be referred to later, the teeth of the two forms are quite similar, with the proviso that in *M. gloria-maris* there is a small rounded patch on the vomer. This is absent in the Japanese form.

Luminous organs.—These have been fully described in our species, and I need not further refer to them, excepting to remark that the mandibulary discs are most conspicuous objects. I can find no trace of such organs in *M. japonicus;* this is therefore an important specific difference.

Scales.—The character of the scales has not been insisted on, but the writer quoted draws attention to the fact that the author of the ichthyological portion of Lydekker's "Royal Natural History" writes of *Monocentris japonicus* as having the scales articulated together so as to form a solid armature, and adds :— "The statement is not, so far as I am aware, confirmed by other authors."

A comparison shows that such differences as occur in the scales are to be found in the sculpture, and not in the method of implantation or connection. In the small Japanese specimens at my disposal the scales are more imbricate than in the larger Australian examples, but the numerous figures of *M. japonicus* certainly indicate the black skin which separates the scales, so that no great imbrication occurs. It is to be mentioned, however, that the scales of the caudal pedicel are imbricate, while towards the lower surface the scales in both species are not only imbricate but are firmly locked together. Actual fusion scarcely occurs, for in the smooth groove into which the ventral spine is received the sutures between the scales can still be traced.

Some further points of difference may now be considered. I have no record of the size to which *Monocentris japonicus* attains, but from the various accounts accessible, it seems to be a much smaller species than ours, which reaches 230 mm. (9 inches) in total length.

If my Japanese examples are immature, the less ornate character of the scales may be thus explained. In the Australian species

the scales are much more rugose, the spines comparatively longer and more jagged There is also a tendency to rugosity in otherwise smooth places, such as the snout, top of the head, post orbitals, opercles, etc., and the width of the snout is much less; whereas in *M. japonicus* the single scale on the isthmus is narrow; in *M. gloria-maris* it is triangular and very broad at its base. The greatest differences, however, are presented by the mouth parts. In the former species the suborbital is deep, almost as deep as the eye, and the distal end of the maxilla is considerably dilated, its width half the depth of the eye. In the latter the suborbital is reduced to a narrow strip of bone, so that when the mouth is shut the maxilla is pressed close to the subocular border. This alone produces a considerable difference in what I may term the countenance or expression of the two fishes. The maxilla also is scarcely dilated. In Japanese examples the profile of both upper and lower jaw is almost straight and normal. In our specimens both are curiously bent, the whole mouth is greatly widened, and the premaxillæ are bent downwards towards the centre, each half widely separated from its fellow; above it is excised to receive a process from the preorbital; the mandible is remarkably thickened and bent; the symphysis is depressed, and at its lateral third the bifurcation occurs, mentioned by Ogilby, the two limbs embracing the luminous disc; the external limb ceases at the posterior margin of the disc, and is limited by a deep notch; the inner limb is greatly elevated above the disc.

Another subject which seems worth mentioning, and may indeed be of considerable interest, is the colour of the membrane lining the mouth. In *M. japonicus*, as far as I can gather, this presents no peculiarity; in *M. gloria-maris* it is quite black. It has been pointed out by several writers that this colour is quite common to the lining membrane of fishes from deep water, and is apparently correlated with luminous organs. It is in such connection that we now observe it in the Australian *Monocentris*.

Family MULLIDÆ.

UPENEICHTHYS, *Bleeker.*

UPENEICHTHYS POROSUS, *Cuvier & Valenciennes.*

RED MULLET.

Upeneus porosus, Cuv. & Val., Hist. Nat. Poiss., iii., 1829, p. 455.
Upeneichthys valmingii, Hector, Trans. N.Z. Inst., ix., 1876, p. 465, pl. ix., fig. 5.

Stations 1, 12, 21, 22, 24, 27, 28, 29, 39, 48.

Although frequently exposed in the Sydney Fish Market, members of the *Mullidæ* can scarcely be accounted common on the

coast. All the specimens obtained were attributable to *U. porosus*, although the very nearly allied *U. signatus*, Günth., is usually accounted the commoner species. This may be in part explained by observing that whereas the former has a wide distribution, *U. signatus* has not been recorded on the coast, other than from Port Jackson and Botany Bay.

Family SCOMBRIDÆ.

SCOMBER (*Artedi*), *Linnæus.*

SCOMBER PNEUMATOPHORUS, *De la Roche.*

MACKEREL.

Scomber pneumatophorus, De la Roche, Ann. Mus. Hist. Nat., xiii., 1809, pp. 315, 334. McCoy, Prod. Zool. Vict., Dec. iii., 1879, pl. xxviii.

Station 38.

The only example obtained was a partially digested individual ejected by a Dory as it lay on deck. On the Mackerel being recognised a sharp look-out was kept for Mackerel shoals, but not a living example was seen.

SARDA, *Cuvier.*

SARDA CHILENSIS, *Cuvier & Valenciennes.*

HORSE MACKEREL.

Pelamys chilensis, Cuv. & Val., Hist. Nat. Poiss., viii., 1831, p. 163.
Pelamys schlegeli, McCoy, Prod. Zool. Vict., Dec. xvi., 1888, pl. clv.

Stations 17, 27.

Originally described from the coast of Chili, and known also from Japanese, Indian and Australian Seas, yet the only recorded Australian habitats are Port Phillip in Victoria, whence a single example has so far been made known, and the Port Jackson district in New South Wales, where it is quite common. Its known range on our coast is now extended considerably northward.

Station 17 is off Broughton Island, north of Port Stephens, while Station 27 is much further north, off the Manning River, and was the most northern point at which the trawl was lowered Some of the specimens obtained were in spawn.

Family CARANGIDÆ.

SERIOLA, *Cuvier.*

SERIOLA LALANDII, *Cuvier & Valenciennes.*

KING FISH.

Seriola lalandii, Cuv. & Val., Hist. Nat. Poiss., ix., 1833, p. 208. McCoy, Prod. Zool. Vict., Dec. xviii., 1889, pl. clxxii.

This fine fish was freely taken by the line off Seal Rocks, and afforded good sport to such members of the expedition as were not at the time engaged in repairing the trawl.

The interest of fishing and of net-mending was, however, greatly eclipsed by the excitement aroused in watching the seals *(Otaria forsteri)* to the number of one hundred or more. As the "Thetis" steamed close up to the rock, the movements of these animals as they fought with one another or otherwise disported themselves, were followed with the keenest interest.

SERIOLA HIPPOS, *Günther.*

SAMSON FISH.

(Plate ix.)

Seriola hippos, Günth., Ann. Mag. Nat. Hist., (4), xvii., 1876, p. 392. Ogil., Edible Fishes, N.S.W., 1893, p. 85.

Riding at anchor on March 1st, in Port Stephens, where we had been driven by stress of weather, we were entertained for some time by a herd of *Seriola hippos*. The fishes raced around the "Thetis," sometimes within arm's length, and jumped clear out of the water apparently with keen enjoyment. They reminded me very much of Dolphins (*Delphinus*).

So favoured were our opportunities for observing them that there could be no doubt as to the species, they being readily distinguishable from their nearest ally of our waters, *S. lalandii*. On returning from my cabin, whither I had gone for a gun, the shoal had disappeared, but was afterwards seen a few hundred yards away.

S. hippos has, as far as known, a very restricted distribution, and the present record extends the range considerably to the northward.

Previously the habitat was stated as follows :—"So far as can be ascertained from public records and from our own experience, the purely Port Jackson district, stretching from Broken Bay in the north to Port Hacking in the south, can alone be given as the acknowledged habitat of this species on our coast."* (Ogilby).

The accompanying plate is drawn from a young example, measuring 200 mm. ($7\frac{7}{8}$ inches) in total length. In specimens of this size, and smaller, two or three rows of very large scales are present above the eye. In older examples they become obsolete, as do also the dark bands on the dorsal surface and sides. These bands are not always constant in number or position, and the two sides of the fish figured, are dissimilar ; on the left side, as shown, they are six in number, situated, one over the eye, one on the occiput, one beneath the spinous dorsal, two below the soft dorsal and one on the caudal peduncle. The right side differs in having an additional band, there being three beneath the dorsal rays. None of the bands reach the ventral profile, but that on the caudal is faintly produced across the peduncle.

The scales on the body are too minute to be indicated in a drawing of a fish as small as that illustrated.

TRACHURUS, *Rafinesque.*

TRACHURUS DECLIVIS, *Jenyns.*

YELLOW-TAIL.

Caranx declivis, Jenyns, Zool. Beagle, Fish., 1842, p. 68, pl. xiv.

Stations 17, 24, 26, 39.

One scarcely expects to meet with this fish while trawling, and indeed those secured were obtained under quite adventitious circumstances. Few of them were perfect, the others were damaged due to having been more or less digested by some carnivorous fish. On two occasions partially digested examples were ejected by Dories, and as these latter fishes are known to be predatory feeders, it is possible that most of the Yellow-tails were secured by their efforts and the remainder taken as the trawl approached the surface. All the specimens secured were small, not exceeding 6 inches in length.

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* Ogilby—Edible Fishes, N.S.W., 1893, p. 86.

Family POMATOMIDÆ.

POMATOMUS, *Lacépède.*

POMATOMUS SALTATRIX, *Linnæus.*

TAILOR.

Perca saltatrix, Linn., Syst. Nat., Ed. x., i., 1758, p. 293.
Temnodon saltator, McCoy, Prod. Zool. Vict., Dec. xix., 1889, pl. clxxxiii.

Stations 1, 23.

Probably encountered as the trawl neared the surface, two examples were taken; had the season been spring, instead of autumn, more might have been caught, but the seine and not the trawl is the correct implement to be used for this species. At any time it is scarcely a favourite with fishermen on account of the damage it does to their nets, and its habits in this direction have locally earned for it the name Tailor.

Family PEMPHERIDÆ.

PEMPHERIS, *Cuvier & Valenciennes.*

PEMPHERIS MACROLEPIS, *Macleay.*

BULLSEYE.

(Plate x.)

Pempheris macrolepis, Macl., Proc. Linn. Soc. N.S.W., v., 1881, p. 517.
Pempheris lineatis, Ogil., Proc. Linn. Soc. N.S.W., x., 1886, p. 447.

Station 10.

By the kindness of Mr. George Masters, Curator of the Macleay Museum, I have examined the author's types of *P. macrolepis*. They are not in good condition, and have lost most of the scales. On comparing with them the type of *P. lineatis*, I do not see any grounds for regarding this latter species as distinct. Macleay identified his own species from Port Jackson.

Our examples, three in number, were obtained in 28 fathoms off Broken Head. They have lost all their scales except those of the lateral line, which alone are very adherent. Being thus

unfitted for delineation the accompanying figure has been drawn from the type specimen of *P. lineatis*, which is in excellent preservation.

P. mülleri, Klz., and *P. multiradiatus*, Klz.,* are more nearly allied to *P. compressus*, White†, from which, indeed, they are doubtfully distinct.

Family CHEILODIPTERIDÆ.

APOGONOPS, *Ogilby.*

APOGONOPS ANOMALUS, *Ogilby.*

(Plate xi., fig. 1.)

Apogonops anomalus, Ogil., Proc. Linn. Soc. N.S.W., xxi., 1896, p. 24.

Stations 55, 57.

This species was twice obtained, first off Crookhaven River, north of Jervis Bay, and again off Wata Mooli, south of Botany Bay. These with the type are the only examples known. Both are larger than the type, and measure 58 and 70 mm. respectively. The larger example taken off Crookhaven River was trawled in 11-15 fathoms, and the smaller was brought from the depth of 54-59 fathoms.

ENOPLOSUS, *Lacépède.*

ENOPLOSUS ARMATUS, *White.*

OLD WIFE.

Chætodon armatus, White, Voyage to New South Wales, 1790, pl. xxxix., fig. 1.

Enoplosus armatus, Cuv. & Val., Hist. Nat. Poiss., ii., 1828, p. 133, pl. xx.

Stations 18, 22, 26.

Although this common little fish is best known swimming around the wharfs and jetties of the harbours, it is, as our records show, not confined to shallow water, having been taken in 48 fathoms. It cannot be obtained in large quantities, for it occurs chiefly in rocky ground where the net cannot be used, and it very seldom

* Klunz—Sitz. der K. Akad. Wissen., Wien., lxxx., 1879, p. 380-1.

† White—Voyage to New South Wales, App., 1790, p. 267, fig. 2.

takes the hook. It does not usually attain to a length greater than eight or nine inches. The only three examples obtained in the trawl were taken between Newcastle and Port Stephens.

Family SERRANIDÆ.

ACANTHISTIUS, *Gill.*

ACANTHISTIUS SERRATUS, *Cuvier & Valenciennes.*

WIRRAH.

Plectropoma serratum, Cuv. & Val., Hist. Nat. Poiss., ii., 1828, p. 399.
Plectropoma myriaster, Steind., Sitzb. K. Akad. Wiss. Wien., liii., 1866, p. 426, pl. i., fig. 3.

Station 25.

The only two examples secured were obtained by the trawl in 48 fathoms, in the vicinity of a wreck, the anchor-chain and a plank of which were hauled aboard. Although easily caught with the hook and tolerably common, the Wirrah is accounted of little value for the table; it is said to be good only when boiled. It appears to be a very local species, confined to the coast of New South Wales, and more common in the vicinity of Port Jackson than elsewhere. Our specimens were trawled off Newcastle.

EPINEPHELUS, *Bloch.*

EPINEPHELUS SEPTEMFASCIATUS, *Thunberg.*

GREY-BANDED PERCH.

Perca 7-fasciata, Thunb., Vetensk. Akad. Handl. Stockholm, xiv., 1793, p. 56, pl. i.
Plectropoma susuki, Temm. & Schleg., Fauna Japon., Pisc., 1844, p. 11, pl. iv., fig. 1.

Station 51.

In 1867 two specimens of this fish were sent from Sydney to London. These are, I believe, the only examples previously known from Australia. I am therefore pleased to be able to once more record it from our waters; it is a fine fish, attaining a length of 12 inches. The only example trawled was taken in Shoalhaven Bight in 15 fathoms or under. While apparently rare in Australian seas, it has a wide distribution, ranging from the tropical Atlantic through the Indian Ocean to the Chinese and Japanese Seas.

HYPOPLECTRODES *(Poey), Gill.*

HYPOPLECTRODES SEMICINCTUS, *Cuvier & Valenciennes.*

HALF-BANDED SEA PERCH.

Plectropoma semicinctum, Cuv. & Val., Hist. Nat. Poiss., ix., 1833, p. 442. Guich, Gay's Hist. Chile, Zool., ii., 1848, p. 153. Ictiol, pl. ii., fig. 1.

Not taken in the trawl. A single example was secured by hook and line on the reef off Cape Hawke in company with rock-frequenting fish.

Under the impression that the term *Hypoplectrodes*, Gill, was a *nomen nudum*, Mr. Boulenger, in his catalogue,* used the name *Gilbertia*, Jord. and Eigen, for the genus. Dr. Gill thereupon pointed out† that his diagnosis had been published by Professor Poey, and should therefore be used.

CÆSIOPERCA, *Castelnau.*

CÆSIOPERCA LEPIDOPTERA, *Forster.*

BASTARD LONGFIN.

Epinephelus lepidopterus, (Forst.), Bloch & Schneider, Syst. Ichth., 1801, p. 302.
Scorpis hectori, Hutton, Fish. New Zeal., 1872, p. 4, pl. i., fig. 4.

Station 15.

A single specimen has been recorded from Port Jackson; this is in the Macleay Museum and was taken in 1895. Since that time the Australian Museum has received one or two examples from the mouth of the Hawkesbury River. This species was obtained by the "Thetis" Expedition off Tuggerah Lakes in 32-48 fathoms in one haul only, when but two examples were taken. I was rather surprised not to have trawled it at some of the southern Stations, as it appears to be a southern form with its headquarters off the Tasmanian coast, whence it journeys into New Zealand waters.

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* Boulenger—Cat. Fish. Brit. Mus. (2nd ed.), i., 1895, p. 306.

† Gill—Proc. U.S. Nat. Mus., xviii., 1896, p. 568.

CAPRODON, *Temminck & Schlegel.*

CAPRODON LONGIMANUS, *Günther.*

LONGFIN.

Anthias longimanus, Günth., Cat. Fish. Brit. Mus., 1859, i., p. 94.
Caprodon longimanus, Boul., Cat. Fish. Brit. Mus., (2nd Ed.), i., 1895, p. 315, pl. xii.

Stations 15, 42, 48, 56, 57.

On the Australian coast this species has been recorded only from Port Jackson, and our observations extend its range but slightly. Bungaree Norah (Station 15), between Broken Bay and Newcastle, marks its northern limit, while the southern range is extended to Wollongong (Station 48). It occurred in rather deep water, being taken between 32 and 80 fathoms, on sand, mud, or rock.

ANTHIAS, *Bloch.*

ANTHIAS PULCHELLUS, sp. nov.

(Plate xii.)

Stations 15, 42, 48, 49.

B. vii. D. x. 16-17. A. iii. 8. V. i. 5. P. 16. C. 17. L. lat. 44. L. tr. 5/14.

Length of head 2·8, height of body 2·47 in the length of body (caudal excluded). Snout scaly, shorter than the eye and 4·6 in the length of the head. Eye 3·6 in the same. Interorbital space scaly, flat, 1·2 in the diameter of the eye and 3·75 in the length of the head.

The upper profile of the head is slightly concave; the first dorsal spine marks the highest point, whence the descent is a gentle curve to the caudal pedicel; the ventral profile is less convex. The lower jaw projects beyond the upper and the cleft of the mouth is very oblique. Maxillary scaly, reaching to below the first fourth of the orbit, its distal breadth slightly more than half the diameter of the eye. The anterior nostril has a skinny rim; the posterior one is a simple opening and situated midway between the orbit and the anterior nostril. Opercle armed with three spines, of which the middle is the longest. Both limbs of preopercle finely serrated, those at the angle not enlarged.

About 26 long and slender gill-rakers on the lower limb of the first arch; pseudobranchiæ well-developed.

Teeth.—At the symphysis of the upper jaw and just within the mouth is a pair of canines strongly recurved and appreciably separated. On the outer margin of the jaw is placed a pair of widely separated canines; these are strong, conical and directed horizontally forward; a few smaller teeth are also to be found scattered between the two pairs of canines and one or more rows of cardiform teeth on the front margin of the jaw. In the mandible the anterior canines are smaller and sometimes in two pairs; in the middle of the lateral series are one or two pairs of strong, recurved canines. The teeth on the vomer form a large Λ-shaped patch, those of the palatines a broad band: the tongue and entopterygoids toothless.

Fins.—The dorsal commences above the middle opercular spine; the spinous and soft portions are of equal height; the former has the longer base by about one-tenth. The spines are strong, the fourth being the longest, 2·1 in the length of the head and twice the length of the first spine; the second is 1·4 in that of the fourth, to which the third is almost equal; the others are subequal with the exception of the last two, which are somewhat shorter; anteriorly the inter-spinous membrane is deeply notched. The soft portion is higher than the posterior spines, but the longest ray (the 11th) does not exceed the fourth spine. The anal spines are very strong; the second is the longest, but nearly equalled by the third; it is as long as the third dorsal; the first dorsal and first anal are alike in size and character. The anal rays are much longer than those of the dorsal, the longest (second and third) being 1·7 in the length of the head. The ventral spine is slightly longer than the fourth dorsal; the second ray, which is the longest, fails to reach the vent and is 1·4 in the length of the head. The pectoral is elongate and subsymmetrical; rays branched near their extremities; the middle ray, the eighth, is the longest, and reaches the base of the third anal spine; the whole fin is longer than the head by one-tenth; the caudal is crescentic; the outer rays are not produced, and the lobes are equal.

Scales rather large; those covered by the base of the pectoral measure 10 mm. along their exposed edge in the largest example; they are closely ciliate and firmly adherent. The bases of all the fins are scaly, as is also the entire head, including the branchiostegals.

The lateral line, after rising to beneath the fourth dorsal spine, follows the curvature of the back to beyond the fin, bending horizontally to the caudal pedicel; the tubules are simple, and extend along nearly the entire scale; there are five series of scales

between the first dorsal spine and the lateral line, and three between the line and the middle dorsal spines; the least height of the caudal pedicel measures one-third the length of the head.

Colours generally red, but turning brown in spirits, each scale of the upper portion with a dark mark in the centre; these form longitudinal lines; along the middle line of the body is a broad ill-defined yellow band; cheeks yellow, with a pink band below the eyes; fins yellow; a black blotch situated on the 1-6 dorsal rays may be present or absent; irides crimson, with an orange ring.

Total length of largest example, caudal included, 223 mm.

The position and affinities of this new species may be best ascertained by comparing it with the synopsis of species as published by Boulenger.*

The circumstance of the head being completely scaly places it in division II., and the nature of the lateral line limits it to sub-section B, while the number of scales between the dorsal spines and the lateral line suggests that it is one of two species, namely, *A. hypselosoma* and *A. pleurotœnia*, the former recorded from Lord Howe Island and the latter from the north-east coast of Australia.

The variation in the dorsal rays (16-17) of *A. pulchellus* is a little striking, the two examples possessing the black blotches have seventeen rays, the other two but sixteen; both agree, however, in possessing eight anal rays; those of the two species above mentioned have seven only. In all cases I count the last divided ray as a single one; otherwise the number would be nine. On account of its peculiarities *A. pleurotœnia* may be dismissed from consideration. I was at first inclined to write down the "Thetis" examples as *A. hypselosoma*. They are, however, distinct from the specimen of that species identified by Ogilby with *A. cichlops*,† and possess features irreconcilable with the descriptions.

In addition to the increased number of rays in the anal it differs from its nearest ally in the length of the maxillary, the sub-equal character of the preopercular serrations, the longer pectoral and shorter anal, the extra number of scales between the dorsal spines and the lateral line. Also, apparently, by the character of the teeth, the colouration, and, as far as known, by attaining much larger dimensions.

It is also to be remarked that the pectoral has but sixteen rays, a character common to all four specimens; while the pectoral formula for the genus is seventeen-eighteen.

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* Boulenger—Cat. Fish. Brit. Mus., (2nd ed.), i., pp. 321-2.

† Ogilby—Proc. Zool. Soc., 1889, p. 151.

This new species was taken on four occasions, extending from Bungaree Norah, south of Newcastle, to Wollongong, and at depths between 32 and 78 fathoms.

CALLANTHIAS, *Lowe.*

CALLANTHIAS PLATEI, *Steindachner.*

Callanthias platei, Steind., Fauna Chilensis, Zool. Jahrb., Supp., iv., 2, 1898, p. 284, pl. xv.

Station 15.

Shortly after the publication of the Preliminary Report* with reference to the species provisionally referred to *C. allporti*, Mr. J. D. Ogilby placed on my table a reprint of Dr. Steindachner's paper on the Plate Collection, open at page 284. We jointly decided that the species there described was identical with the "Thetis" examples.

Next followed Boulenger's note on *Callanthias*,† wherein, on reference to my pen and ink sketch, he expresses his opinion that the Chilian and Australian species are the same. In his interesting note he further draws attention to several species common to Eastern Australia and Chili, and suggests that in future closer comparison be instituted between the fishes of the western and eastern parts of the South Pacific than has hitherto been the case.

Then Ogilby, looking up a specimen he had obtained in 1897, made a critical comparison of the two forms, and proposed for Australian specimens the trinomial *Callanthias platei australis*.‡

We trawled six examples, attaining a length of 205 mm. off Norah Head, 36 miles north of Port Jackson, in 32-48 fathoms. They may have been netted among rocks, as obstructions were encountered which rendered the raising of the trawl a necessity. According to Dr. Plate, however, as quoted by Steindachner, they are also of pelagic habit, as indicated by the following passage:—"Although by no means abundant, this species surrounds the island of Juan Fernandez in large shoals of many hundreds of individuals. From the edges of the tablelands I have seen such swarms of fish that they appeared a dense mass under the surface of the water, like golden spots in the remoter distance."

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* Waite—"Thetis" Prelim. Report, 1898, p. 31.

† Boulenger—Ann. Mag. Nat. Hist., (7), iii., 1899, p. 346.

‡ Ogilby—Proc. Linn. Soc., N.S.W., xxiv., 1899, p. 173.

Family PRIACANTHIDÆ.

PRIACANTHUS, *Cuvier.*

PRIACANTHUS MACRACANTHUS, *Cuvier & Valenciennes.*

RED BULLSEYE.

Priacanthus macracanthus, Cuv. & Val., Hist. Nat. Poiss., iii., 1829, p. 108.
Priacanthus benmebari, Temm. & Schleg., Fauna Japon., Pisc., 1844, p. 19, pl. vii., fig. 1.

Stations 22, 23.

This species was but twice obtained in the trawl, having been encountered in 16-40 fathoms off Newcastle. It is believed that in the autumn this fish leaves the sea and passes up the rivers for the purpose of spawning.

Family THERAPONIDÆ.

THERAPON, *Cuvier.*

THERAPON CUVIERI, *Bleeker.*

TRUMPETER PERCH.

Pristipoma sex-lineatum, Quoy & Gaim., Voy. Freyc., Poiss., 1824, p. 320.
Therapon cuvieri, Bleek., Atlas Ichth., vii., 1873-6, Perc., pl. xxxvii., fig. 2.

Station 52.

One specimen only was obtained, in 20 fathoms, off Shoalhaven Bight. If examples of this fish were required we should prefer drawing the seine at Botany Bay or Middle Harbour. Around the shores of Port Jackson it is a very common little fish, and is frequently caught by boys on the wharves, in company with *Trachurus declivis* and *Neosebastes australis.*

Family SPARIDÆ.

SPAROSOMUS, *Gill.*

SPAROSOMUS AURATUS, *Bloch & Schneider.*

SCHNAPPER.

Labrus auratus, Bloch & Schneider, Syst. Ichth., 1801, p. 266.
Pagrus unicolor, Tenison Woods, Fish and Fisheries N.S.W., 1882, p. 39, pl. viii. and frontispiece.

Stations 1, 2, 8, 12, 15, 21, 23, 29, 33, 52, 53.

Judging by the inquiries made as we on the several occasions entered port, a stranger might have thought that there was only one fish in our waters, and that the Schnapper. We were by no means anxious to obtain this fish, for its advent was a tolerable indication that we were in the vicinity of rocks, objects of all others to be avoided in trawling. At four out of the above eleven Stations the net was badly torn, and at several of the other Stations, where the damage was less severe, the numbers of Sponges, Gorgonias, and other rock-frequenting forms sufficiently indicated the nature of the obstruction encountered. Occasionally, Schnapper were obtained on ideal trawling-ground. It was, however, then significant that not more than one or two individuals were netted.

The circumstance of Red Bream (young Schnapper) of 2 lb. weight in full breeding condition was considered to be of great interest and considerable importance. Taking into account the number of small Schnapper secured in such mature condition, we can scarcely believe that this phase of Schnapper life is unknown to fishermen.

CHRYSOPHRYS, *Cuvier.*

CHRYSOPHRYS AUSTRALIS, *Günther.*

BLACK BREAM.

Chrysophrys australis, Günth., Cat. Fish. Brit. Mus., i., 1859, p. 494. McCoy, Prod. Zool. Vict., Dec. i., 1878, pl. iv.

Considering the comparatively large number of Stations at which the Schnapper was secured, one might have expected that

one Black Bream at least would have been trawled; such was, however, not the case. On the other hand, this experience is quite in accord with the known habits of the species, frequenting the coastal and estuary areas rather than the more open seaway. Lines put down on the recognised Schnapper grounds failed to secure them, and they were obtained only in the sheltered harbour of Port Stephens.

Family GERRIDÆ.

XYSTÆMA, *Jordan & Evermann.*

XYSTÆMA OVATUM, *Günther.*

SILVER BELLY.

(Plate xiii.)

Gerres ovatus, Günth., Cat. Fish. Brit. Mus., i., 1859, p. 343, and iv., 1862, p. 257.

Station 23.

The only specimen secured was taken off Newcastle, in 16-19 fathoms. It is a very common fish in shallower water, where it frequents the long sandy reaches.

An examination of all the specimens available to me shows that the species is referable to the genus *Xystæma*, characterised by having the second interhæmal spine solid (and therefore not receiving a horn of the air bladder as in *Gerres*), and by the preopercle being entire.

The fish taken is that commonly identified as *Gerres ovatus*, Günth. Although it very generally agrees with the description of that species, there are one or two points of difference which call for remark. In *G. ovatus* the anal fin terminates behind the dorsal; in our example, in advance of it. The suborbital groove in Günther's species does not extend beyond the anterior margin of the eye; in our form considerably beyond it. In Ogilby's description of *G. ovatus** the dorsal and anal fins are said to be without scaly sheaths. This sheath is present in our specimens, which in such particular agree with the original description. The

* Ogilby—Edible Fishes, N.S.W., 1893, p. 147.

scales are extremely deciduous, and it is very rare to meet with a perfect specimen; the accompanying plate is from a beautiful example kindly lent me by Mr. Ogilby.

Family KYPHOSIDÆ

CÆSIOSOMA, *Kaup.*

CÆSIOSOMA ÆQUIPINNIS, *Richardson.*

SWEEP.

Scorpis æquipinnis, Rich., Voy. Ereb. & Terr., Fish, 1844, p. 121.
Scorpis lineolata, Kner, Reise Novara, Fische, 1869, p. 108, pl. v., fig. 3.

Not once having entered the trawl, this common species finds a place in the list by virtue of it having been taken at two places with the hook, namely, over Schnapper Rock, between Cape Hawke and Crowdy Head; and on Young Banks, the favourite Schnapper grounds off Crookhaven Bight.

Family SCIÆNIDÆ.

ATRACTOSCION, *Gill.*

ATRACTOSCION ATELODUS, *Günther.*

TERAGLIN.

Otolithus atelodus, Günth., Ann. Mag. Nat. Hist., (3), xx., 1867, p. 60. Tenison Woods, Fish and Fisheries N.S.W., 1882, p. 54, pl. xvii.

Stations 1, 11, 12, 23, 25.

This species, so extremely common on our coast, has not yet been recorded outside the limits of the Colony. Although sometimes taken in the seine, it is more often caught with the line at moderate depths. Of the dozen examples trawled none exceeded a foot in length, although it is known to attain to three times that size. Attention may be drawn to the fact that the soundings at all the above named Stations showed a sandy or muddy bottom, the depths ranging from 16 to 48 fathoms.

Family CIRRHITIDÆ.

LATRIS, *Richardson.*

LATRIS CILIARIS, *Forster.*

BASTARD TRUMPETER.

Sciæna ciliaris, Forst., Descr. Anim., Ed. Licht., 1844, p. 137.
Latris ciliaris, Rich., Voy. Ereb. & Terr., Fish., 1844, p. 37, pl. xxvi., figs. 6-7.

Station 53.

Having its headquarters in New Zealand waters, this species is scarce in our Colony, and when secured is only taken with hook and line. Dr. Hector,* writing of it in New Zealand waters, remarks, however, "it rarely takes the bait, but is chiefly caught with the net." Our line fishermen tell me that it is only taken on rocky bottom, and our single example was certainly secured in such situation, for no sooner had the trawl reached the ground than it became fouled and got rather badly torn. This occurred off Shoalhaven Bight in 23 fathoms.

DACTYLOSPARUS, *Gill.*

DACTYLOSPARUS CARPONEMUS, *Parkinson.*

MORWONG.

Sparus carponemus, Parkinson.
Cheilodactylus carponemus, Cuv. & Val., Hist. Nat. Poiss., v., 1830, p. 362, pl. cxxviii.
Chilodactylus carponemus, McCoy, Prod. Zool. Vict., Dec. xviii., 1889, pls. clxxiii., clxxiv.

Stations 7, 12, 21, 42, 48, 58.

It is to be noticed that although neither of the nearly-related fishes, *Dactylosparus macropterus*, nor the common *Chilodactylus*

* Hector—Edible Fish. N.Z., 1872, p. 108.

fuscus, was obtained, *D. carponemus* was gathered in considerable quantities. Hitherto almost unknown, excepting from adult examples, we were fortunate in netting young ones. Most of them were collected in deep water, say 45 to 75 fathoms, and none were got in less than 23 fathoms. Beyond enabling us to note the fact, our observations were not sufficiently extensive to empower us to form any definite opinion as to the breeding habits of this species, a subject at present quite unknown. Had operations been continued further southward we should probably have met with greater success with this species, as it is peculiarly a southern form, known from Victoria, South Australia, and New Zealand. Station 21, in the Newcastle Bight, is, I believe, the most northern point whence it has so far been recorded.

Family POMACENTRIDÆ.

HELIASES, *Cuvier & Valenciennes.*

HELIASES IMMACULATUS, *Ogilby.*

BROWN PULLER.

(Plate xiv.)

Heliastes immaculatus, Ogil., Proc. Linn. Soc. N.S.W., x., 1886, p. 446.

Station 30.

This species is closely allied to, if not identical with *H. hypsilepis*, Günth.,* the description of which, however, is insufficient for comparative purposes. It is to be noticed that our specimen, and also all others caught off the coast, have immaculate fins, and in this particular differ from the description of *H. hypsilepis*. Each body scale of our example bears at its basal portion a faint purple mark ; an appearance of longitudinal lines is thus produced.

The single representative was secured off Cape Hawke, in 35 fathoms, where the trawl encountered rock the moment it touched bottom.

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* Günth.—Ann. Mag. Nat. Hist., (3), xx., 1867, p. 66.

Family LABRIDÆ.

OPTHALMOLEPIS, *Bleeker.*

OPTHALMOLEPIS LINEOLATA, *Cuvier & Valenciennes.*

RAINBOW FISH OR MAORI.

Julis lineolatus, Cuv. & Val., Hist. Nat. Poiss., xiii., 1839, p. 436.
Opthalmolepis lineolata, Kner, Reise Novara, Fische, 1869, p. 258, pl. xi., fig. 1.

This species was never taken in the trawl, but examples were secured by means of the line. It is not found northward of our Colony, but what its northern limit may be appears to be unknown.

I am, indeed, not certain that it has been previously recorded from, although doubtless taken off Schnapper Rock, between the Manning River and Cape Hawke, where we hooked several specimens.

NOVACULICHTHYS, *Bleeker.*

NOVACULICHTHYS JACKSONENSIS, *Ramsay.*

KEEL-HEADED PARROT FISH.

(Plate xv.)

Novacula jacksonensis, Rams., Proc. Linn. Soc. N.S.W., vi., 1882, p. 198.

Station 32.

This species was first made known from Manly, immediately north of Port Jackson, on March 22nd, 1881, since which date it had not been met with, until the 6th March, 1898, when we trawled a second individual in 10-12 fathoms, between Cape Hawke and Charlotte Head.

Having the type specimen also before me, I am able to compare the two, and find, apart from size, only the following differences :— In Ramsay's example, which is immature, the profile of the head slopes backwards, and the lower pair of canine teeth is developed equally with the upper, the second spine is quite detached from the third, but a glass reveals indication of a ruptured membrane between them.

In my specimen, well preserved in formol, the anterior profile is vertical and the lower pair of canine teeth is ill-developed. The two portions of the spinous dorsal are connected by a low membrane; the species thus enters the genus *Novacula* as restricted by Gill, or the *Hemipteronotus* of Bleeker.

The following is a description of the "Thetis" example:—

D. ii. vii. 12. A. iii. 12. P. 13. V. i. 5. C. 15. L. lat. 22 + 6. L. tr. 3/11.

Length of head 3·2, height of body 2·45 in total length (caudal excluded); the eye has a pronounced fleshy margin and is 5·2 in the length of the head; pectoral 1·2, and caudal rays 2·0 in the same.

From in front of the eye to the mouth, the profile of the head is almost perpendicular; passing upwards and backwards with a sweeping curve, the highest point of the body is attained at the base of the third spine; the dorsal profile is at first gently, afterwards more pronouncedly, convex to the end of the dorsal fin, whence it passes obliquely to the caudal rays. The ventral profile forms a more even but similar convexity. The height of the caudal peduncle is slightly more than its length behind the last dorsal ray.

The jaws are equal and the cleft of the mouth one-half longer than the diameter of the eye, and does not reach to its anterior margin. In front of the upper jaw is a pair of curved and divergent canine teeth directed somewhat forward. In the lower jaw is also a pair of canines; these are very short, close together, and bite between the upper ones. Behind the canine in each ramus of both jaws is a series of conical teeth to the number of eight or nine.

Nasal apertures very small, rather close together, the anterior with a low skinny rim nearer the eye than the edge of the snout, the posterior a horizontal fissure on a higher level. On the head are some scattered pores, the position of which are indicated in the accompanying figure. The anterior profile of the head forms a sharp keel, whose extent is circumscribed by a closely set series of shallow horizontal grooves. The eye is surrounded by a membrane which is widest above and below the posterior angles, where it is free behind.

The first dorsal spine is planted slightly behind the centre of the eye, and is a little shorter than the second, which is 2·35 times in the length of the head. This spine is remote from the third, but attached by a low membrane. The remaining spinous portion is low, but the rayed part uniformly increases in height, and the last rays, which are longer than the second spine, extend to the base of the

caudal rays. The anal commences beneath the first dorsal ray, and it is similar to the corresponding part of that fin, but is continued further back, and its posterior rays extend slightly beyond the base of those of the caudal. The pectoral arises from a fleshy base, its second and third rays are the longest and reach to above the third anal spine. The ventral extends to the vent, but the outer ray, which is produced, reaches to the origin of the anal. The caudal is truncate or slightly rounded.

Scales.—Four imperfect rows of small scales on the cheeks, those of the body are large, thin, and adherent, marked with faint radiating striæ. The tubules of the lateral line are simple and very low, and terminate in a large pore opening at some distance from the margin of the scale. The lateral line is interrupted on the twenty-second scale, and three rows lower is continued along six scales in the median line of the tail to within a scale of the caudal rays.

Colours.—In life the general colour was of an opalescent translucent salmon tint with oblique blue hair-lines on the dorsal surface, one to each scale, lost about the lateral line. Two or three rows of scales bordering the ventral fin and extending along the lower side of the caudal peduncle were marked each with a large blue blotch at its base. All the fins orange, the dorsal and anal marked with oblique wavy blue lines and the tail with five bars of the same colour. Eye orange. Preserved in formol the colours are the same, but have faded somewhat.

Total length of specimen 185 mm., the length of the type 132 mm.

Family ZEIDÆ.

ZEUS *(Artedi), Cuvier.*

ZEUS AUSTRALIS, *Richardson.*

DORY.

Zeus australis, Rich., Voy. Ereb. & Terr., Fish., 1846, pp. 36 and 138, pl. xxv., fig. 1.

Stations 2, 4, 5, 7, 8, 9, 11, 12, 15, 17, 21, 22, 23, 25, 26, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 46, 47, 48, 50, 52, 56, 57, 58.

Although retaining Richardson's name, I am strongly inclined to agree with Günther in regarding the species as identical with *Z. faber*, Linn. With a nice series before me most of the characters emphasised by Richardson are seen to be variable, and in some

examples such agree exactly with the descriptions of the old world species.

The dorsal spines are doubtfully shorter and stouter than in *Z. faber*, and the base of the soft portion is slightly less than that of the spinous. The spiny scutes at the base of the soft dorsal and anal fins vary in number from seven to eight. In all our examples the thoracic and abdominal scutes are strongly spinose, none at all reduced to the tuberculate character figured by Richardson.

As will be seen by a reference to the Stations quoted, Dories were trawled on no less than thirty-three occasions. At Station 36 they were the only fishes taken, and at Station 37, twenty-eight large individuals were obtained in one haul of two hours' duration immediately south of Botany Bay and within three miles of the coast. Depth, between the extremes at which we trawled, seemed to have no effect on its numbers, it being equally common either at 16 or 84 fathoms. Indeed, the known habits of the British Dory indicate that it may swim freely at the surface, for when the Pilchards appoach the shore this fish is often taken in considerable numbers. The only Pilchard obtained by us was voided by a Dory (Station 26), and the single Mackerel was obtained in the same way (Station 38), while, as has been previously mentioned, many of the Yellow-tails *(Trachurus declivis)* secured had been partially digested, doubtless by Dories. When these latter fish were in the trawl the fact was generally made apparent by numbers of dead examples rising to the surface and floating away (owing to their peculiar conformation) on their sides, many were washed over the ground line and thus lost.

Cunningham* writes:—"In the aquarium at Plymouth I have noticed that the dory has a peculiar and interesting method of securing its prey. It does not overtake it by superior speed like the mackerel, or lie in wait for it like the angler, but stalks it and approaches it by stealth. It is able to do this in consequence of the extreme thinness of its body, and the peculiar movement of its hinder dorsal and ventral fins. The dory places itself end on towards the fish it desires to devour, and in this position it is evident that it excites no alarm on the part of its prey. The appearance of the dory seen in this way is a mere line in the water, to which no particular significance can be attached. I have not particularly noticed the effect of the ribbons of membrane, which project from the dorsal fin. But I have observed that the movements of the dory are very gradual, except in turning: it alters the position of its body by a turn of the tail or side fins, and then slowly swims forward by vibrating the second dorsal and ventral, a movement which causes very

* Cunningham—Marketable Marine Fishes, 1896, p. 322.

slight disturbance of the water. The whole appearance of the dory in these actions is suggestive of suppressed excitement, his eyes being fixed on his prey. I do not recollect seeing him actually swallow another fish, but have no doubt that he gets near enough to a sprat for example, without alarming it, to seize it by the sudden elongation of his curious jaws."

Family MONACANTHIDÆ.

MONACANTHUS, *Cuvier.*

MONACANTHUS AYRAUDI, *Quoy & Gaimard.*

COMMON LEATHERJACKET.

Monacanthus ayraudi, Quoy & Gaim., Voy. l'Uranie, Poiss., 1824, p. 216, pl. xlvii., fig. 2.

Stations 1, 2, 4, 5, 7, 8, 9, 10, 11, 12, 15, 17, 20, 21, 22, 26, 27, 28, 33, 44, 52, 54, 57.

Previously the known range of this species was summed up in the following words :—"The only localities from which this species can be recorded with certainty are the metropolitan district of New South Wales and King George's Sound" (Ogilby). It was taken by us all along the coast line from the Manning River to Jervis Bay, and at all depths from 10 to 84 fathoms. Wherever lines were put over on the reefs this ubiquitous species was hooked, and proved as irritating as usual, cutting lines and gut with its sharp teeth, or monopolising the bait intended for Schnapper and other esteemed fish. Young and half-grown examples were freely netted, while the adults reached a length of 510 mm. (= 20 inches).

MONOCANTHUS SETOSUS, sp. nov.

(Plate xvi.)

Station 49.

D. 34. A. 34. P. 12. C. 12.

Length of head 3·7, height of body 2·3 (or 1·7 when ventral bone is extended), length of caudal 3·4 in the total. The eye is large, 2·8 in the length of the head, and equal to the interorbital space, which is slightly convex: it lies nearer to the snout than to the dorsal rays.

The gill opening is slightly oblique, placed under the centre of the eye and directed to its posterior margin; it is shorter than the eye and is separated therefrom by less than its own length. Nostrils approximate, each with a skinny margin, placed in front of the upper anterior angle of the eye.

The teeth are damaged. There are three pairs in the lower jaw.

Upper profile of head straight. From the spine to the rays the body is also straight and ascends very slightly, the first ray marking the highest point of the body, whence it descends in an even curve to the caudal pedicel. When the ventral process is depressed the lower profile is an even low arc, broken by an obtuse angle when the process is extended.

The dorsal spine is placed over the posterior third of the eye; it is slightly curved backward at the base, otherwise straight, 1·3 in the length of the head, strong at the base, much weaker above; the front is rounded and without enlarged spines, excepting a few small ones at the apex; it is closely studded with low uniform spinules, as determined with a hand lens, all trending upwards. At each lateral margin is a row of low conical spines directed outward and downwards. The dorsal and anal rays are similar, of medium height; the latter commences under the sixth dorsal ray and terminates slightly behind that fin. The ventral spine is below the space between the dorsal spine and rays, when extended rather nearer the former, when depressed rather nearer the latter; it is fixed and has eight prominent spines, one pair directed forwards, two sideways, and four backwards; of the latter one pair is placed above the other. The pectoral fin is one half longer than the eye, beneath the centre of which its base is inserted. Caudal long and rounded, no short external rays, the pedicel compressed, without either spines or bristles; its height equals the diameter of the eye.

Skin very rough, its texture resembling that of a wire flesh-brush; scales distinct; with from one to four slender curved spines measuring 1·7 mm. in length arising from a bulbous eminence.

Colour.—In spirits uniform greenish-yellow, fins yellow without markings.

It is with some reluctance that I name a *Monacanthus*, especially as many of our species are ill-described. On the whole it seems to be wiser to adopt this course, to supply an adequate description and reliable figure. If more species were figured we should have less synonomy, for, as Dr. P. P. Carpenter said, with the best desire for accuracy and the greatest care, it is hardly possible for an author to so describe that his readers shall see specimens as he sees them.

Monacanthus setosus is most nearly allied to *M. trachylepis*, Günth.,* with which I at first identified it. From this species it differs by having a deeper body, more obtuse snout and larger eye, by the more backward position of the dorsal spine and anterior situation of the gill slit and pectoral fin. The posterior half of the body narrows more obtusely to the caudal pedicel, which is markedly lower, shorter and without spines. In colour it may be distinguished by the absence of blue spots at the base of the fins characteristic of *M. trachylepis*.

It is also allied to *M. rudis*, Rich.,† and *M. convexirostris*, Günth.,‡ but it differs from these species more than it does from *M. trachylepis*.

The single specimen from which the description and figure is made, was obtained off Wollongong in 63-75 fathoms, and is therefore probably an inhabitant of deep water.

MONACANTHUS MOSAICUS, *Ramsay & Ogilby.*

(Plate xvii., fig. 1.)

Monacanthus mosaicus, Rams. & Ogil., Proc. Linn. Soc. N.S.W., xi., 1886, p. 5.

Station 39.

A single example of this rare species was taken by the trawl in 50 fathoms off Wata Mooli, south of Port Jackson. The species was originally described from two specimens measuring four and two-thirds and four inches respectively, obtained off Shark Reef within Port Jackson, in January, 1886. In December of the same year a third was taken in the Parramatta River, which is still smaller. The fourth known example we now chronicle, shows that the species is by no means a small one ; it measures 255 mm. or ten inches in length. The following is a description of the specimen :—

D. 36. A. 34. P. 13. C. 12.

Length of head 3·33, height of body 1·6, length of caudal 3·6, in the total. The eye is one-fourth the length of the head and equal to the interorbital space ; it lies midway between the end

* Günther—Cat. Fish. Brit. Mus., viii., 1870, p. 248.

† Richardson—Voy. Ereb. & Terr., Fish., 1846, p. 65, pl. xl., figs. 7-8.

‡ Günther—*loc. cit.*

of the snout and the dorsal rays, and nearer to the profile by one-half its diameter; the gill opening is oblique, equal to and separated from the eye by a diameter; it is situated beneath the eye, and slightly in advance of the root of the pectoral. Nostrils in a naked groove in front of and near to the eye.

Teeth.—Two pairs in the lower jaw, each produced into an angular point at its inner margin; three projections are thus formed, one median and two lateral. Three pairs in the upper jaw, of which the two inner pairs are pointed; behind this pair, and between which its point appears, is another tooth on each side with a spine-like apex; five projections are thus formed, the inner one, as in the lower jaw, furnished by two teeth.

Upper profile of snout slightly concave, rather tumid in front of the spine, whence it is flat, but rises considerably to the rays. The anterior rays mark the highest point, thence it descends in a gentle curve to the caudal pedicel. The lower profile is a perfect arc described from the margin, one-fourth of the distance of the dorsal rays from the spine, which arises in the anterior third of the eye; it is 1·6 in the length of the head, not very strong, and slightly curved backwards; it is triangular in section, the anterior ridge furnished with two series of small blunt spines set close together; at each posterio-lateral edge is a single series of spines. Soft dorsal and anal low, the rays regularly increasing to the sixth, which with the few following rays is the longest; the anal arises slightly behind the dorsal and terminates nearer the caudal. Ventral spine immovable, very small, with a few points directed before and behind, situated about an eye-diameter from the end of the ventral bone, which is not extensible. Pectoral fin small, one-fifth longer than the eye, placed beneath the orbit. Caudal large and rounded, no shorter external rays, its pedicel compressed, its height one-third the length of the head without spines or bristles.

Skin — Rubbed from head to tail the skin feels quite smooth, and in the reverse direction very slightly rough; under a half-inch objective it is seen to be crowded with simple spines, which measure 0·2 mm. in length.

Colour yellowish, with wavy blue lines for the most part horizontally disposed, anastomising at intervals, and forming hexagonal figures, many of which enclose a brown blotch; fins uniform yellow.

A reference to the type specimens shows that the colour pattern of the young is to a large extent lost in adult examples. I have therefore drawn one of the types of the natural size.

Family OSTRACIIDÆ.

ARACANA, *Gray.*

ARACANA LENTICULARIS, *Richardson.*

BOX FISH.

(Plates xvii. (fig. 2) and xviii.)

Ostracion lenticularis, Rich., Proc. Zool. Soc., ix., 1841, p. 21, and Trans. Zool. Soc., iii., 1849, p. 158.

Stations 1, 2, 4, 8, 9, 10, 11, 12, 18, 21, 22, 23, 24, 26, 27, 32, 33, 50, 52, 54, 59.

The specimens from which Richardson made his description were but half-grown, and as the species undergoes some change during its lifetime further notes may be made.

D. 10. P. 12. A. 10. C. 11.

Adult.—Length of head 3·66, height of body 1·8, length of caudal 5·5 in the total. The eye, set close to the upper profile, 3·3, and the interorbital space, which is flat, 2·0 in the length of the head; the gill opening is very slightly oblique and lies just behind the posterior margin of the eye, the diameter of which its length exceeds by one-fifth: its upper edge is removed from the orbit slightly less than its own length. Nostrils on a prominent papilla in a depression in front of the eye, the anterior much the larger, oval and crenate within, the posterior a small slit.

Teeth long, incisor-like, five pairs in the upper and four pairs in the lower jaw.

Upper profile of snout extremely tumid and acute, the anterior portion nearly vertical. Attaining its most prominent part it slopes backwards and widens rapidly above; at its widest part the dorsal keel commences and rises to form a prominent rounded hump placed in front of the centre of the body; the profile then falls to the end of the carapace, in advance of the dorsal fin, whence it is slightly concave to the caudal. The lower profile forms an even arc described from the summit of the dorsal hump and broken only by the caudal pedicel. The dorsal and anal fins are similar, the second, or longest, ray being slightly more than half the length of the head; the dorsal is the anterior fin. The pectoral is two thirds the length of the head. The caudal is

broadly fan-shaped with the angles rounded, the lower rays longer than the upper.

Carapace much compressed, forming a ridge above and below and two scarcely perceptible ridges, one from behind the eye and the other beneath the pectoral. The carapace terminates in advance of the dorsal fin and passes obliquely backwards on each side by a sinuous line towards the posterior part of the anal; skirting the base of that fin, it passes forward and again unites with its fellow in advance of the anal. The carapace is composed of hexagonal scutes fused together, most apparent on the sides and around and beneath the mouth. From the upper and lower angles of the mouth are two naked lines which unite and form an unprotected area in front of the gill opening and pectoral fin, thus permitting some movement; the lips also are free and fleshy. The whole of the space from before the dorsal and anal to the caudal is naked, with the exception of four bony plates; a large one immediately behind the dorsal fin, widely separated from a similar but smaller plate behind the anal. A third on the upper part of the caudal pedicel in front of the rays which extends to but is not fused with another plate on the lower part; a few isolated patches of armature also occur on the pedicel. All the scutes closely granular, the grains larger than the spaces between them.

Colour.—Uniform greenish-brown.

Young.—Profile of snout straight, interorbital space concave, caused by enlarged supraocular borders, dorsal profile regularly rounded without hump. The dorsal and anal keels are much more compressed than in the adult and all the features of the carapace more pronounced: the lateral ridges are continued, the upper from above the eye to the dorsal fin, and the lower from the angle of the mouth beneath the pectoral to the anal. These ridges are armed with prominent flattened spines arranged as below. One above the posterior angle of the orbit, one a little further behind, another beneath the highest point of the dorsal ridge and a very small one nearer the dorsal fin; there are three or four spines along the lower ridge, of which the first is below the pectoral and the last in advance of the anal. The largest spine of the body occurs on the side midway between the two ridges in the centre of the carapace. The naked groove from the mouth to the gill opening is apparent only as a non-fusion of the scutes and the space around the pectoral, and the mouth is very restricted. The hexagonal plates are most apparent and have large granules forming radiating ridges, the grains widely spaced.

Colour.—Lilac with metallic yellow blotches arranged without reference to the scutes, which are boldly outlined in black. Naked skin slaty-grey. Fins brown, the caudal darker with a lighter margin.

Family TETRAODONTIDÆ.

LAGOCEPHALUS, *Swainson.*

LAGOCEPHALUS LUNARIS, *Bloch & Schneider.*

Tetrodon lunaris, Bloch & Schn., Syst. Ichth., 1801, p. 505. Temm. & Schleg., Fauna Japon., Pisces, 1850, p. 277, pl. cxxii., fig. 1.

Stations 23, 26.

On two occasions we trawled this species off Newcastle in 16 to 32 fathoms, thus adding it to the fauna of New South Wales. Previously it had not been identified southward of Moreton Bay in Queensland.

The two examples are rather small, measuring 210 mm. and 195 mm. respectively. They are to be identified with *T. spadiceus* of Bleeker, characterised by the interorbital space and fore part of the back being covered with spines, and the length of the head less than its distance from the dorsal fin. Castlenau, identifying an example in the Queensland Museum taken in Moreton Bay, remarks* :—"the length of the head is more considerable than is said in Dr. Günther's description; this fish certainly belongs to Richardson's *spadiceus* from the Chinese and Indian Seas, and may be different to the typical *lunaris*."

AMBLYRHYNCHOTUS, *Bibron.*

AMBLYRHYNCHOTUS OBLONGUS, *Bloch.*

Tetrodon oblongus, Bloch., Ausl. Fisch., 1787, p. 4, pl. cxlvi., fig. 1.
Tetraodon oblongus, Bleek, Atlas Ichth., Gymnod, v., 1865, p. 62, pl. iv., fig. 4.

Stations 23, 51.

Examples were taken on the sandy flats of the Newcastle and Shoalhaven Bights in 15-19 fathoms. The species had been previously recognised in Australian waters only from King George's Sound, and is therefore for the first time recorded for the east coast.

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* Castelnau—Proc. Linn. Soc. N.S.W., iii., 1879, p. 401.

Family DIODONTIDÆ.

DICOTYLICHTHYS, *Kaup.*

DICOTYLICHTHYS PUNCTULATUS, *Kaup.*

PORCUPINE FISH.

(Plate xix.)

Dicotylichthys punctulatus, Kaup., Arch. für Nat., 1855, p. 230.

Station 23.

This is a very common form on our coast, and is frequently included in hauls made by the fishermen on the beaches; it is also often thrown up dead. When the flesh has rotted out the tough dry skin holds the spines firmly, and the light object is trundled about by the wind and buried in the sand hills. The largest specimen I have seen measured seventeen inches in length. One living example only was obtained by the "Thetis"; it was taken in Newcastle Bight in 16-19 fathoms.

CHILOMYCTERUS, *Bibron.*

CHILOMYCTERUS JACULIFERUS, *Cuvier.*

JAVELIN FISH.

Diodon jaculiferus, Cuv., Mém. Mus. Hist. Nat., iv., 1818, p. 130, pl. 7.
Chilomycterus jaculifera, Günth., Cat. Fish. Brit. Mus., viii., 1870, p. 313.

Station 17.

Günther has identified this species from New Zealand, and Castelnau* from Victoria (Hobson's Bay). The single specimen here recorded was taken off Broughton Island, north of Port Stephens, in 29-48 fathoms, and measures 230 mm. (= 9 inches) in length. The peculiarity of the species, emphasised in the name, is the presence of long javelin-like spines. Of two examples in the British Museum, Günther writes:—"One is distinguished by the extraordinary length of certain spines (supraorbital, dorsal, post dorsal, and post pectoral), as noticed by Cuvier. In the other example these spines are but slightly enlarged, and, in fact,

* Castelnau—Proc. Zool. Soc. Vict., i., 1872, p. 211.

all the spines are rather feeble." I do not find that Cuvier noticed long spines either above the orbit or on the back; he wrote of those behind the pectoral and on the flanks. In the "Thetis" specimen the only spines which are strikingly enlarged are a pair behind the root of each pectoral and another on the caudal pedicel. So subequal are the dorsal spines that no particular one can be selected as that referred to. While all other spines are immovable, the post pectoral is capable of some degree of erection; when adpressed the pectoral fails to conceal the point of the spine, but it does not in any way approach the development illustrated by Cuvier. All other spines are very short, and nowhere does the tip of one reach to the base of that behind it, so that no overlapping occurs.

Castelnau's specimen was imperfect, and he described the anal fin as being much smaller than the dorsal: this is incorrect, and the complete radial formula is as follows:—

D. 16. A. 15. P. 20. C. 8.

Colour dark brown above, each spine on the body set in an ill-defined black blotch; underneath parts white without spots; from the dark dorsal portion and passing into the white beneath are three black vertical bars, one in front and another behind the pectoral, and a third below the origin of the dorsal. No darker mark below the eye.

Cuvier's figure, although indicating the peculiarities of the species, is somewhat crude; yet as our example is perhaps scarcely typical, I hesitate to illustrate it.

Family SCORPÆNIDÆ.

SCORPÆNA (*Artedi*), *Linnæus*.

SCORPÆNA CRUENTA (*Solander*), *Richardson*.

RED ROCK-COD.

Scorpæna cruenta, Rich., Ann. Mag. Nat. Hist., (1), ix., 1842, p. 217.

Scorpæna militaris, Rich., Voy. Ereb. & Terr., Fish., 1846, p. 22, pl. xiv., figs. 1, 2.

Station 55.

The only occasion on which this fish was netted, the trawl encountered rock, and brought up two large basalt boulders, from which a wealth of invertebrate life was taken. Wherever lines were put over on the various Schnapper-grounds, the species was taken, its capacious mouth receiving the largest bait.

SEBASTAPISTES (*Gill MS.*), *Streets.*

SEBASTAPISTES PERCOIDES (*Solander*), *Richardson.*

RED GURNARD PERCH.

Sebastes percoides, Rich., Voy. Ereb. & Terr., Fish., 1846, p. 23, pl. xv., figs. 1, 2.

Stations 7, 13, 25, 42, 44, 48, 56.

This species is rather uncommon in our markets, and those obtained at the above named stations were for the most part half-grown specimens. Most of the areas on which they were taken were sandy; this would indicate that the species is not so wedded to rocky situations as has been imagined. It was only gleaned in deep water, the least depth being 41 and the greatest 80 fathoms. Although lines were put down on many of the recognised Schnapper-reefs, it was never hooked.

SEBASTES, *Cuvier & Valenciennes.*

SEBASTES THETIDIS, sp. nov.

THETIS FISH.

(Plate xx.)

Stations 7, 42, 48, 49.

B. vii. D. xii. 1/9. A. iii. 5. V. i. 5. P. 13·7. C. 14. L. lat. 38. L. tr. 5·32.

Length of head 2·18, height of body 2·45 in the total length (caudal excluded).

Diameter of eye 3·33, length of snout 3·8, and interorbital space, deeply concave, 4·4 in the length of the head.

Nostrils separated, in a naked area, the anterior surrounded by a low fleshy rim with a tentacle behind; posterior nostril simple. Upper jaw in front, concave, a tubercle at the symphysis of the lower jaw. Cleft of mouth wide and rather oblique, the maxilla reaching to below the posterior fourth of the orbit. The internasal space is concave and is surmounted on each side, near the anterior nostril, by a simple spine. At the antero-superio angle of the eye is a spine which may be simple, bifurcate or trifurcate; further back towards the posterior angle, are three or four irregular spines, all, however, arising from a common base. On the occiput, mid

way between the last named spines and the dorsal, is a pair of flattened spines, converging anteriorly. On the posterior rim of the eye is another trifurcated spine succeeded on the temporal by a jagged flattened series, and in the same line another immediately at the origin of the lateral line. Two opercular spines, the upper simple, on the superior edge; the lower longer and provided half way between its point and the eye by a supplemental spine, connected by a prominent ridge which may also be spinous. A row of jagged spines runs from the preorbital horizontally to a point in advance of, and above the upper preopercular spine, and gives off two downwardly directed spines over the centre of the maxilla.

Preopercle armed with four spines, the upper the largest and reinforced like the lower opercular; the next two are rather jagged, while the lower is simple and obtuse. A large flattened spine on the clavicle, above the origin of the pectoral. Lateral line unarmed, excepting quite anteriorly, where feeble spines are developed.

Teeth cardiform in the jaws, in a triangular band on the vomer, and in bands on the palatines curved anteriorly.

The dorsal commences above the inner angle of the opercle; the fourth spine is the longest, twice the diameter of the eye and much longer than the longest ray; the twelfth spine is two-thirds the length of the thirteenth, which is equal to the first. The base of the spinous portion is more than three times that of the soft, which is not attached to the tail.

The anal commences beneath the twelfth dorsal spine; the second spine is the longest, 1·7 in the fourth and equal to the ninth dorsal spine, or one-third in the length of the head; the third anal is not much shorter than the second. The rays are equal to those of the dorsal.

The ventral does not reach the vent, its length being 1·57 in that of the head; the spine is very strong and equal to the second dorsal; it originates quite close to the lower pectoral ray.

The pectoral is a trifle longer than the ventral and reaches to the vent; the six or seven lower rays are simple. The caudal is gently rounded, the least height of its pedicel being 3·4 in that of the body.

The lateral line at its highest point is concealed by the opercular flap.

Scales.—Entire head, including the snout and maxilla, covered with ciliated scales, each with a central depression, and the margin conspicuously raised so as to give the head a very scabrous appearance. The mandible is scaleless and the inferior margin has four equidistant pairs of large muciferous pores. The scales on the body are larger, deeper and less raised, those on the throat and at the base of the pectoral, much smaller.

Colours.—General colour (in spirits) yellowish-brown, the lower parts reddish-yellow, mandibular, isthmus and branchiostegals pink. The markings are in the form of black blotches, which, judging from our specimens, are very constant in position and extent. Along the dorsal profile are three spots, the first below the 5-7 and the second at the base of the 8-10 spines; the third spot is smaller and situated beneath the 2-4 rays. The opercle is bordered behind by a large blotch which reaches to below the eighth spine; this is succeeded by two spots, of which the anterior is the lower. Another extensive blotch occurs beneath the dorsal rays: all these show bright blue reflections. On the head the dark markings are to be found between the eyes on the occiput, the temporal bone and behind the eye. Fins yellowish, the pectoral with a smoke-coloured blotch near its margin, and the dorsal membrane dark at its edge.

Four examples were obtained, of which the largest measures 305 mm. (= 12 inches) in total length.

The species was taken in comparatively deep water, namely, from 55 to 78 fathoms, off the coast between Port Jackson and Port Kembla.

The genus *Sebastes* has been considerably subdivided, principally as affecting American species. I have, however, so far, been unable to identify *S. thetidis* with any of the genera characterised, and therefore, for the present, merely leave the species in *Sebastes*, as originally understood.

NEOSEBASTES, *Guichenot.*

NEOSEBASTES ROBUSTUS, *Günther.*

Bullrout.

Centropogon robustus, Günth., Cat. Fish. Brit. Mus., ii., 1860, p. 128.

Centropogon trochelii, Steind., Sitz. K. Akad. Wiss. Wien., liii., 1866, p. 440, pl. iv., fig. 1.

Station 51.

The fact of our having trawled this species in Shoalhaven Bight extends the known distribution in a southerly direction; its range, therefore, as far as is known, is from this station to the Mary River, Queensland, where it was obtained by the "Chal-

lenger" expedition. The Bullrout is what may be termed a fluvio-marine species, ranging from the sea through brackish waters to the rivers above tidal influence. Respecting the painful wound caused by the dorsal and preorbital spines of this species the author of the "Edible Fishes of New South Wales" (p. 68) writes :—"No doubt any such wound would cause pain, but the state of the sufferer's health, his nervousness, and his belief in the superstition of its poisonous qualities are all factors which must be taken into consideration. Personally the writer has been 'stung' on many occasions, both by the allied Fortescue *(Centropogon australis)* and by the British Weaver *(Trachinus vipera)* and never felt any more inconvenience than would result from a similar stab of a knife. The fact is the wound is merely a deeply punctured and viciously inflicted one, without any venomous properties whatever."

I also, on more than one occasion, have been stung by both the Australian and British species mentioned, and, without being either nervous or superstitious, my experience is that such wounds are painful in the extreme. Further, I cannot agree with this writer as to the absence of venomous properties. Although the spines are not perforated they are deeply grooved, and the grooves are charged with a fluid-mucous possessing poisonous properties, the truth of which is sufficiently apparent to the majority of persons who have the misfortune to be stung.

The largest example I have met with measures 265 mm. in length.

NEOSEBASTES AUSTRALIS, *White.*

FORTESCUE.

(Plate xxi.)

Cottus australis, White, Voy. to New South Wales, 1790, p. 266.
Centropogon australis, Günth., Cat. Fish. Brit. Mus., ii., 1860, p. 128.

Station 23.

Two examples were obtained in Newcastle Bight at the somewhat unusual depth of 16-19 fathoms, the species being better known in shallow water cruising around the piles of piers and jetties, where it is much dreaded by the wharf-fishers for the painful wounds it inflicts with the dorsal and, more especially, the preorbital spines.

Family COTTIDÆ.

PLATYCEPHALUS, *Bloch & Schneider.*

PLATYCEPHALUS FUSCUS, *Cuvier & Valenciennes.*

FLATHEAD.

Platycephalus fuscus, Cuv. & Val., Hist. Nat. Poiss., iv., 1829, p. 241. Quoy. & Gaim., Voy. de l'Astrolabe, Poiss., 1835, p. 68, pl. x., fig. 1.

Stations 1, 2, 4, 5, 7, 8, 9, 10, 11, 12, 13, 20, 21, 22, 23, 24, 25, 26, 27, 28, 32, 33, 34, 35, 37, 38, 39, 41, 42, 43, 44, 46, 48, 49, 50, 51, 52, 54, 55, 56, 58, 59.

The array of stations at which this species was obtained indicates how common it is on our seaboard. It is plentiful in our rivers a long way above tidal influence; it occurs on all the mud banks and sand flats along the coast, and is found at considerable depths also. We trawled it in 78, 80 and 84 fathoms. As the trawling took place during the known spawning season of this fish, it was not surprising to find many of the examples heavy with ova, while not a few small fry were trawled, indicating that breeding had already taken place. The largest example I have seen measured 920 mm. ($=36\frac{1}{4}$ inches) in length.

PLATYCEPHALUS BASSENSIS, *Cuvier & Valenciennes.*

BASS FLATHEAD.

Platycephalus bassensis, Cuv. & Val., Hist. Nat. Poiss., iv., 1829, p. 247. Quoy. & Gaim., Voy. de l'Astrolabe, Poiss., 1835, p. 683, pl. x., fig. 3.

Stations 8, 9, 13, 39, 44.

It was only at the above mentioned stations that I definitely recognised this species, but it is more than probable that some were overlooked. When the quarter-deck of the vessel was simply one mass of fish, it was quite impossible for me to personally examine every specimen of *Platycephalus* or *Lepidotrigla* which were sometimes piled on the deck by thousands. *P. bassensis*, although not so common as *P. fuscus*, is yet very plentiful in the Sydney Fish Market.

Family TRIGLIDÆ.

LEPIDOTRIGLA, *Günther.*

Three species of the genus were obtained, one of which proves to be new. I regret that I am unable to supply the stations exactly for each species. It was quite impossible for me, working as I was, unaided, to pass under hand every specimen obtained. I can, therefore, only give a general list of the stations whence members of the genus were taken, together with one or two exact references where notes were made.

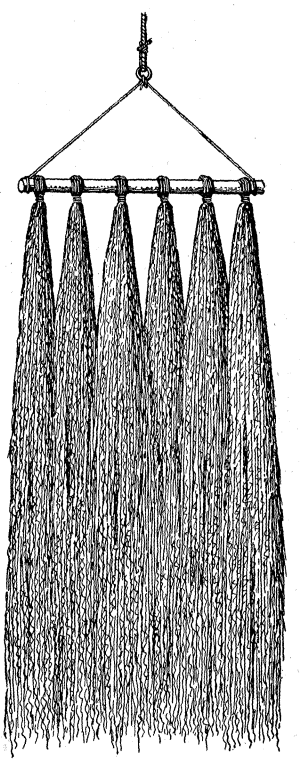

Fig. 7.

As the net neared the surface large numbers of dead Gurnards rose to the top and floated belly upwards, with their pectoral fins extended; they were taken at almost every haul, sometimes in extremely large numbers, forming an immense heap on the deck. They were also taken in the tangles (fig. 7), their spiny armaments rendering them particularly liable to be so caught.

The list of stations is as follows:—

Stations 1, 2, 4, 5, 7, 8, 9, 10, 11, 12, 13, 22, 24, 25, 26, 27, 28, 32, 34, 35, 37, 38, 39, 40, 41, 43, 44, 46, 47, 48, 49, 51, 52, 56, 57, 58, 59.

LEPIDOTRIGLA MULHALLI, *Macleay.*

(Plate xxii.)

Lepidotrigla mulhalli, Macl., Proc. Linn. Soc. N.S.W., viii., 1884, p. 460.

Stations 13, 46; also see note above.

Macleay described this species as being abundant in 40 fathoms of water outside Port Jackson Heads. We found it to extend

all along the coast within the area worked and common at the greatest depths tested. The original description being rather short, a more detailed account is now furnished and a figure supplied.

B. vii. D. ix. 14. A. 14. P. 11. 3. V. i. 5. L. lat. 60. L. tr. 3/16.

Length of head 3·26, height of body 4·28 in total length (caudal excluded). Diameter of eye 2·87, length of snout 2·3 in the length of the head, interorbital space, which is slightly concave, three-fourths the diameter of the eye. The whole profile of the head is markedly convex, that of the nasal region approaching the perpendicular. Two spines at the antero-superio angle of the orbit, a long protuberance at the posterior angle. Preorbital greatly produced, bearing two or three very strong spines and a number of smaller ones. Angle of preoperculum jagged, without distinct spines. Opercle with two obtuse spines. Clavicular spine very strong, finely toothed on its basal half, supra-scapula spine moderately strong. The maxilla reaches the anterior third of the eye. The first two dorsal spines are weakly serrated in front, the third is the longest, 1·6 in the length of the head. The anal commences and terminates evenly with the soft dorsal, to which it is therefore equal in extent. The pectoral, which is longer than the head by one-seventh, reaches the sixth anal ray. The ventral equals the head in length and extends to the fourth ray. Caudal emarginate. The armoured area surrounding the dorsal fin is composed of twenty-two scales, all are strongly spined; a constriction takes place in front of the rayed portion, the following paired spines being separated by only half the distance between those of the anterior spinous portion.

Scales smooth, the spines of the lateral line are weak and consist of a median series only.

Colours.—Brilliant red throughout when alive, dirty brown in spirits; pectoral black within.

Total length 197 mm.

LEPIDOTRIGLA MODESTA, sp. nov.

(Plate xxiii.)

Stations 17, 46; also see note above.

This new species appears to be associated with *L. mulhalli*, but may be less common. It would seem to be more plentiful to the northward, and I did not definitely recognise it south of Botany

Bay (Station 46), while off Broughton Island (Station 17) it was plentiful in 66 fathoms.

B. vii. D. ix. 16. A. 16. P. 9·3. V. i. 5. L. lat. 60.
L. tr. 4/12.

Length of head 3·35, height of body 4·4 in total length (caudal excluded). Diameter of eye, which equals the length of the snout, 2·87 in that of the head Interorbital space extremely concave, V-shaped, three-fourths the diameter of the eye; superciliary ridges very large. Nasal profile very steep and slightly concave. Two spines at the antero-superio angle of the orbit, which is laterally concave, culminating in a bony protuberance on the upper posterior angle; preorbital produced and emarginate, bearing anteriorly several strong spines. Preoperculum with two or three small points. Two opercular spines, the lower the larger. Apart from the fins the largest spine occurs on the clavicle; the ridge of the spine is strongly serrated almost to its apex. The serrations of the supra-scapula lead up to a single spine. A groove between the ocular and occipital regions. The maxilla only just reaches as far as the margin of the orbit. The two first dorsal spines are serrated anteriorly; the second is the longest, 1·6 in the length of the head. The anal commences beneath the second dorsal ray and extends rather further back than the dorsal. The pectorals and ventrals both reach the first anal; they are of equal length, exactly that of the head. Caudal slightly emarginate. The armoured area surrounding the dorsal is composed of twenty-four scales, the anterior three or four rugose, the remainder strongly spined. The median spines of the lateral line are not very strong and do not project beyond the free margin; in parts this spine is doubled, the additional point being directed upwards.

Colours.—Bright red when first obtained. In spirits a uniform yellowish-brown. Pectoral dark within; all other fins immaculate; no trace of a spot on the dorsal.

All the scales with the exception of those bordering the dorsal and those of the lateral line have been lost: the pits have therefore been counted for the transverse series above given. Total length 188 mm.

LEPIDOTRIGLA PLEURACANTHICA, *Richardson.*

Trigla pleuracanthica, Rich., Voy. Ereb. & Terr., Fish., 1846, p. 23, pl. xvi., figs. 1-4.
Lepidotrigla pleuracanthica, Rams. & Ogil., Proc. Linn. Soc. N.S.W., x., 1886, p. 578.

Station 52; also see note above.

The only specimen recognised was trawled in 20 fathoms off Shoalhaven Bight. Although a scarce species on our coast, it is

more than probable that examples were elsewhere overlooked for reasons given in the above note. I have since taken another specimen in Jervis Bay.

CHELIDONICHTHYS, *Kaup.*

CHELIDONICHTHYS KUMU, *Lesson & Garnot.*

RED GURNARD.

Trigla kumu, Less. & Garn., Voy. Coquille, Poiss., 1826, pl. xix.
Chelidonichthys kumu, Jord. & Everm., Report U.S. Com. Fish. for 1895 (1896), p. 488, footnote.

Stations 1, 2, 5, 10, 11, 12, 13, 17, 21, 26, 31, 33, 38, 39, 40, 41, 46, 47, 52, 54, 58, 59.

A glance at the above figures might give one the idea that the species is plentiful on the coast; this, however, would be scarcely correct, for although taken on twenty-two occasions, not more than five or six were averaged at each take, while some of the stations are represented each by a single individual.

Several examples of three or four inches in length obtained would indicate that the spawning season is about November or December, as deduced by Ogilby.* The largest example I measured was 580 mm. ($22\frac{3}{4}$ inches) in length.

PTERYGOTRIGLA, gen. nom. nov.

This name is proposed in lieu of *Hoplonotus* for *Trigla polyommata*, Rich. In 1866 Guichenot made this species the type of a new genus, using the name *Hoplonotus:* this name is untenable, having been, in 1851, applied by Blanchard to a genus of Coleoptera.

PTERYGOTRIGLA POLYOMMATA, *Richardson.*

"FLYING" GURNARD.

Trigla polyommata, Rich., Proc. Zool. Soc., 1839, p. 96, and Trans. Zool. Soc., iii., 1849, p. 87, pl. v., fig. 2.
Hoplonotus polyommatus, Guich., Ann. Soc. Linn, Maine-et-Loire, Ichth., ix., 1866 (*fide* Zool. Rec. 1866, p. 146.)

Stations 1, 11, 38, 40, 41, 43, 46, 56, 57.

This species was taken less commonly than the last, but all the specimens were of large size, smaller ones being almost unknown

* Ogilby—Edible Fishes, N.S.W., 1893, p. 110.

so far north. The Port Stephens district is regarded as its most northern range; and in confirmation of this it is to be noticed that it was never obtained north of Tuggerah Lakes, and only twice north of Port Jackson.

Family TRACHINIDÆ.

SILLAGO, *Cuvier.*

SILLAGO MACULATA, *Quoy & Gaimard.*

TRUMPETER WHITING.

Sillago maculata, Quoy & Gaim., Voy. Freycinet, Zool., 1824, p. 261, pl. liii., fig. 2.

Stations 1, 2, 4, 8, 9, 13, 17, 20, 21, 22, 23, 24, 25, 26, 27, 33, 38, 39, 43, 50, 51, 52, 58.

Great confusion has existed in the determination of our two common species of *Sillago*, namely, *S. maculata* and *S. ciliata*, and it has been stated that, except in the matter of spawning, they do not differ materially in habit. Such a statement is by no means borne out by our experience.

S. maculata was trawled on no less than twenty-three occasions throughout almost the whole area traversed, namely, from the Shoalhaven to the Manning River, and at all depths ranging from 16 to 84 fathoms. *S. ciliata* was never once taken. My experience indicates that, of the two, it is only this latter species that is caught by hook and line off the ocean beaches or bays, while, as seems probable, the former is more partial to deep water, and would probably be the fish taken by the trawl. *S. ciliata* is said to spawn along the sand banks of the bays and rivers, otherwise in shallow water. Many examples of *S. maculata* were taken heavy in spawn, while some had apparently just shed their ova.

Family PERCOPHIDÆ.

PARAPERCIS, *Gill.*

PARAPERCIS OCULARIS, sp.nov.

(Plate xxiv.)

Stations 4, 5, 6, 13, 21, 42, 43, 46, 47, 56.

B. vi. D. v. 21. A. 18. V. i. 5. P. 19. L. lat. 62. L. tr. 4·17.

Length of head 3·8, of caudal fin 4·8, height of body 4·7, in the total length. Eye very large, 2·6 in the length of the head,

rather more than the length of the snout, and thrice the interorbital space. The greatest width of the head is greater than the length of the eye and snout together. Snout rather acute. Cleft of mouth slightly oblique; lower jaw a little the longer; the maxillary reaches to just within the anterior margin of the eye. The hind limb of the preoperculum is tuberculate rather than serrated. One flat opercular spine.

Teeth.—A broad band of villiform teeth in each jaw, the outer row the larger; four pairs of canines at the symphysis of both jaws, and similar teeth on the lateral edges; a large patch of teeth on the vomer; palatines toothless. Dorsal spines subequal, one-third the length of the head, the first two originating close together. Rays long, 1·6 in the same. The pectoral is contained 1·2 in the length of the head, and is longer than the ventral, which latter reaches the anal. The anal is lower than the soft dorsal. Caudal truncate, its pedicel one-third the length of the head.

Scales ciliate, rather large, rather adherent, those of the lateral line anteriorly with the tubule ascending.

Colours.—Warm brown above, each scale with a lighter centre; white beneath, with an ill-defined yellowish band separating the areas; head greyer and darker than the body; seven large dark brown blotches at the base of the dorsal, extending below the lateral line anteriorly; a dark band at the base of the caudal rays, forming a blotch at the upper and lower margins; tail crossed by five vertical yellow bands; no blotch in the spinous dorsal; its margin, as also that of the rays, ornamented with white spots; rest of fins yellow.

Total length 190 mm.

The species of this genus have been so ill-described that one naturally hesitates to bestow additional names. On the other hand, without reference to the actual type, it is absolutely impossible to decide how far any description may be applied to an individual.

As far as may be judged, therefore, the present form is undescribed, and I consider the wiser course is to publish the foregoing description and accompanying figure for the consideration of those who may be in a position to solve the problems involved.

The most striking features of the species are the very large size of the eye and the small width of the interorbital space. These characters, together with the subequal length of the dorsal spines, render it a very striking and peculiar species. As I have examined all other specimens available to me, some observations made thereon may be fittingly published.

When Ogilby described *Percis novæ-cambriæ*,* he considered that this was the species upon which *P. nebulosus*, Q. & G., had been assigned to the Australian fauna, and in his catalogue† he wrote under *P. novæ-cambriæ*: —"This species has been confounded by Australian naturalists with the *Percis nebulosus* of Quoy and Gaimard, from which, however, it is very distinct."

It is to be remarked, however, that the identification of Australian specimens rested with Quoy and Gaimard, and I now propose to support their action. In the Museum Collection is a specimen labelled *P. nebulosus*. This is certainly not *P. novæ-cambriæ*, and agrees so well with the description of the first named species that I have thereto assigned it. From this specimen the type of *P. coxi*‡ does not differ. It is a faded example of *P. nebulosus*, and was obtained in Port Jackson.

The following species are now to be regarded as belonging to the fauna of New South Wales:—

Parapercis nebulosus, Quoy & Gaim. (? *P. maculata*, Bl. Schn.).

P. allporti, Günth. (Twofold Bay).

P. novæ-cambriæ, Ogil.

P. ocularis, Waite.

Parapercis ocularis is apparently a denisen of deeper water. It was very sparingly taken about 30 fathoms, but abundantly so in the deepest areas tried, namely, 80 to 84 fathoms. The large size of the eye is in accord with the ascertained vertical range.

CENTROPERCIS, *Ogilby.*

CENTROPERCIS NUDIVITTIS, *Ogilby.*

(Plate xi., fig. 2.)

Centropercis nudivittis, Ogil., Proc. Linn. Soc. N.S.W., (2), 1895, x., p. 320.

Station 46.

The example obtained is but the second known and was taken eight miles south of Maroubra Bay, where the type was collected. It is much larger than the type, measuring 103 mm. in length, and advantage is taken to slightly amend the original description.

The number of tubular scales on the lateral line is twenty-seven, and not eighteen merely, as stated; the naked bands along

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* Ogilby—Proc. Linn. Soc. N.S.W., (2), x., 1896, p. 228.

† Ogilby—Cat. Fishes, N.S.W., 1886, p. 30.

‡ Ramsay—Proc. Linn. Soc. N.S.W., viii., 1883, p. 179.

the abdominal surface are alternate to those above, and from the throat to the vent is a broad silvery space in which the ventrals are inserted.

The type specimen was washed ashore at Maroubra Bay in a perfect though dying condition. Our example was taken in the trawl from a depth of 50-66 fathoms, when mud and abattoir refuse was brought to the surface.

Family URANOSCOPIDÆ.

ICHTHYSCOPUS, *Swainson.*

ICHTHYSCOPUS INERMIS, *Cuvier & Valenciennes.*

STARGAZER.

Uranoscopus inermis, Cuv. & Val., Hist. Nat. Poiss., iii., 1829, p. 310, pl. lxv. Temm. & Schleg., Fauna Japon., Pisces, 1850, p. 27, pl. x. A.

Ichthyscopus inermis, Day, Fishes of India, 1878, p. 261, pl. lv., fig. 5.

Stations 8, 10, 23, 26, 28, 33, 49.

Although without doubt of this species the specimens differ from those previously described in minor particulars, all the supports of the dorsal fin, with the exception of the first two, are articulated as determined by means of a hand lens; the first four are simple, the remainder divided.

White round or oval spots on the body and fins are entirely absent, the ornamentation taking the form of three broad bands, one on the soft part of the preopercle, the second behind the operculum embracing the four anterior dorsal rays and the whole of the pectoral, and the third below the 12-17 dorsal rays; none of these bands reach the ventral surface. The example below referred to as from Newcastle exhibits these bands very distinctly, but it is noteworthy that the white markings are also present.

It is now first recorded from Australian waters, but an example was obtained by Mr. Whitelegge at Newcastle some years ago, off which port we secured the greater number; once only, and then a single specimen, was it taken south of Port Jackson (Station 49), but it is rather remarkable that it was there trawled at the depth of 63-75 fathoms. At none of the other stations was a greater depth than 28 fathoms recorded. A large example, measuring 25 inches in length, contained a *Sillago ciliata*, 14 inches long: the capture of such a lively fish indicates how admirably the sluggish *Ichthyscopus* must assimilate its surroundings.

KATHETOSTOMA, *Günther.*

KATHETOSTOMA LÆVE, *Bloch. & Schneider.*

STONE LIFTER.

Uranoscopus lævis, Bloch. & Schn., Syst. Ichth., 1801, p. 47, pl. viii. Cuv. & Val., Nat. Hist. Poiss., iii., 1829, p. 319.

Stations 9, 13, 42, 43.

Although occasionally taken in Port Jackson, whence I have seen two or three examples, this species does not appear to have been previously recorded from the colony. Günther* gives Port Arthur (Tasmania) as a definite locality, while Castelnau† describes it as being rather common on the Melbourne Market.

It was not obtained far, either north or south of Port Jackson, but was taken at the unexpected depth of 78 fathoms, the minimum being 28. All the examples were small, none being more than 6 inches in length.

The fact of the trawl having freely secured fishes of such burrowing habits as the *Uranoscopidæ* indicates how closely it must have swept the ocean floor.

Family BLENNIIDÆ.

CRISTICEPS, *Cuvier & Valenciennes.*

CRISTICEPS ARGYROPLEURA, *Kner.*

(Plate xi., fig. 3.)

Cristiceps argyropleura, Kner, Reise Novara, Fische, 1869, p. 199, tab. vii., fig. 4.

Station 46.

The single example obtained is assigned to this species, but the Australian members of the genus much require revision. As our specimen does not wholly agree with Kner's account, the following description is furnished:—

B. vi. D. iii./34. A. 24. V. 3. P. 11. C. 11. L. lat 49.

The height of the body, the first dorsal spine, the pectoral and the caudal each equal the length of the head, which is 4·4 in that of the body, caudal excluded. The diameter of the eye is contained five times in the length of the head; the snout is a third less than the diameter of the eye, and is equalled by the inter-

* Günther—Cat. Fishes Brit. Mus., ii., 1860, p. 231.

† Castelnau—Proc. Zool. Soc. Vict., i., 1872, p. 91.

orbital space; a simple tentacle over the eye and a digitate one on the snout. The first dorsal, which arises over the orbit, is attached to the second at the base; the second dorsal commences low, little more than a third the height of the first spine, but increasing in height; the thirtieth ray is twice that of the first.

The anal is much lower than the dorsal, longer posteriorly, and terminates at the origin of the caudal pedicel; the dorsal, on the other hand, being attached thereto by a membrane, which however does not reach the caudal rays. The pectoral attains to the fourth anal ray. The ventral just fails to reach the vent; its rays are free for one-third their length. The caudal pedicel is long and slender, its least height equal to the length of the snout; the fin is lanceolate in shape. The lateral line arises in advance of the opercular flap, over which it forms an obtuse angle; the first thirty-three pores are crowded together, thence it suddenly drops to the mid line of the body, where the pores are separated, widely so, as the caudal is approached. The fish is scaleless, and the muscle bands are very pronounced.

Preserved in formaline the colour is uniform pale orange; the vertical fins are clouded, with the exception of their lengthened posterior margins, which are clear.

Total length 80 mm.

The specimen was secured between Cape Hawke and Charlotte Head in 10-12 fathoms.

The type of *C. argyropleura* was sent from Sydney. It measures but two inches in length, or less than two-thirds the length of ours. The figure quoted represents our example tolerably, but the caudal rays are represented (if one may so say) of subequal length. It has therefore been thought advisable to figure the larger example.

Family GNATHANACANTHIDÆ.

HISTIOPTERUS, *Temminck & Schlegel.*

HISTIOPTERUS ELEVATUS, *Ramsay & Ogilby.*

(Plate xxvi.)

Histiopterus elevatus, Rams. & Ogil., Proc. Linn. Soc. N.S.W., (2), iii., 1888, p. 1311.

Stations 5, 7, 15, 22, 34, 38, 42, 44, 47, 48, 56, 57.

This species was established on a single and imperfect specimen, and was afterwards considered by one of the authors (Ogilby)*

* Ogilby—Edible Fishes, N.S.W., 1886, p. 31.

to be identical with *H. typus*, Schlegel, from Japan. Originally, the authors wrote:—"But for the difference in the number of the dorsal spines and some other minor variations, I should have been inclined to consider this to be the species described in the 'Fauna Japonica' as *H. acutirostris*."

A reference to the descriptions of Schlegel's species shows that *H. elevatus* is quite distinct, and further suggests that *H. acutirostris* is merely a young form of *H. typus*.

From an examination of the good series of *H. elevatus* obtained by the expedition, I am able to supplement and amend the original description as below:—

B. vi. D. v. i. 26-28. A. iii. 14. V. I. 5. P. 14. C. 17.
L. lat. 66-68. L. tr. 14-43.

Length of head 2·54, height of body 1·6 in the length (caudal excluded). Diameter of the eye 3, length of the snout 2, and the interorbital space 4, in the length of the head.

The snout above is markedly concave, the occiput less so, and bounded above by a very prominent bony boss. The interorbital area is convex, marked by a deep median groove. Above the bony boss the profile rises by a gentle convex curve to the third or fourth dorsal ray, which marks the highest point of the body, thence it suddenly descends to the caudal pedicel. The lower profile from the snout to the first anal ray is almost straight, thence, corresponding to the dorsal, it abruptly gains the caudal pedicel.

Lower jaw the longer; cleft of mouth slightly oblique; the maxilla extends nearly to below the anterior nostril, the width of its distal extremity less than five in the diameter of the eye. The serrations of the preopercle and post temporal are weak, less so at the angle of the former.

Teeth.—Both jaws are furnished with small conical teeth, set in a very broad band in front, much narrower at the sides. Vomer, palatines and tongue edentulous.

In the original description the dorsal fin formula is rendered as vii. 24, but a recount of the spines of the type, and a comparison with perfect examples, shows that this is an error, the first ray having been mistaken for and counted as a spine, although noticed as a slender one.

The first dorsal spine is very small, and the rest regularly increase to the sixth, which is the longest, slightly shorter than the head, being 1·1 therein. The relative length of the spines is 1, 4, 7, 11, 17. The first two rays are produced, nearly equal, as long as the head and body, or two and a half times

the length of the longest spine; regular but rapid diminution takes place, so that the seventh ray is no longer than the last spine; the last ray equals the second spine in length. The first anal spine is small, equal to the second dorsal; the second is the longest, and by far the strongest, intermediate in length between the fourth and fifth dorsal, and 2·2 in the length of the head.

The soft anal is similar to the hinder part of the dorsal; none of the rays are elongate, and the first is about two-thirds the length of the head.

The ventral spine is somewhat shorter, but much stronger than the last dorsal; the three anterior rays are nearly as long as the head and reach the origin of the anal rays, and the pectoral, which is of similar length, attains the same point. The caudal lobes are equal, the tail is slightly emarginate, and the height of the pedicel is 2·6 in the length of the head. The thickest part of the fish is immediately behind the orbit; this does not exceed 2·5 in the length of the head.

Scales cycloid, of moderate size; scales on the cheeks, and on a small patch above and another behind the eye; also a somewhat larger one on the upper part of the opercle; other portions of the head sculptured, chiefly in lines radiating from a centre. The lateral line rises abruptly from the opercle, and when beneath the fifth or sixth dorsal spines assumes the curvature of the profile to beneath the last ray, whence it passes horizontally to the base of the caudal rays.

Colour.—The general colour is silvery-grey, with three indistinct vertical bands, the first including the frontal boss, the second embracing the centre of the body, and the third passing obliquely from the posterior dorsal rays, crossing the base of the caudal peduncle, and terminating behind the anal. None of the spines are coloured; a black blotch occurs between the twelfth and eighteenth dorsal rays, and the membranes of the ventrals are black.

HISTIOPTERUS FARNELLI, *Waite.*

(Plate xxvii.)

Histiopterus farnelli, Waite, "Thetis" Prelim. Report, 1898, p. 33, pl. iv.

Station 50.

B. vi. D. vii. 17. A. ii. 10. V. i. 5. P. 17. C. 17.
L. lat. 135.

Length of head 2·85, height of body 2 in the length (caudal excluded). Diameter of eye 3·85, length of snout 2·25, and inter-orbital space 3 in the length of the head.

Fifteen gill-rakers on the lower part of the first arch, all small, the anterior ones nearly obsolete. The snout and occiput are concave, the interorbital space flat, with a shallow groove. The cleft of the mouth is nearly horizontal, the maxilla extends to between the nostrils, which are wholly nearer the eye than the end of the snout. Lower jaw the longer. The preopercle is produced backwards at the angle and moderately serrated.

Teeth conical, in a broad patch at the front of each jaw, those on the sides in a narrow band, tuberculate; the anterior teeth rather large, deflected outwards; palate, vomer and tongue edentulous. The symphysis of the lower jaw very acute.

The snout is concave, thence the profile rises abruptly to the dorsal spines and reaches its highest point at the base of the second and third, whence by a low curve it reaches the caudal. The lower profile forms a moderately convex curve.

The first dorsal spine arises above the margin of the preopercle and is rather small, the second is four-fifths and the third twice the diameter of the eye; the next four spines are lengthened: the fourth spine is the longest, one and a half times the length of the head, the fifth somewhat shorter, and the sixth and seventh still more so. The rays take up the decreasing length in regular sequence, the last being equal to the second spine.

The anal commences beneath the eighth dorsal ray, and of the two spines the first is smaller than the first dorsal and the second rather longer than the third. The rays are a little longer than the posterior portion of the soft dorsal and the fin terminates slightly in advance of the dorsal.

The ventral is long, reaching to the second anal ray, and somewhat longer than the head, to which the spine is equal: the pectoral is short and does not reach the anal: the caudal is slightly emarginate.

Scales.—The scales are very small, ctenoid and adherent. Cheeks and two small patches behind the upper part of the eye scaly, the remaining portions of the head naked and sculptured. The lateral line rises from the opercle to a point below the fifth dorsal spine, whence at some distance from the dorsal it takes a rather wavy course to the caudal pedicel, where it becomes horizontal and terminates in advance of the caudal rays.

Colour.—Grey with black markings; the head and the elevation above dark; from the third dorsal spine a black band arises and is directed obliquely backwards and downwards, bifurcating a broader portion reaches the space between the ventral and the anal, while a smaller limb passes indistinctly to the hinder part of the anal. Another band originates below the

fifth and sixth dorsal spines and passes backwards to the upper surface of the caudal pedicel, broadening in its course and enclosing an elongate patch of the ground colour. The whole of the scales bordering the dorsal from the origin of this band are also black. At the base of the caudal rays is an indistinct band and the caudal is tipped with black. All the remaining fins are black except the pectoral, which is of a dirty grey tint.

Total length, caudal included, 200 mm.

This species is nearest allied to *H. labiosus*, Günther,* but while the radial formula agrees with that species, the general proportions of the fins and the relative dimensions of the head and body are very different. *H. labiosus* is much more elongate, has a shorter head and longer snout, a very much smaller eye, and the spinous dorsal lower, not one-fourth the relative height of *H. farnelli*; this latter species also has longer ventrals and a larger number of scales along the lateral line. A comparison of the accompanying figure with that rendered by Günther and Ogilby† shows how greatly the two species differ.

The single example obtained was taken in Shoalhaven Bight, in the comparatively shallow water of 15-18 fathoms. I associated with this interesting species the name of Mr. Frank Farnell, M.L.A., by whose kind offices we were enabled to secure the fine collection to be dealt with.

Family GADIDÆ.

LOTELLA, *Kaup.*

LOTELLA CALLARIAS, *Günther.*

BEARDIE.

Lotella callarias, Günth., Ann. Mag. Nat. Hist., (3), xi., 1863, p. 116. McCoy, Prod. Zool. Vict., Dec. ii., 1878, pl. xix.

Station 24.

Not previously recorded north of Broken Bay, our single example extends its published range to Newcastle, whence it was trawled in 21-48 fathoms. In the northern hemisphere the *Gadidæ* include very many fishes of the highest marketable character, the capture and preservation of which provide food and employment for thousands. It is most deplorable that the few representatives found in southern waters are not only of small size but are accounted of slight value as food.

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* Günther—Proc. Zool. Soc., 1871, p. 658, pl. lix.

† Ogilby—Edible Fishes, N.S.W., 1893, p. 29, pl. vii.

PSEUDOPHYCIS, *Günther.*

PSEUDOPHYCIS BACCHUS, *Forster.*

AUSTRALIAN COD.

Gadus bacchus, Forst., Descr. Anim., Ed. Licht., 1844, p. 120.
Lota breviuscula, Rich., Voy. Ereb. & Terr., Fish., 1846, p. 61, pl. xxxviii., fig. 1.

Stations 24, 25.

This species was twice obtained, both hauls being contiguous to and off Newcastle, the most northern range yet recorded. It was obtained in 21-48 fathoms. An allied species (*P. barbatus*, Günth.) is, according to McCoy, commonly caught with a line all the colder months of the year in Port Philip Bay on rocky reefs in five or six fathoms of water.

Family PLEURONECTIDÆ.

PARALICHTHYS, *Girard.*

Three species of this genus were obtained, namely, *P. arsius*, *P. novæ cambriæ* and *P. tenuirastrum*. Of the first named nothing need here be said; it is an easily recognised species and the records may be taken as accurate. While on board I recognised one other species only, namely, *P. multimaculatus*, obtained at the following Stations:—

1, 4, 5, 6, 9, 10, 11, 12, 22, 23, 24, 26, 27, 28, 31, 39, 41, 43, 44, 46, 47, 48, 50, 51, 52, 54, 56, 57, 58.

Quite recently (December, 1898) Ogilby has pointed out that our commonly regarded *P. multimaculatus* is a distinct species for which he proposes the name *P. novæ cambriæ*. An examination of the "Thetis" *Paralichthys* shows that apart from *P. arsius* the bulk of the specimens taken belong either to *P. novæ cambriæ* or to an undescribed species which I herein name *P. tenuirastrum*. My difficulty is therefore this: I am unable to state, with exceptions, by which of the two species below named each of the above quoted stations is represented. Observations, however, indicate that while *P. novæ cambriæ* is a shallow water form frequenting the sandbanks and mudbanks close in-shore and at the mouths of the rivers, *P. tenuirastrum* is found only in deep water, say from 20 fathoms downwards.

PARALICHTHYS ARSIUS, *Buchanan-Hamilton.*

LARGE-TOOTHED FLOUNDER.

(Fig. 8).

Pleuronectes arsius, Ham.-Buch., Fish Ganges, 1822, p. 128.
Pseudorhombus russellii, Bleek., Atlas Ichth. Pleuron, vi., 1866-72, p. 6, pl. ccxxxiii., fig. 2.

Stations 1, 6, 9, 11, 12, 21, 22, 23, 25, 26, 27, 32, 41, 42, 43, 44, 46, 47, 49, 50, 51, 54, 55, 57, 58.

Described as being essentially a tropical species, the Large-toothed Flounder did not appear to be a whit less common in Shoalhaven than in the Manning Bight (Station 27), and, therefore, probably extends along the whole length of the seaboard of the Colony. Station 54, our most southerly haul, was within Jervis Bay. This flounder was taken most freely in the shallower water, and the greater depth—up to 80 fathoms—yielded but one or two examples.

It is immediately separable from the two following species by the dentition, the canines being of such size as to have earned for the species the popular name here given. There are six gill-rakers on the posterior and thirteen on the lower border of the first arch; their tips are broad and slightly recurved, with the upper border beset with six or more spinules irregularly arranged (fig. 8).

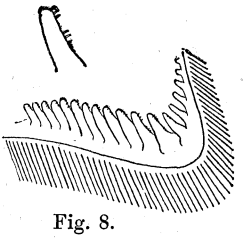

Fig. 8.

A scale taken from behind the curvature of the lateral line has at its free edge about thirty strong marginal teeth and about six rows of smaller teeth at the base of the marginal series.

PARALICHTHYS NOVÆ-CAMBRIÆ, *Ogilby.*

(Fig. 9).

Paralichthys novæ-cambriæ, Ogil. Proc. Linn. Soc. N.S.W., 1898, xxiii., p. 296.
Pseudorhombus multimaculatus (non Günther), Ogil. Edible Fishes, N.S.W., 1893, p. 157, pl. xxxviii.

Stations 1, 9, 10, 22, 23, 24, 26, 27, 31, 39, 50, 51, 52, 54, 58.

Hitherto this flounder has been recorded on our coast only between Cape Hawke and Botany Bay. The former point was within twenty miles of the northern limit of our operations, so

that we cannot extend its known range further than the Manning River in that direction. Southward, however, it was taken more freely, being especially plentiful in the Shoalhaven Bight and obtained at our most southerly Station (54), namely, within Jervis Bay. As before intimated, the list of stations is incomplete and uncertain. The specimens examined revealed the fact that they were in spawn, about half developed, so that approximately the breeding season may be fixed about June. This species was taken more abundantly than *P. arsius*, and was secured more commonly in shallow water.

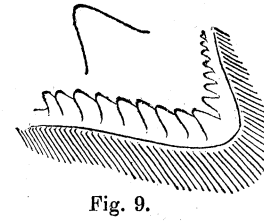

Fig. 9.

The gill-rakers are stout, broad at the base and widely set; seven on the posterior and nine on the lower limb of the first arch; they are almost smooth (fig. 9).

A scale taken from behind the curve of the lateral line has a single row of teeth which is marginal.

PARALICHTHYS TENUIRASTRUM, sp. nov.

(Plate xxviii. and fig. 10.)

Stations 19, 26, 39.

D. 75. A. 60. V. 6. P. 12. C. 15. L. lat. 91.

Length of head 4·3, height of body 2·2 in the total length, (caudal excluded). Upper eye very slightly in advance of the lower, its diameter 5 in the length of the head; interorbital space a narrow bony ridge. Anterior sinistral nostril with a cutaneous margin produced into a tentacle behind; posterior nostril simple; the dextral nostrils are respectively similar but rather smaller. Jaws equal: cleft of mouth oblique, not very large; the maxilla extends to beneath the centre of the orbit, its length 2·6 in that of the head.

Teeth in a single series in each jaw, those of the upper symphysis scarcely enlarged; twenty-seven in each side of the upper and twenty-two in the lower jaw.

The dorsal fin commences over the anterior margin of the upper eye: the longest rays are 2·3 in the length of the head; all the tips of the rays are free. Ventral fins equal, reaching to the second anal ray; the second of the sinistral and the third of the dextral fin the longest, their length 3·1 in that of the head. The pectoral does not extend beyond the curve of the lateral line,

its length 1·6 in that of the head; the height of the pedicel is 4 in that of the body.

Scales of the upper side subctenoid, almost imbedded, the spinous margin alone exposed. A scale taken from behind the curve of the lateral line is seen to be longer than broad, its posterior margin evenly rounded, its anterior edge truncate; eight small spines occupy the median third of the breadth near the free edge, but they are not marginal. The scales of the lower side are cycloid, subcircular; head scaly with the exception of the snout, preorbital and interorbital space; maxilla scaly in part; small scales on the rays of the dorsal, anal, ventral and caudal fins. Lateral line arched above the pectoral and continued to the base of the caudal rays. On the head the line skirts the posterior margin of the orbit and passes to beneath the lower eye; a branch passes forwards from the opercle towards the dorsal surface. Gill-rakers, five on the posterior and twelve on the lower limb of the first arch; they are closely set, short, not a fourth the diameter of the eye, delicate, narrow and tapering, furnished on their posterior or upper border with nine or less spinules (fig. 10).

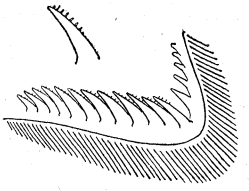

Fig. 10.

Colours.—Greyish-brown above with round black markings having light centres; many are more or less encircled with bright yellow dots. These markings are disposed, four or five along the lateral line, six within the dorsal margin, accurately paired with similar marks within the anal margin; between the lateral line and these marginal spots, both above and below, is another series of three or four pairs; two or three faint marks occur over the curvature of the lateral line, and a pair are to be found on the caudal pedicel. All the fins are marked with darker wavy lines; the dorsal and anal have a series (the former nine and the latter seven) of dark spots midway between the base and margin of the fin and a marginal alternate series of small and fainter marks. At the base of the caudal rays are two dark blotches, the upper of which is the more pronounced.

Total length 265 mm.

As ascertained by the examples preserved, the range of the species is at present known to be from Port Hacking in the south to Port Stephens in the north. It was obtained in 20 fathoms, but it is probable that it finds a home at much greater depths, having been more freely taken in 52 fathoms.

After finding the species was distinct from *P. novæ-cambriæ*, I concluded that we had the true *P. multimaculatus*, but this is

not so; it differs from Günther's species by having the body much more elongate, the maxillary shorter, and the teeth different in character and number. The scales also are much smaller, 91 as against 78 on the lateral line. It is most nearly allied to *P. novæ-cambriæ*, but differs therefrom by its more lengthened shape, the greater number of dorsal and anal rays, the shorter maxilla, not extending beyond the centre of the eye, with its posterior border oblique (almost vertical in *P. novæ-cambriæ*). A very striking difference is presented by the gill rakers, and the foregoing descriptions of isolated scales may also be compared.

The figure of *P. mülleri*, Klunz.,* appears to have been reversed or drawn from a dextral example. In this the lower eye is the anterior one; the number of teeth in the lower jaw is but seven or eight, while the gill-rakers, although short and spiny, are broadened at the free end and truncated, thus differing greatly from those of *P. tenuirastrum*.

AMMOTRETIS, *Günther.*

AMMOTRETIS ROSTRATUS, *Günther.*

LONG-SNOUTED FLOUNDER.

Ammotretis rostratus, Günth., Cat. Fish. Brit. Mus., iv., 1862, p. 458.
Ammotretis adspersus, Kner, Reise Novara, Fische, 1869, p. 286, taf. xiii., fig. 4.

Station 50.

The only example obtained was trawled in Shoalhaven Bight in 15-18 fathoms. The radial formula which it exhibits is:—

D. 80. A. 53. P. 10. V. dex. 7, sin. 4. C. 14. L. lat. 90.

The dextral ventral rays in the type are rendered as six, and, mainly on account of an example possessing seven rays, as in ours, Kner guardedly proposed that if it was not *A. rostratus* it might be called *A. adspersus*. In its shorter body our example agrees with *A. zonatus*, Macl.,† afterwards renamed *A. macleayi* by Ogilby,‡ but later§ sunk as a synonym of *A. adspersus*.

235 mm. is the length of the specimen.

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* Klunzinger—Sitz. K. Akad. Wissen. Wien., 1879, lxxx., pl. ix., fig. 2.
† Macleay—Proc. Linn. Soc. N.S.W., vii., 1883, p. 367.
‡ Ogilby—Proc. Linn. Soc. N.S.W., x., 1886, p. 121.
§ Ogilby—Cat. Fishes, N.S.W., 1886, p. 48.

LOPHONECTES, *Günther.*

LOPHONECTES GALLUS, *Günther.*

CRESTED FLOUNDER.

Lophonectes gallus, Günth., Chall. Report, Zool., i., 1880, p. 29, pl. xv., fig. B.

Stations 1, 2, 4, 7, 9, 11, 13, 28, 33, 35, 37, 38, 41, 42, 43, 44, 46, 47, 48, 49, 50, 54, 55, 56, 57, 58.

It is a matter for regret that this species, the commonest flat fish secured, does not attain larger dimensions. The largest taken did not exceed 7½ inches, while few were more than 6 inches.

Immense quantities of fry, under 2 inches in length, were retained in the trawl whenever mud was brought up, indicating the breeding season to be during the height of summer. Whether these fry frequent the mud only, or whether they are also found in sand and sifted out of the trawl with it, it is not possible to say.

This fish was taken all along the coast from Jervis Bay to the Manning River, and at all the depths tested from 10 to 84 fathoms.

Ogilby has pointed out in the following words that the figure quoted is defective*:—"In Dr. Günther's figure the fish is coloured on the wrong side, the short first dorsal ray is omitted, and there is a separation between the elongate and short rays of that fin, which is purely imaginary."

Family SOLEIDÆ.

ASERAGGODES, *Kaup.*

ASERAGGODES MACLEAYANA, *Ramsay.*

NARROW-BANDED SOLE.

(Plate xxix.)

Solea macleayana, Rams., Proc. Linn. Soc. N.S.W., v., 1881, p. 462. Ogil., Edible Fishes, N.S.W., 1893, p. 159.
Solea fluviatilis, Rams., Proc. Linn. Soc. N.S.W., vii., 1883, p. 111.

Stations 23, 24, 32, 51.

Two interesting and important observations have been made with regard to this species, namely, its distribution and season of spawning.

* Ogilby—Cat. Fishes, N.S.W., 1886, p. 48.

Previously it was known only from a very small portion of our coast line, ranging from Port Hacking in the south to Lake Macquarie in the north. At Station 51 we secured it very freely off the Shoalhaven River in 15 fathoms, while its northern range was extended to Cape Hawke, off which point (Station 32) it was trawled in 10-12 fathoms. As against the plentiful supply obtained it may be argued that it was only taken on four occasions; it will be well, therefore, to point out that this species is most probably an inhabitant of shallow water, and that most of our stations indicate a greater depth than suits it. Station 23 was in 16-19 fathoms; and although 21-48 fathoms was sounded at Station 24 it is quite possible that this fish was taken when the trawl was first lowered, and before it descended to greater depths. It may be further pointed out that it was obtained most abundantly in the shallowest water wherein we trawled, and has indeed been taken in fresh water. Mr. J. D. Ogilby exhibited before the Linnean Society* an example caught in fresh water fifty-eight miles above the mouth of the Richmond River, and Dr. E. P. Ramsay had previously recorded the same species under the name *Solea fluviatilis* from fresh water in the Hunter River.

As far as I am aware, the breeding habits of this species were previously unknown. All the specimens of sufficient size were full of almost ripe ova, and as the extreme dates are the 2nd and 19th March, the end of that month may be approximately determined as the spawning season. Eleven inches is recorded as the maximum size obtained, but eight or nine is about the average. On evidence it is mature at a much smaller size, for a large number of our specimens measuring only six inches in length were in full spawn. As to its edible properties, all on board the "Thetis," where it was freely partaken of, pronounced it to be of admirable flavour.

SYNAPTURA, *Cantor.*

SYNAPTURA NIGRA, *Macleay.*

Black Sole.

(Plate xxx.)

Synaptura nigra, Macl., Proc. Linn. Soc. N.S.W., v., 1881, p. 49.
Ogil., Edible Fishes, N.S.W., 1893, p. 160, pl. xxxix. (outline).

Stations 23, 50.

Of this species Ogilby writes:—"The Sole appears to be a purely estuary fish, never, so far as we can ascertain, having been

* Ogilby—Proc. Linn. Soc. N.S.W., xxi., 1896, p 817.

recorded from the open sea." This statement now no longer applies, for we took two examples, one off Newcastle, and the other in Shoalhaven Bight. After all, one may naturally expect to find this fish inshore, as it occurs in all the estuaries of the New South Wales coast. Had we trawled in shallower water more specimens might have been taken, those secured having been obtained in 15-19 fathoms.

On the other hand, these isolated specimens are the exception which prove the rule, for a net put down in the upper reaches of the harbour, say the Parramatta River, entraps this Sole in large numbers. It is most freely taken in the slimy grey mud, now such a characteristic feature of the bed of the river, and with which its peculiar colour harmonises so well.

SYNAPTURA FASCIATA, *Macleay.*

MANY-BANDED SOLE.

(Plate xxxi.)

Synaptura fasciata, Macl., Proc. Linn. Soc. N.S.W., vii., 1883, p. 14.

Station 10.

D. 75. A. 67. V. 4. P. 6. C. 17. L. lat. (see below).

Length of head 6·6, height of body 2·54 in the total length (caudal excluded). Upper eye very slightly in advance of the lower, its diameter 5·1 in the length of the head. Interorbital space flat, less than the diameter of the eye, being contained 1·5 therein. Nostrils situated in cutaneous flaps, the anterior appendage of the right side is large, longer than the interorbital space, and situated midway between the lower eye and the snout; posterior flap small, immediately in advance of the eye. Nasal tentacles of the blind side relatively similar, but smaller.

Lower jaw the shorter. Cleft of mouth narrow, twisted to the blind side, in each ramus of which is a patch of villiform teeth. Lower margin of head and opercular flap, especially of the left side, with short simple papillæ. The dorsal fin commences over the front margin of the eye, but is preceded by a few papillæ. Two ventrals, similarly developed, separate from the anal, which commences beneath the gill cover. Pectorals very small, each with six rays; on the right side the fin is easily overlooked, that of the left is larger, about four-fifths the diameter of the eye. Caudal moderate, its central rays produced. Entire head, body and fin rays scaly.

Scales of both sides similar, more than twice as long as broad, much expanded at the base, and narrowed suddenly at the free end, which is furnished with from seven to nine slender marginal spines.

Lateral line equally and similarly developed on both sides; it is quite straight from the head to the extremity of the caudal rays; on the head it is strongly arched, and being continued forward it attains the dorsal profile above the eye. The number of pores along the straight line to the base of the caudal is one hundred and two. There are nineteen pores along the curve of the head, and eighteen on the caudal ray.

Colours.—On the upper side dark brown, with twenty transverse brown bars (extending on to the fins), of which five occupy the head; there are two bars on the caudal rays, of which the posterior one is sub-marginal; free portion of all the fins, a narrow edge of membrane, and the whole under side, pale yellow.

Total length of specimen 210 mm.

The single example obtained, and from which the above description is made, was trawled off the coast between Cape Three Points and Tuggerah Lakes, in 28 fathoms.

In his description of this species Macleay states that pectoral fins are absent. I am inclined to think that he overlooked them and perhaps examined only the coloured side where the fin is most inconspicuous, and especially so in an example scarcely more than half the length of ours. Instead, therefore, of belonging to Bleeker's *Achiroides*, it should be assigned to *Anisochirus*, characterised by the left pectoral being longer than the right.

Family ANTENNARIIDÆ.

ANTENNARIUS, *Lacépède.*

ANTENNARIUS NUMMIFER, *Cuvier.*

Chironectes nummifer, Cuv., Mém. Mus. Hist. Nat., iii., 1817, p. 430, pl. xvii., fig. 4.
Antennarius nummifer, Bleek., Atlas Ichth., v., 1865, p. 18, pl. cxcviii.

Station 48.

This species, which has a wide distribution from Africa and India to the South Seas, has been recorded by Macleay from Port Jackson. The only example secured by the "Thetis" expedition was trawled off Wollongong in 55 fathoms.

BRACHIONICHTHYS, *Bleeker.*

BRACHIONICHTHYS HIRSUTUS, *Lacépède.*

Lophius hirsutus, Lacép., Ann. Mus. Hist. Nat., iv., 1804, p. 202, pl. lv., fig. 3.
Chironectes punctatus, Cuv., Mém. Mus. Hist. Nat., iii., 1817, p. 434, pl. xviii., fig. 2.

Station 57.

The only example obtained is very young, less than 15 mm. in length. It was taken from 54-59 fathoms off Wata Mooli.

In his diagnosis and description, Günther * gives as a generic character, "Three dorsal spines, the two posterior of which are connected by a membrane with each other and *with the soft dorsal.*" In our example the spines are unconnected with the soft portion and so agree with Cuvier's figure and with Günther's condensed description of the species: "The anterior dorsal spine is free, terminating in a small lobe; the two others are joined into one fin, *separate from* the soft dorsal."

Our specimen is rather small for specific identification, but on account of the character above mentioned, together with the roughened skin, it should be assigned to *B. hirsutus* and not to *B. lœvis*, Lacép., in which the dorsal spines and rays are connected and the skin nearly smooth. Opinion is divided as to the position of *B. politus*, Rich.

The species here chronicled was taken at Twofold Bay in 150 fathoms by the "Challenger"; ours is thus the second example known from the coast of New South Wales, where it appears to be a deep water form and apparently breeding with us. It was first described from Tasmania, which seems to be the head quarters of the genus.

* Günther—Cat. Fish. Brit. Mus., iii., 1861, pp. 178 and 182.

ADDENDUM TO INTRODUCTION.

ADDENDUM TO INTRODUCTION.

Since the foregoing was in type another fishing experiment has been made here, and I am able to supplement the introductory account, and bring the résumé of operations to the end of the century.

The first intimation I had of this latest venture was the following newspaper paragraph :—

"FISHING BY ELECTRIC LIGHT.—The Fisheries Commissioners are desirous of proving whether fish can be captured by electric light, and have constructed a wire netting trap, which is connected by an electric light apparatus, with a view of undertaking a series of experiments in deep-sea waters for the capture of fish. They have also written to the Colonial Secretary asking whether the 'Thetis' can be lent for the purpose of trying the apparatus, and in their letter they point out that this mode of capture has been very successful at Monte Carlo and that if the experiment proves successful it will form an important factor in connection with the fish supply of the metropolis. The Minister for Works, to whom the request has been referred by the Colonial Secretary, has approved of the 'Thetis' being lent for the purpose of the experiment, and she will be placed at the disposal of the Commissioners for two or three days during next week." *

The Fisheries Commissioners having kindly invited me to witness the experiment, I once more joined the "Thetis," which late on the 24th November, 1899, left the harbour and anchored for the night in Botany Bay. Next day we proceeded southward and stood off Jervis Bay, where the first trial was made. The apparatus, suspended from a boom, was seen to consist of a circular fish-trap eleven or twelve feet in diameter, provided with six entrances. Its central portion was occupied by a square box, the sides of which were formed of silvered glass. An incandescent electric lamp hung in front of each mirror, and before being lowered fish-bait was placed within the trap.

The apparatus was let down in daylight off the John Young Banks into twenty-six fathoms, but five minutes after the dynamo was started the lights went out. The water pressure at the depth attained had apparently been under-estimated, for on hauling the trap it was found that the connections had been damaged and that some of the globes contained water.

We then ran for Jervis Bay for repairs, and here the night was spent. Unfortunately the sea had risen, so that next day (Novem-

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* *Daily Telegraph*, 15th November, 1899.

ber 26th) it was not deemed wise to trust the trap overboard outside the Bay. Having a small Otter Trawl aboard, this was dragged for a short time in the Bay, but the only fishes netted were *Trygonoptera testacea* and *Lepidotrigla pleuracanthica*. A seine net hauled from the shore produced Sand Whiting (*Sillago ciliata*), White Trevally (*Caranx georgianus*), Black Bream (*Chrysophrys australis*), and Mullet (*Mugil dobula*).

I put a tow-net overboard and secured some pelagic organisms.

Shoals of Mackerel (*Scomber pneumatophorus*) were swimming around the "Thetis" as she lay at anchor, and numbers were caught by line in company with Yellow-tails (*Trachurus declivis*). After breakfast we steamed outside and hand-fished the ground between Jervis Bay and Wreck Bay. The following fishes were obtained :—

Gummy (*Galeus antarcticus*).
Fiddler (*Trygonorhina fasciata*).
Sergeant Baker (*Aulopus purpurissatus*).
Nannygai (*Beryx affinis*).
Schnapper (*Sparosomus auratus*).
Sweep (*Cæsiosoma æquipinnis*).
Teraglin (*Atractoscion atelodus*).
Morwong (*Dactylosparus carponemus*).
Maori (*Opthalmolepus lineata*).
Pig Fish (*Lepidaplois oxycephalus*).
Leather Jacket (*Monacanthus ayraudi*).
Red Rock Cod (*Scorpæna cruenta*).
Common Flathead (*Platycephalus fuscus*).
Bass Flathead (*Platycephalus bassensis*).
Flying Gurnard (*Pterygotrigla polyommata*).
Short-finned Pike (*Sphyræna novæ-hollandiæ*).

Returning at dusk to Jervis Bay, the electric fish-trap was later put over in nine fathoms and the lights kept going brilliantly for an hour and a quarter. The area for fully a hundred yards around was well illuminated and Garfishes (*Hemirhamphus intermedius*) could be seen swimming in and out through the wire meshes. When the trap was hauled out of the water it was empty.

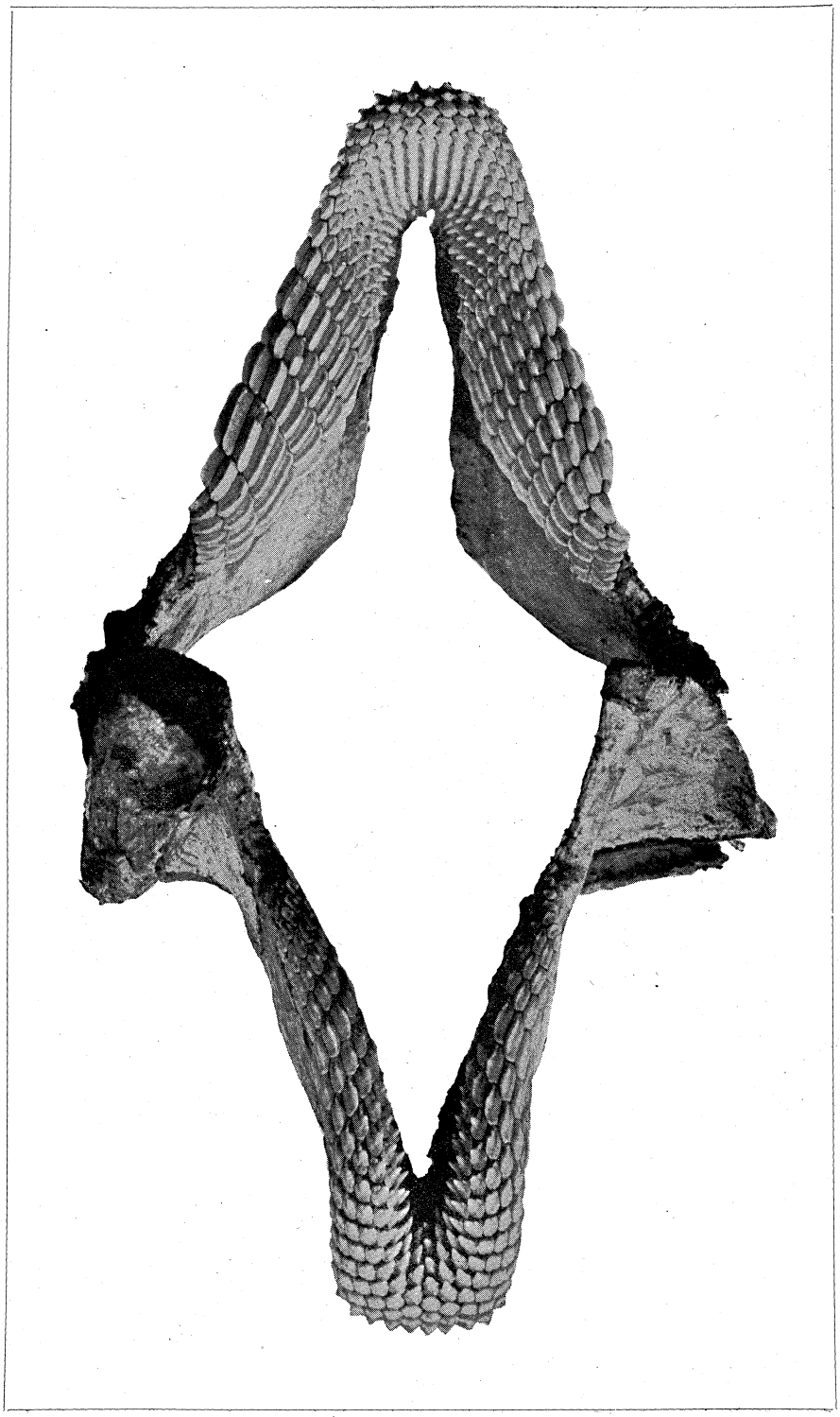
It is most likely that the illumination was altogether too brilliant, so that instead of attracting the fish it scared them away. In future experiments it might be well to copy natural illuminants of the water and provide a number of faintly glowing lamps rather than few of excessive brilliancy.

I lowered an incandescent lamp in a tow-net and obtained a number of small Invertebrates, thus reproducing the experiments conducted at the Liverpool Biological Station.

EXPLANATION OF PLATE I.

Gyropleurodus galeatus, Günther.

Jaws natural size (from a photograph).



EXPLANATION OF PLATE II.

Catulus analis, Ogilby.

Fig. 1.—Female, one-third natural size.

Parascyllium collare, Ramsay & Ogilby.

Fig. 2.—Male, three-fourths natural size.

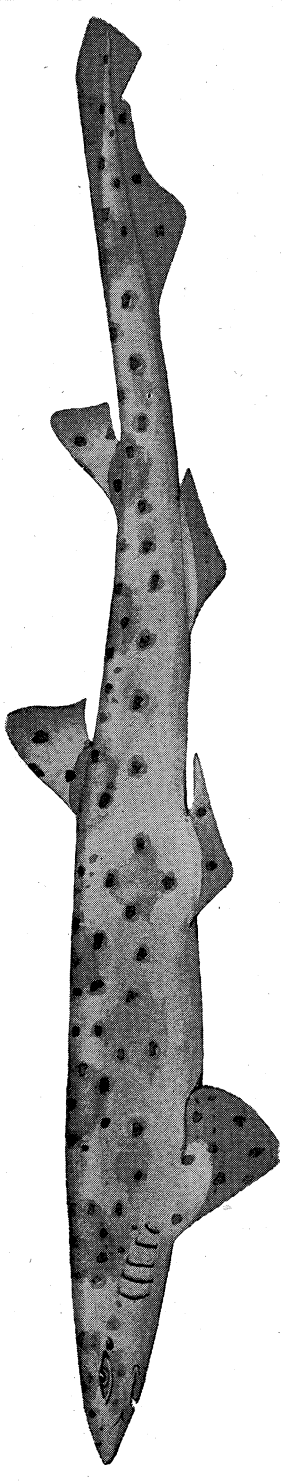


Fig. 1.

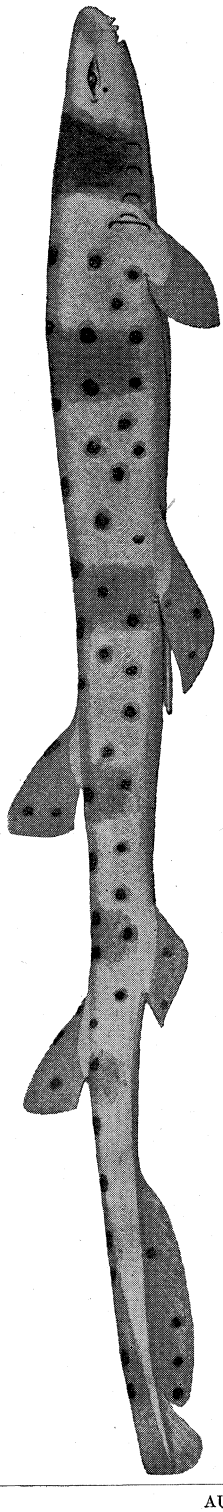


Fig. 2.

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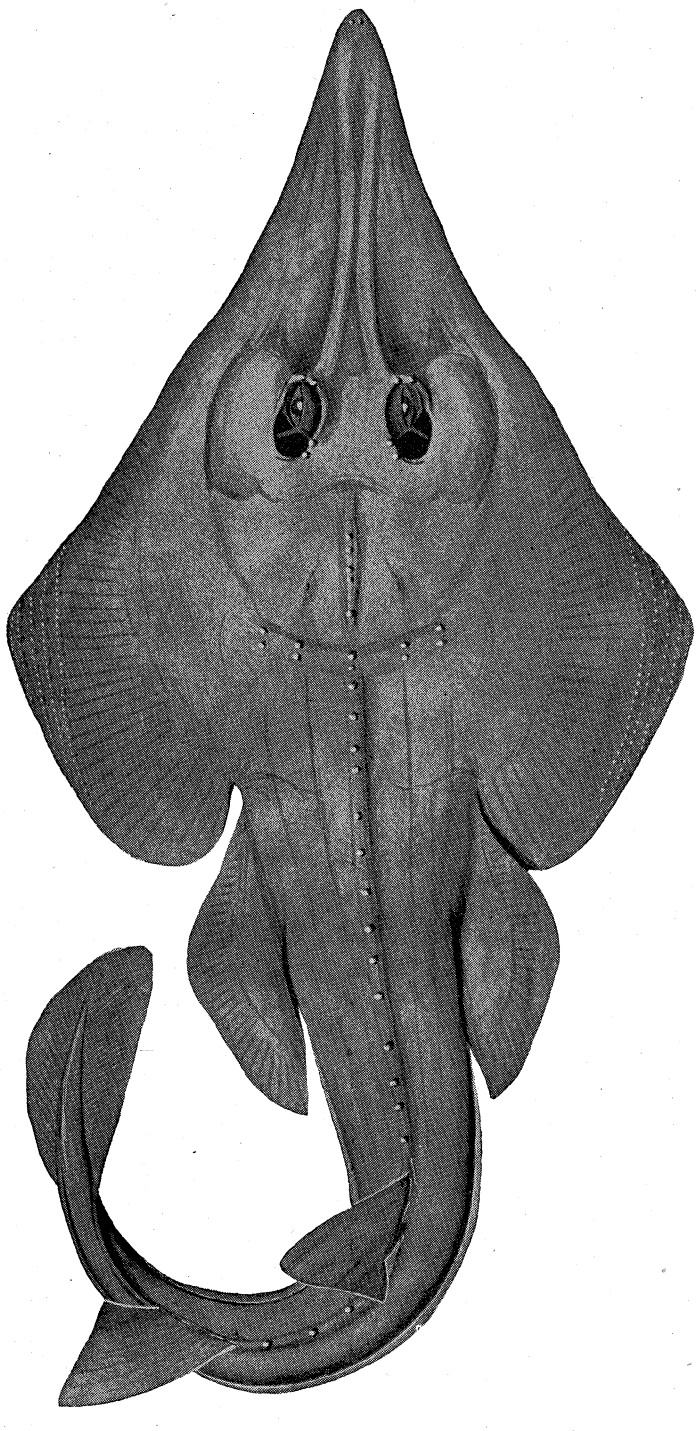
EXPLANATION OF PLATE III.

Rhinobatus banksii, Müller & Henle.

Female, less than half natural size.



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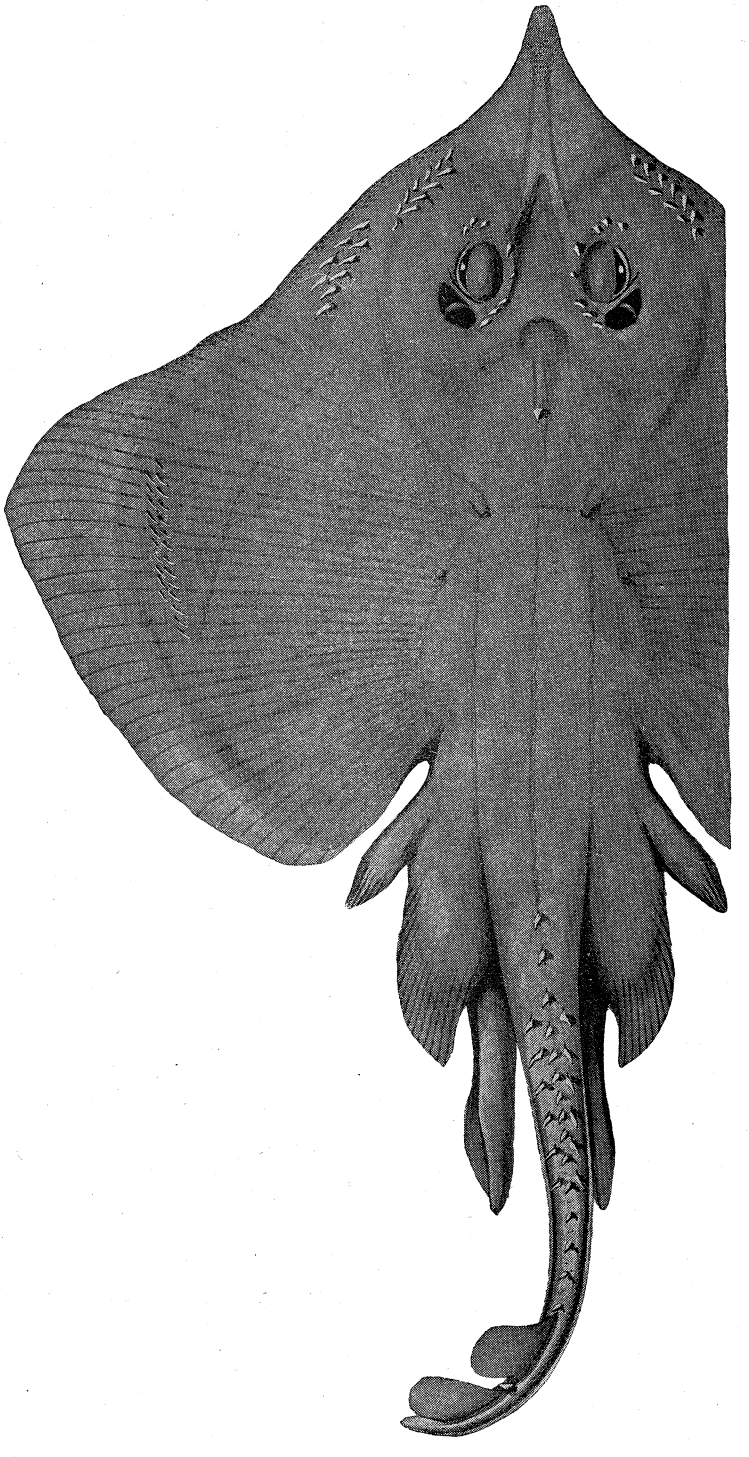
EXPLANATION OF PLATE IV.

Raja australis, Macleay.

Male, less than half natural size.



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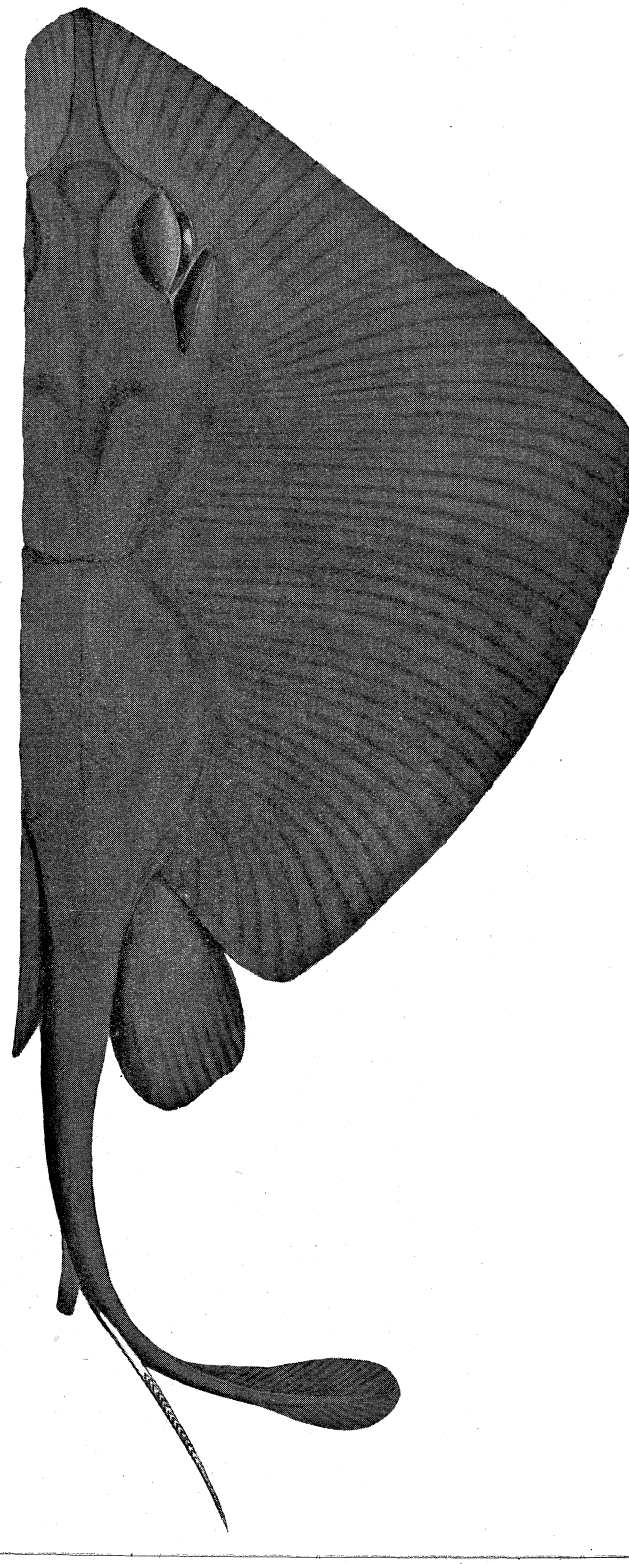
EXPLANATION OF PLATE V.

Trygonoptera bucculenta, Macleay.

Two-fifths natural size.



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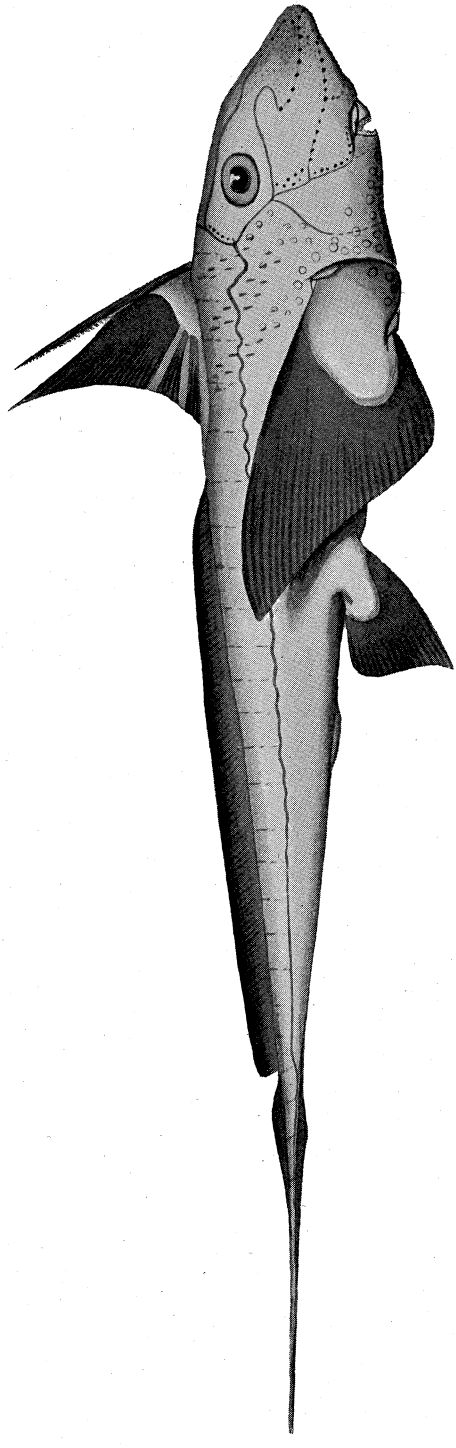
EXPLANATION OF PLATE VI.

Chimæra ogilbyi, Waite.

Female, two-thirds natural size.



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EXPLANATION OF PLATE VII.

Macrorhamphosus scolopax, Linnæus, var. *elevatus*, Waite.

Fig. 1.—Natural size.

Macrorhamphosus gracilis, Lowe.

Fig. 2.—Natural size.

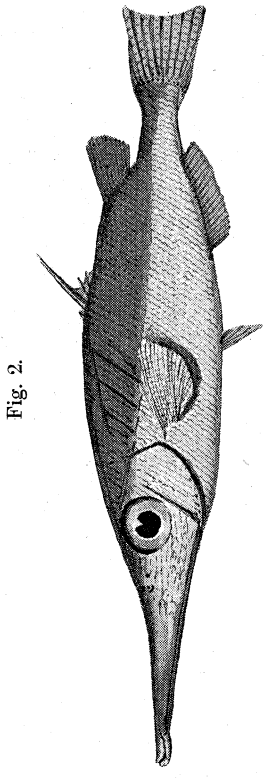


Fig. 2.

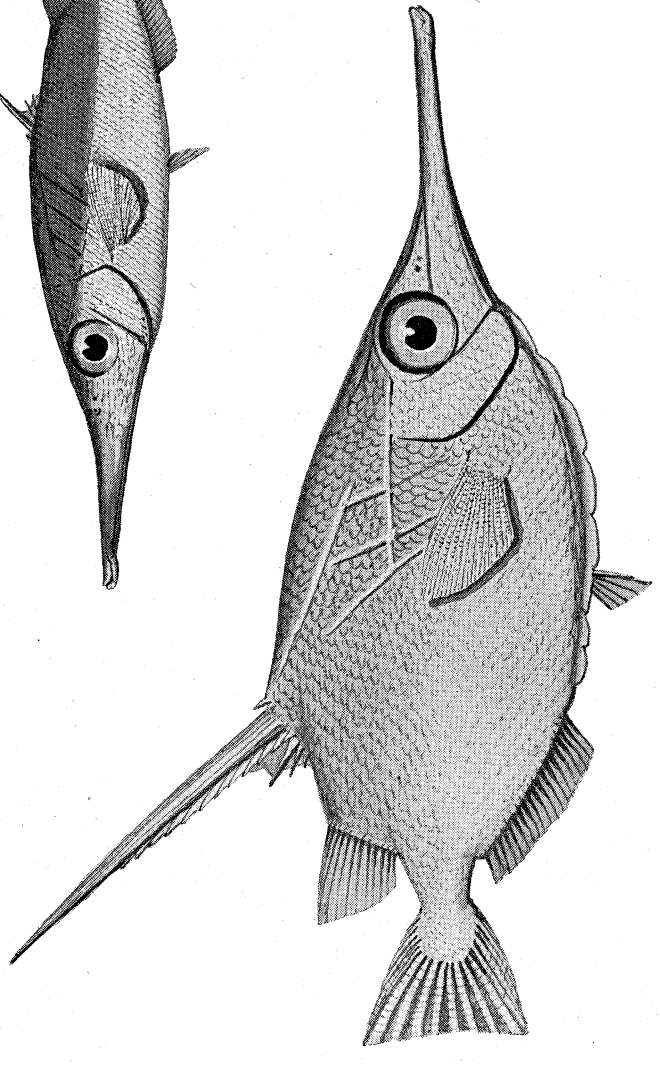


Fig. 1.

EXPLANATION OF PLATE VIII.

Monocentris gloria-maris, De Vis.

Figs. 1 and 2.—Front and profile of head, natural size.

Monocentris japonicus, Houttuyn.

Figs. 3 and 4.—Front and profile of head, natural size.

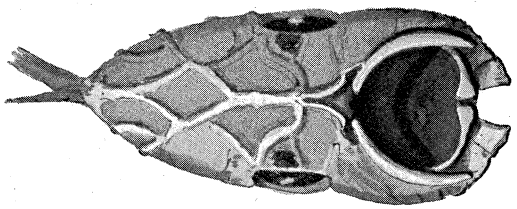


Fig. 4.

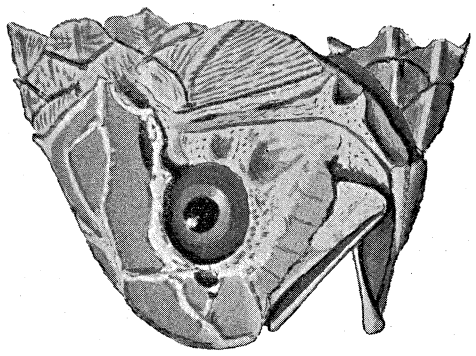


Fig. 3.

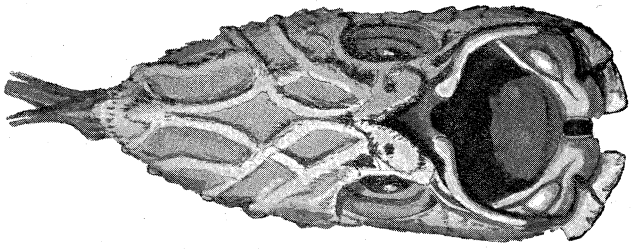


Fig. 2.

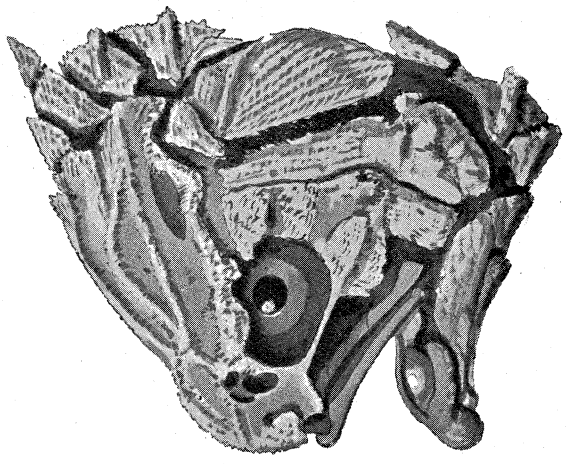
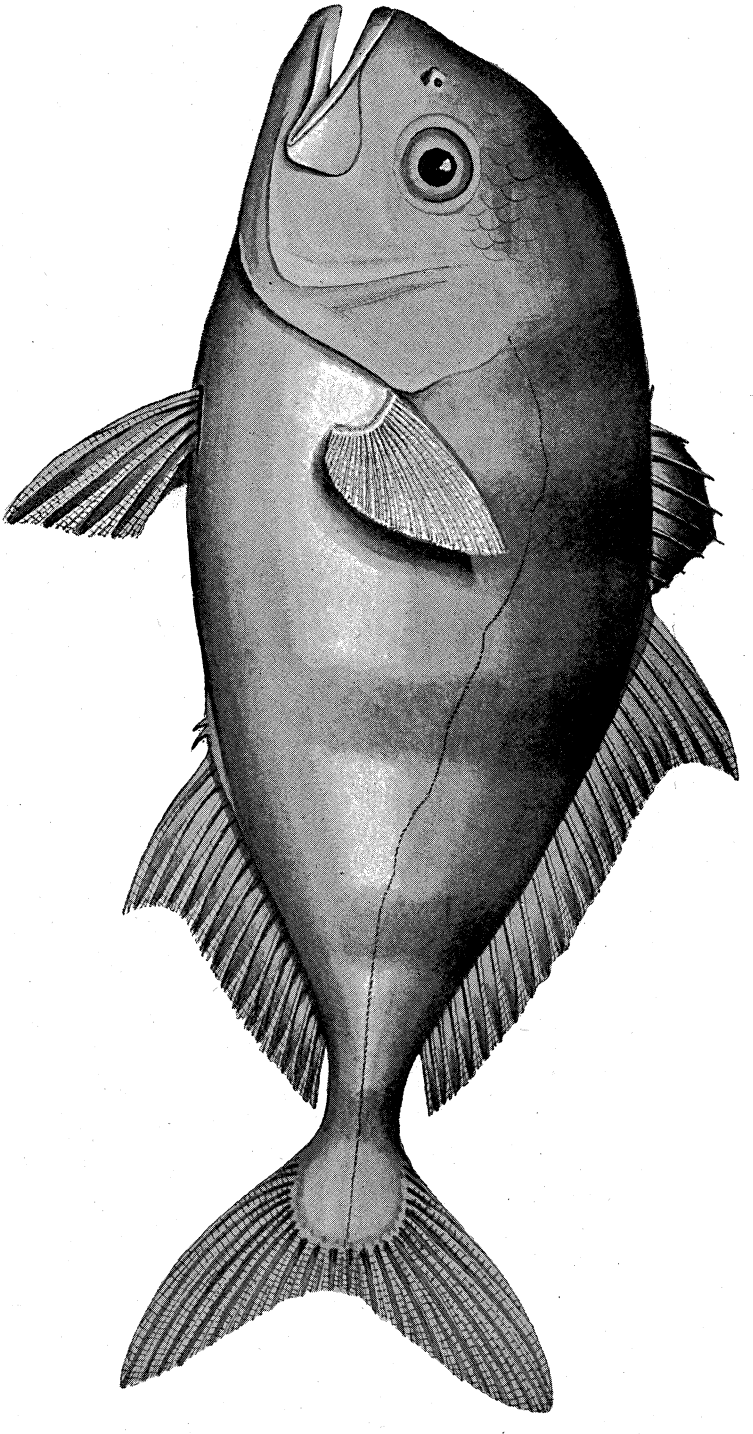


Fig. 1.

EXPLANATION OF PLATE IX.

Seriola hippos, Günther.

Young, natural size.



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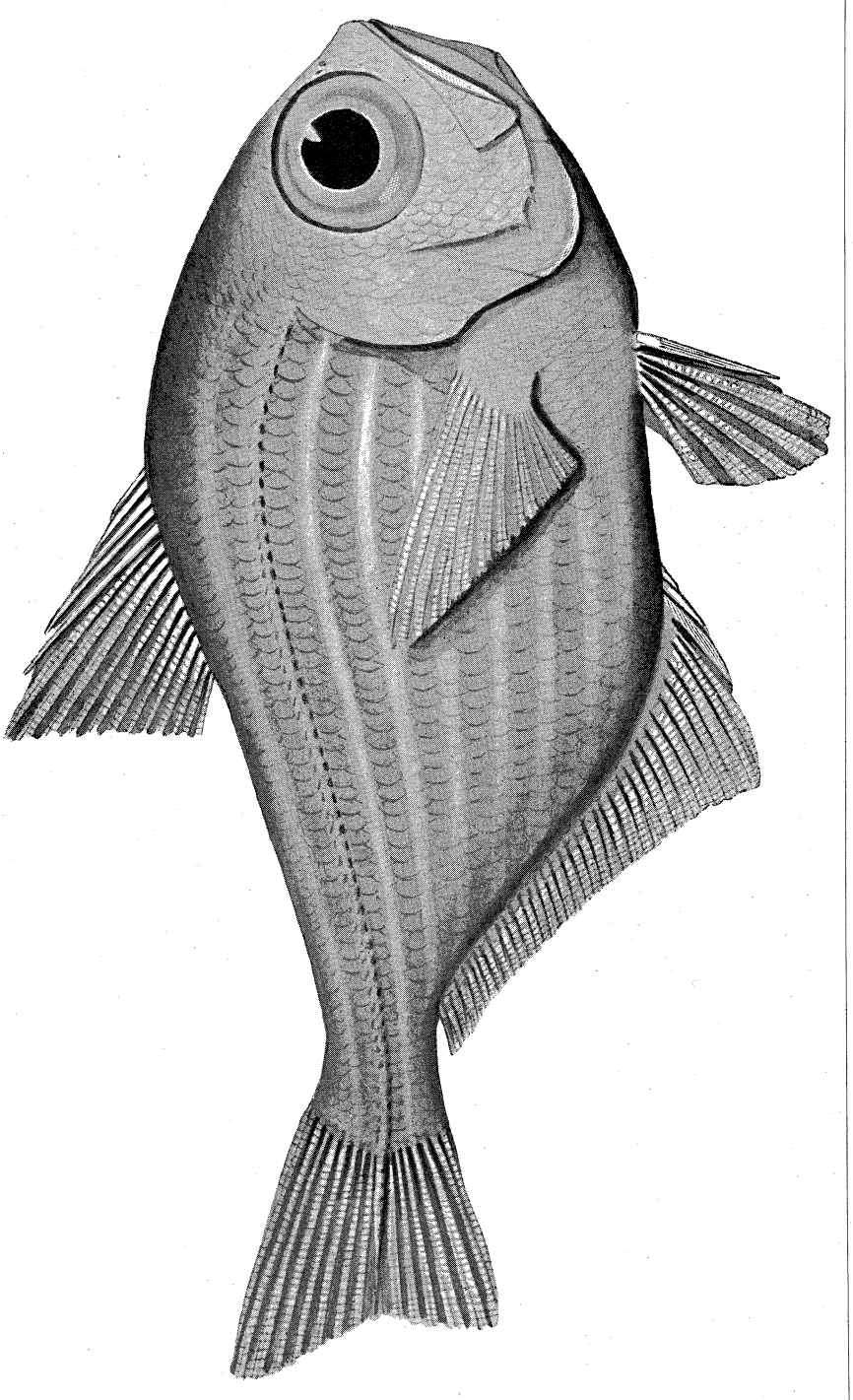
EXPLANATION OF PLATE X.

Pempheris macrolepis, Macleay.

Natural size.



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EXPLANATION OF PLATE XI.

Apogonops anomalus, Ogilby.

Fig. 1.—Natural size.

Centropercis nudivittis, Ogilby.

Fig. 2.—Natural size.

Cristiceps argyropleura, Kner.

Fig. 3.—Natural size.

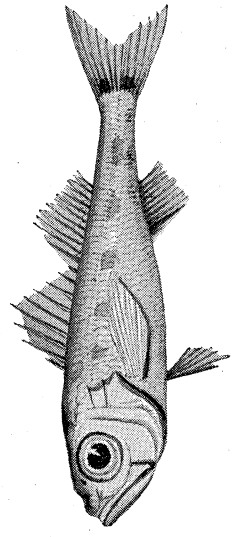


Fig. 1.

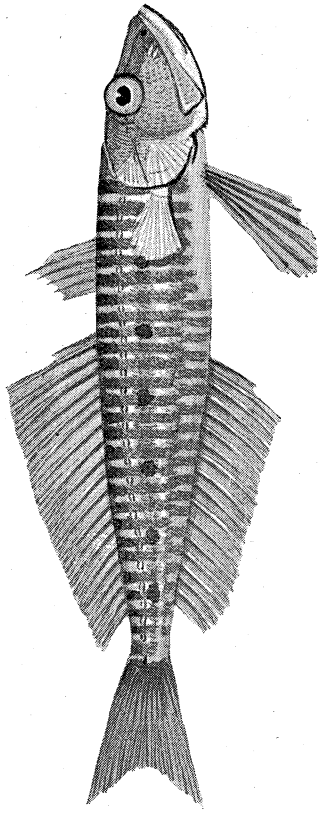


Fig. 2.

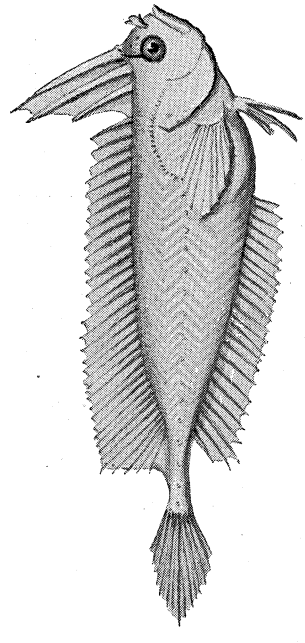
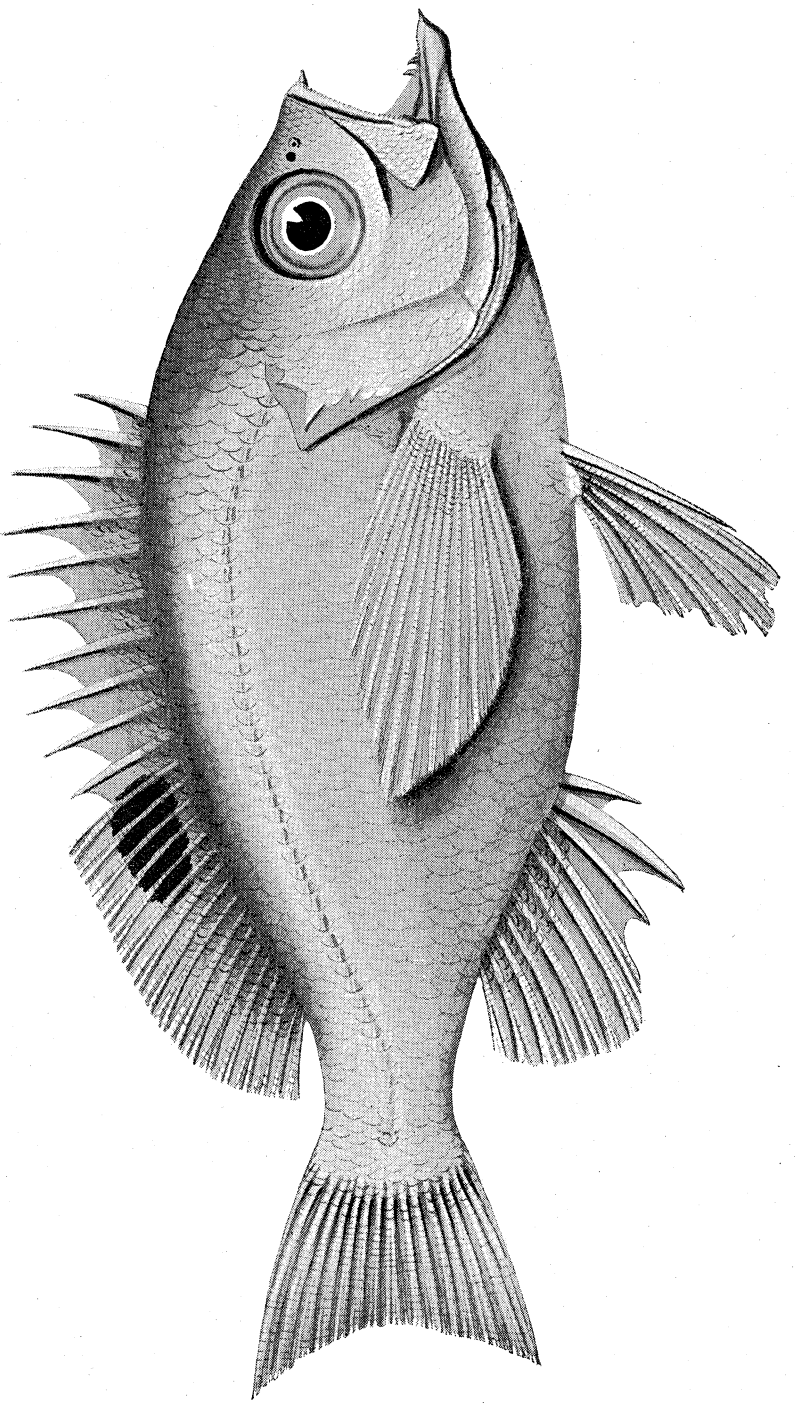


Fig. 3.

EXPLANATION OF PLATE XII.

Anthias pulchellus, Waite.

Four-fifths natural size.



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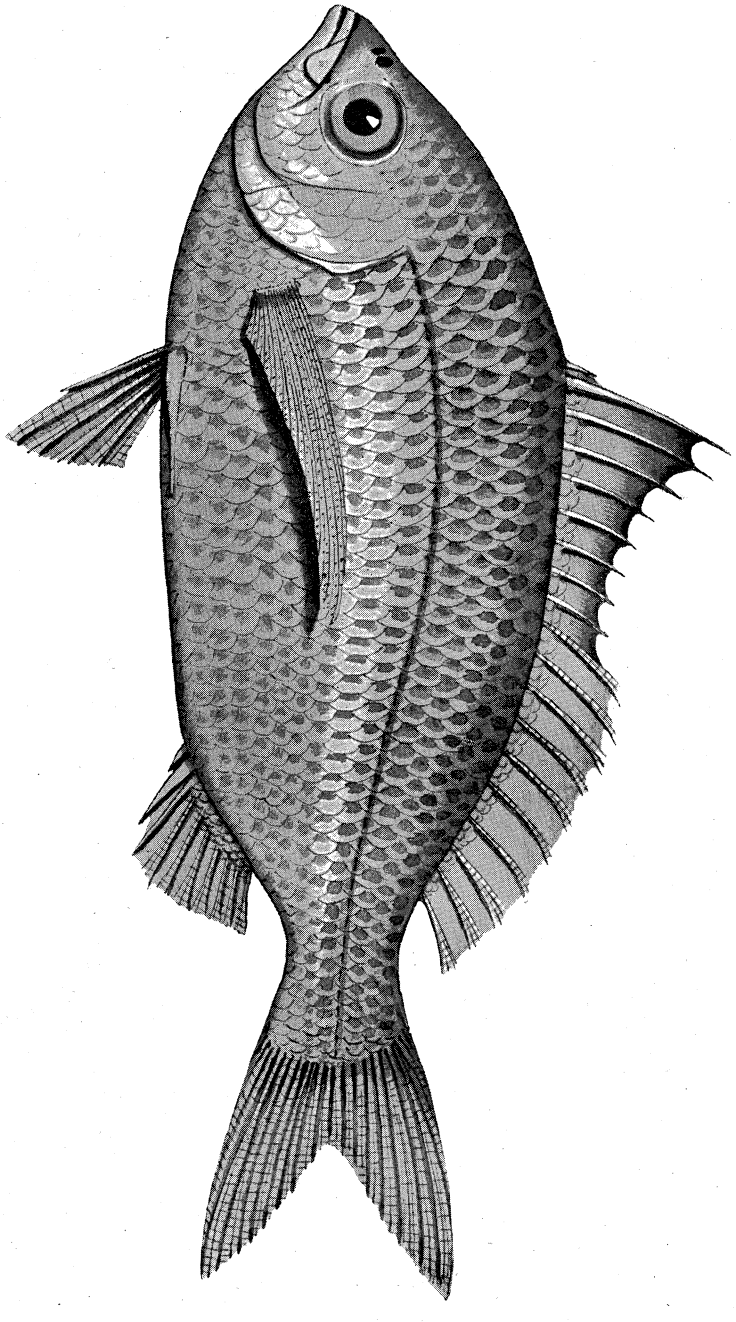
EXPLANATION OF PLATE XIII.

Xystœma ovatum, Günther.

Natural size.



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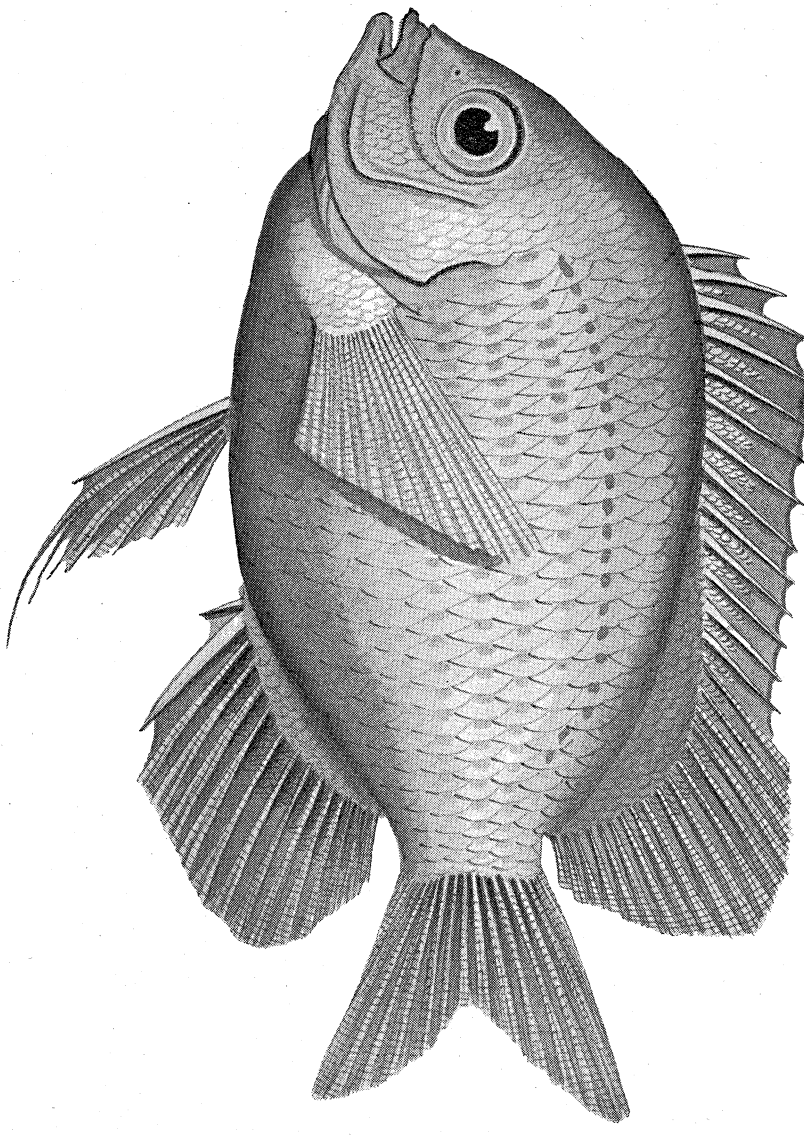
EXPLANATION OF PLATE XIV.

Heliases immaculatus, Ogilby.

Natural size.



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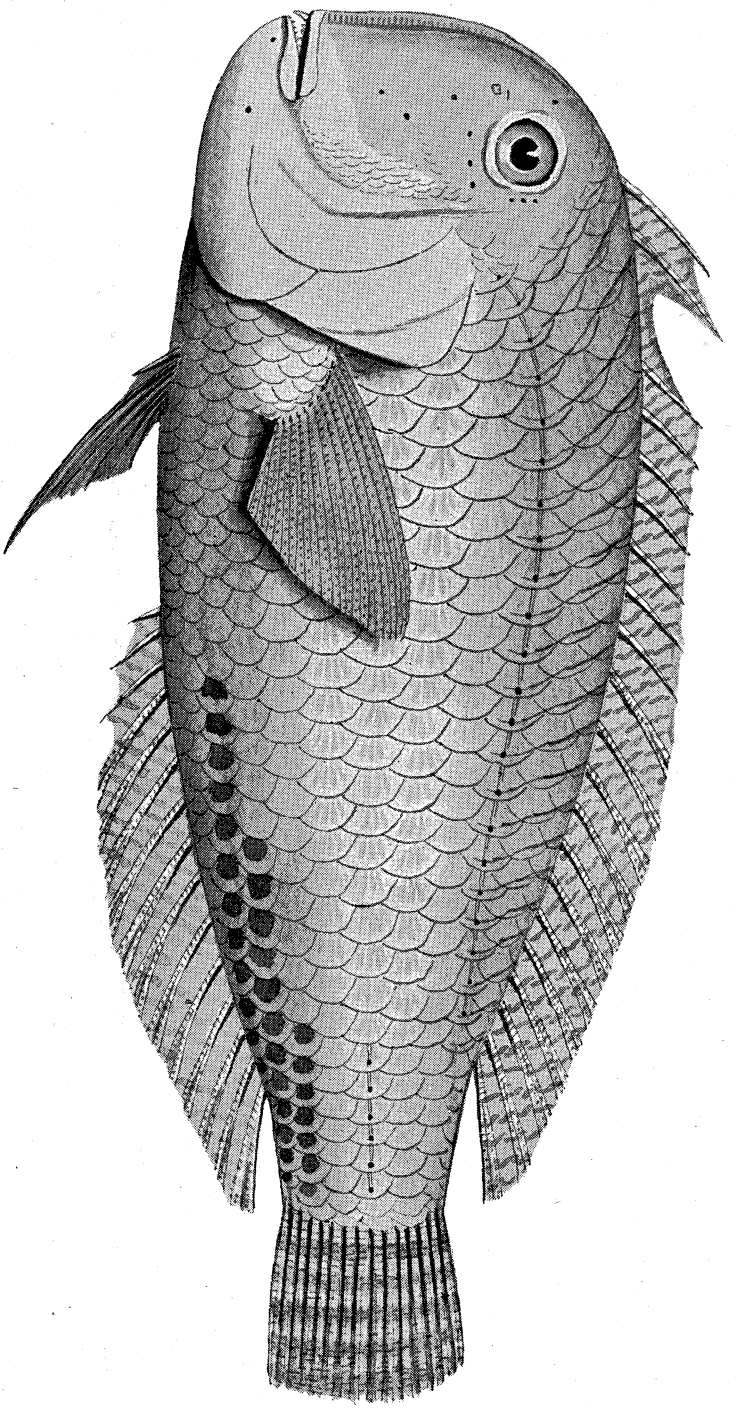
EXPLANATION OF PLATE XV.

Novaculichthys jacksonensis, Ramsay.

Natural size.



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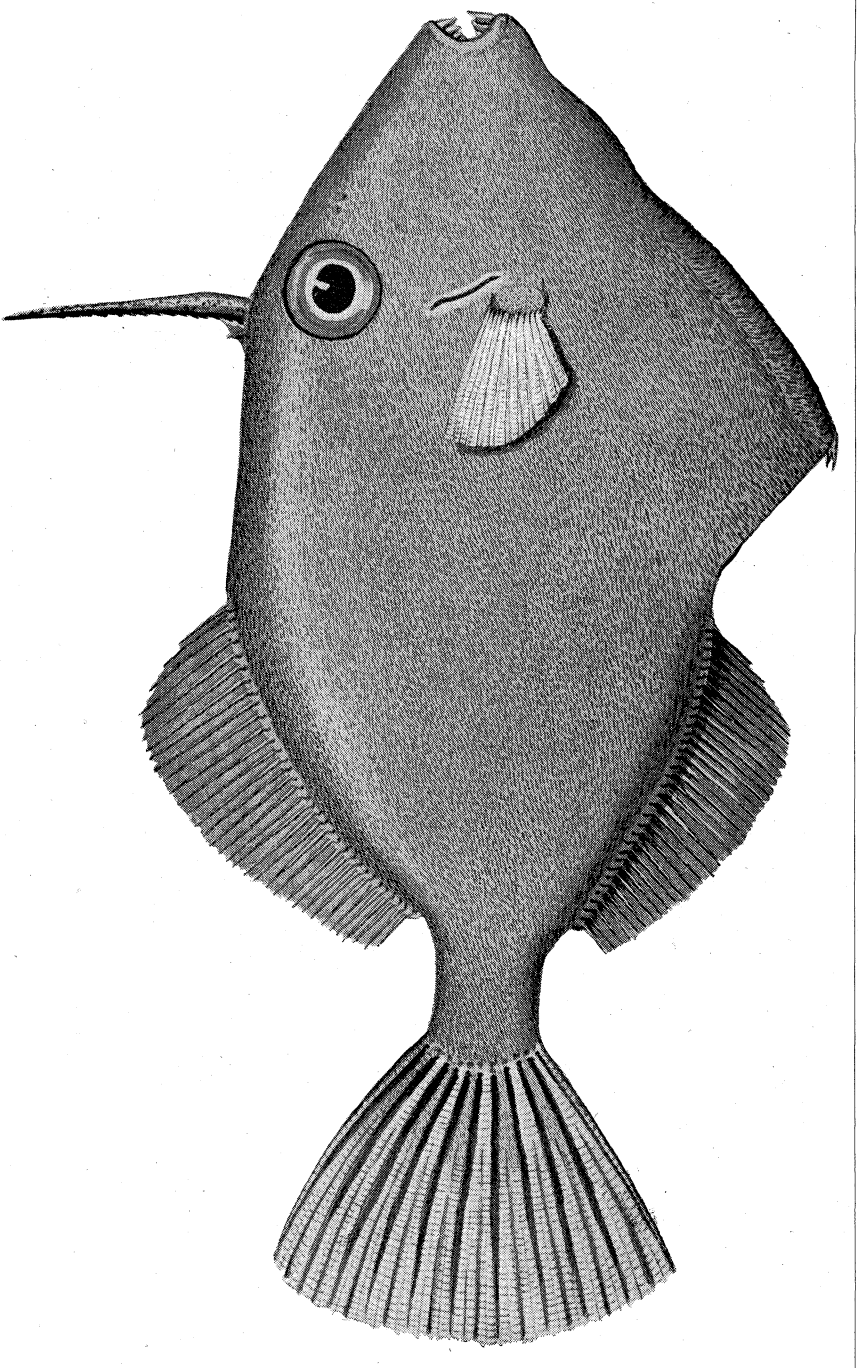
EXPLANATION OF PLATE XVI.

Monacanthus setosus, Waite.

Six-sevenths natural size.



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EXPLANATION OF PLATE XVII.

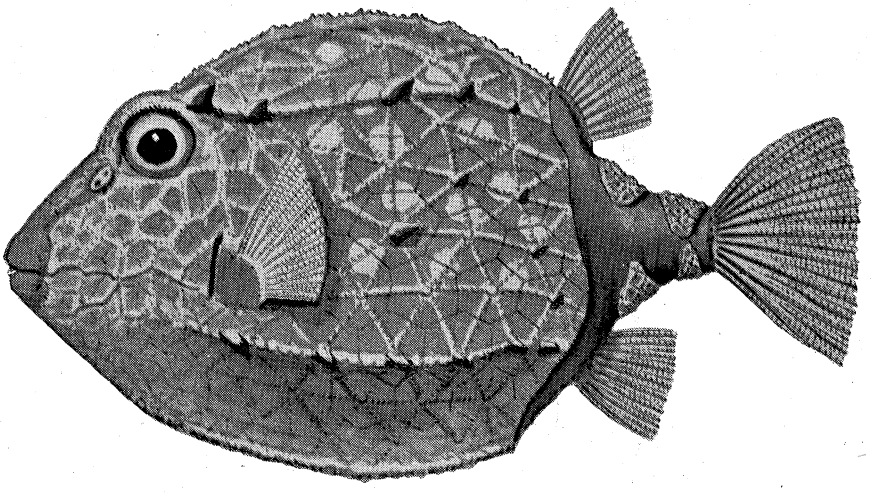
Monacanthus mosaicus, Ramsay and Ogilby.

Fig. 1.—Young, natural size.

Aracana lenticularis, Richardson.

Fig. 2.—Young, natural size.

Fig. 2.



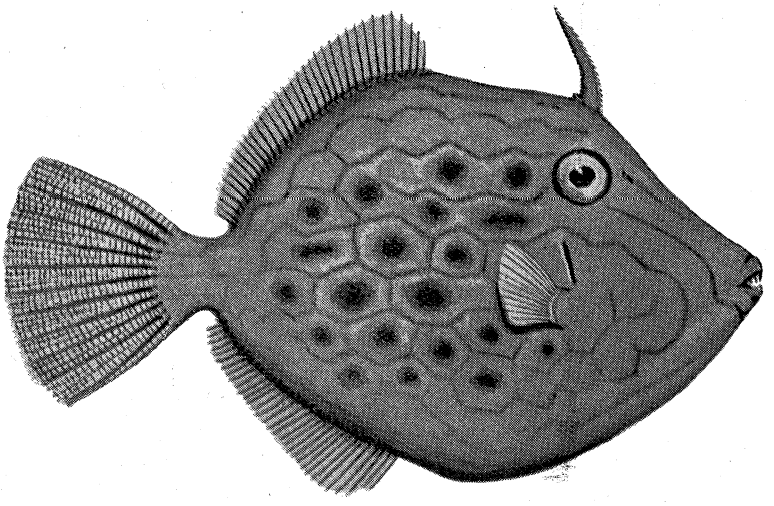
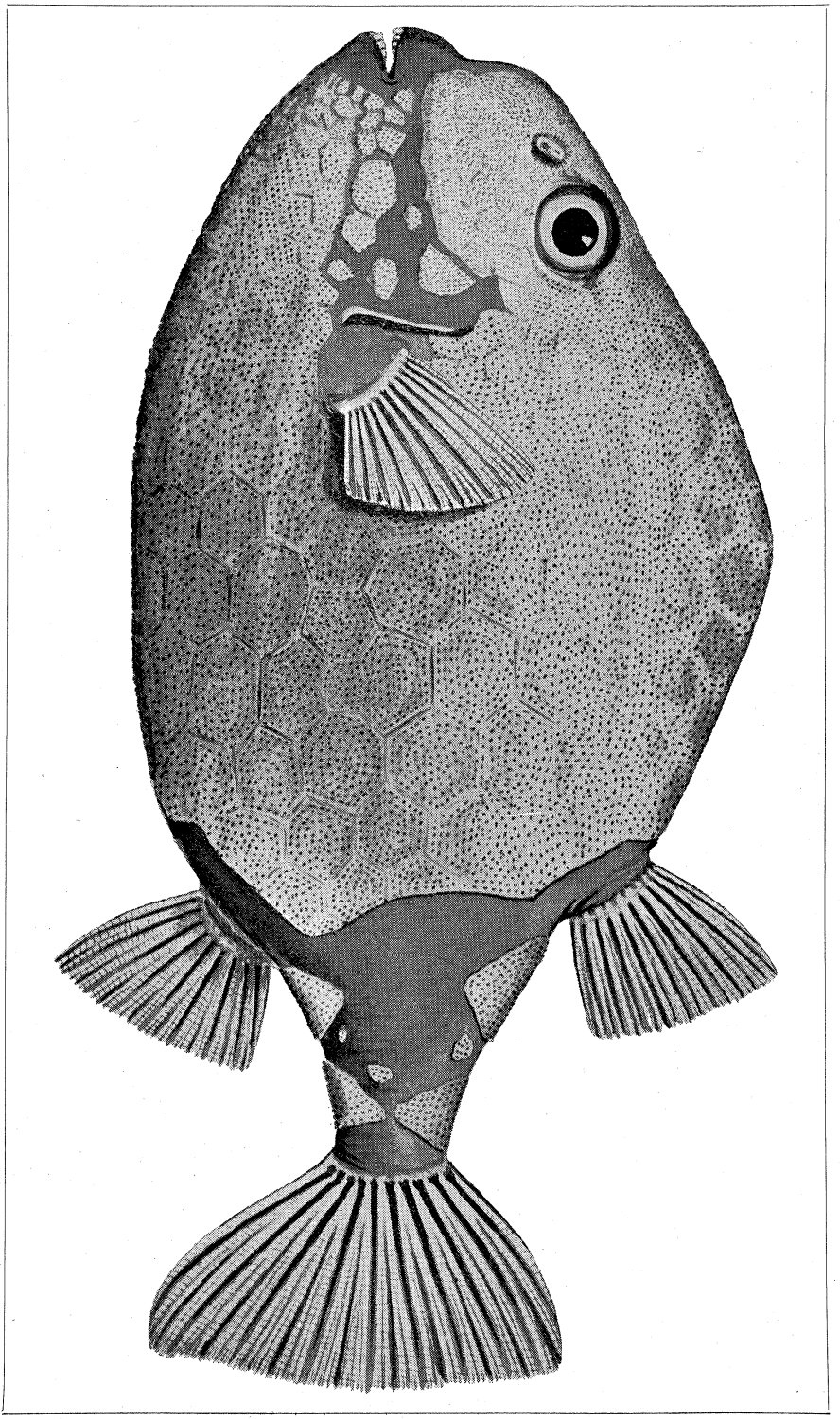


Fig. 1.

EXPLANATION OF PLATE XVIII.

Aracana lenticularis, Richardson.

Adult, three-fourths natural size.



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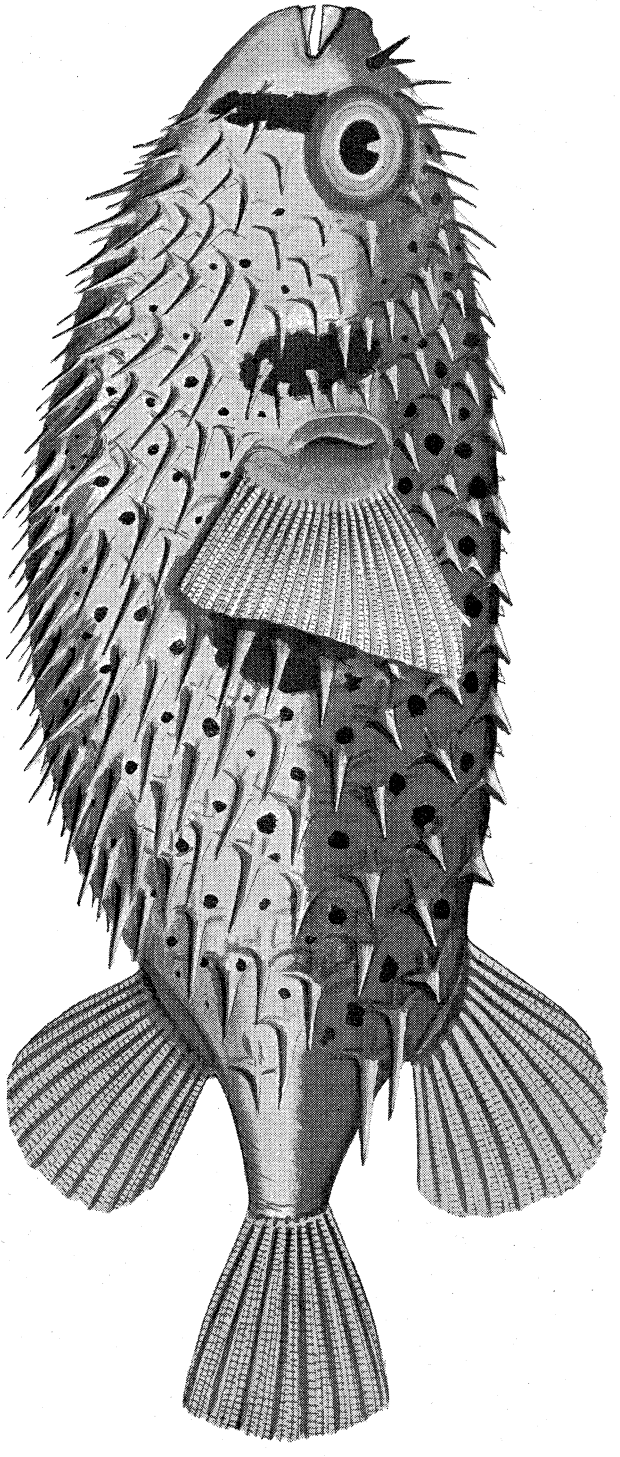
EXPLANATION OF PLATE XIX.

Dicotylichthys punctulatus, Kaup.

Two-thirds natural size.



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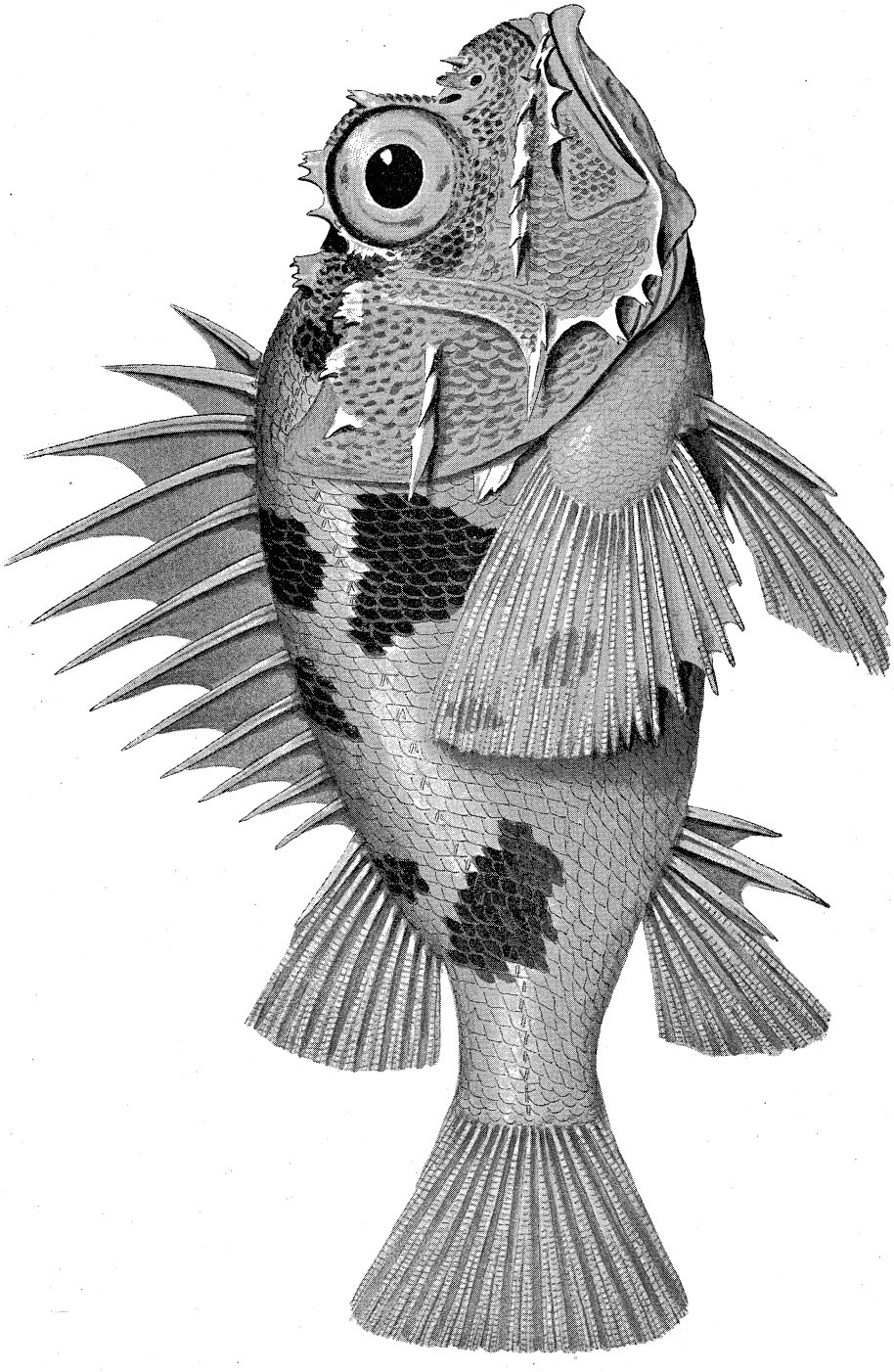
EXPLANATION OF PLATE XX.

Sebastes thetidis, Waite.

Two-thirds natural size.



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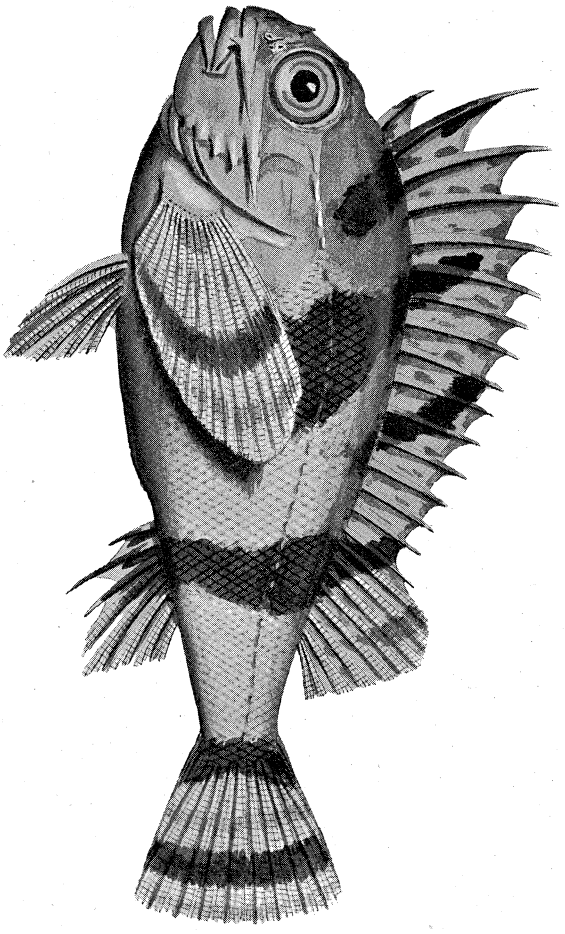
EXPLANATION OF PLATE XXI.

Neosebastes australis, White.

Natural size.



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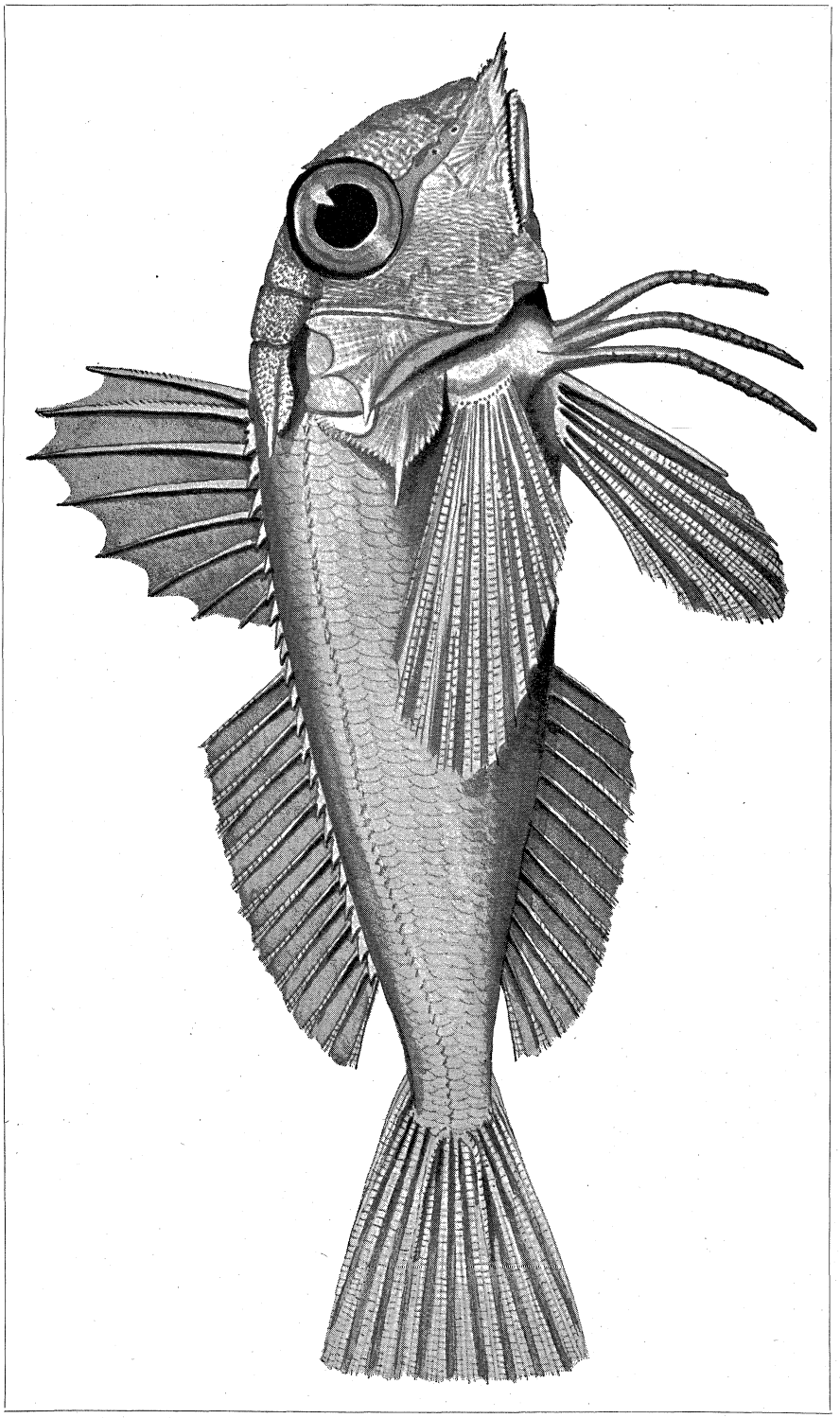
EXPLANATION OF PLATE XXII.

Lepidotrigla mulhalli, Macleay.

Natural size.



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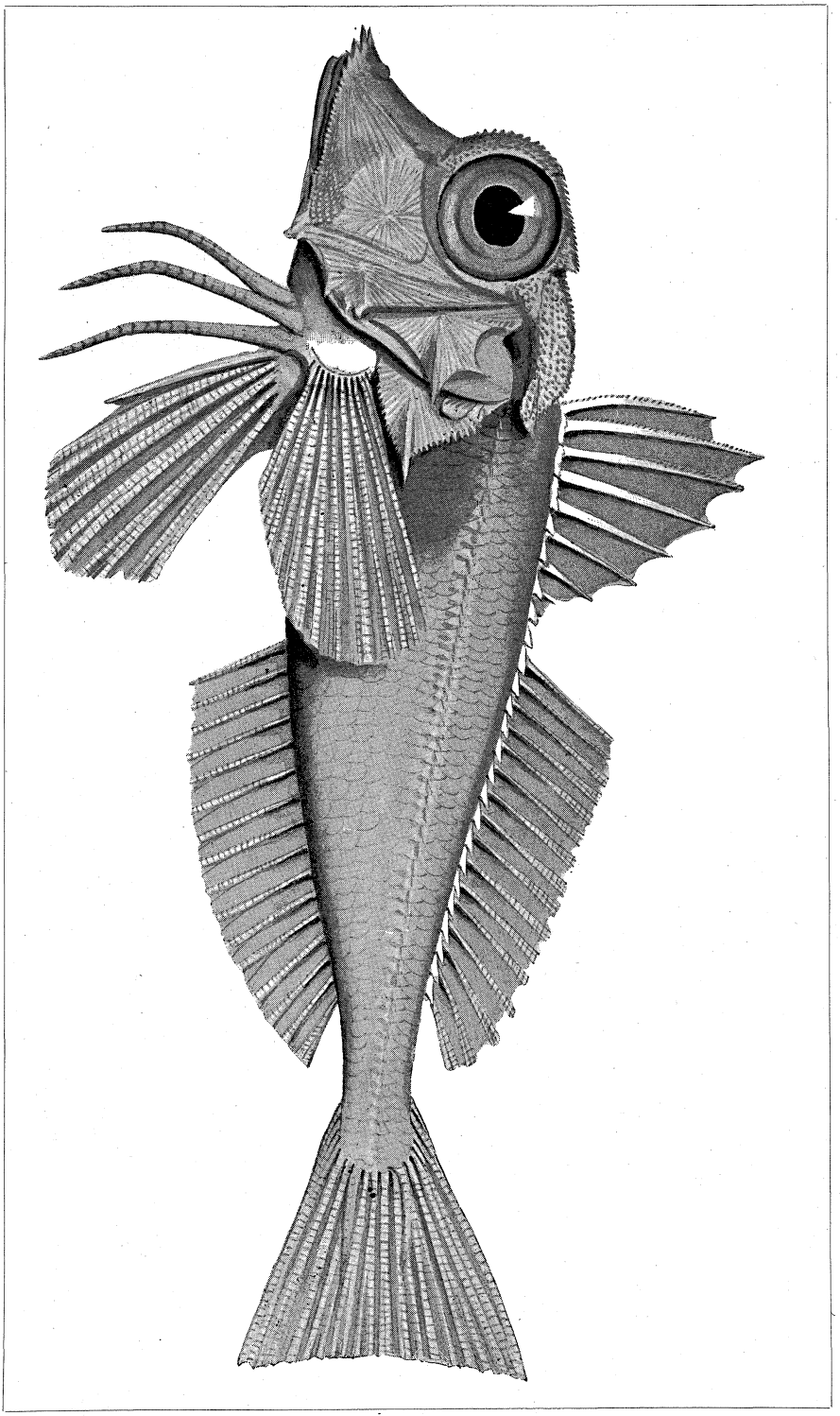
EXPLANATION OF PLATE XXIII.

Lepidotrigla modesta, Waite.

Natural size.



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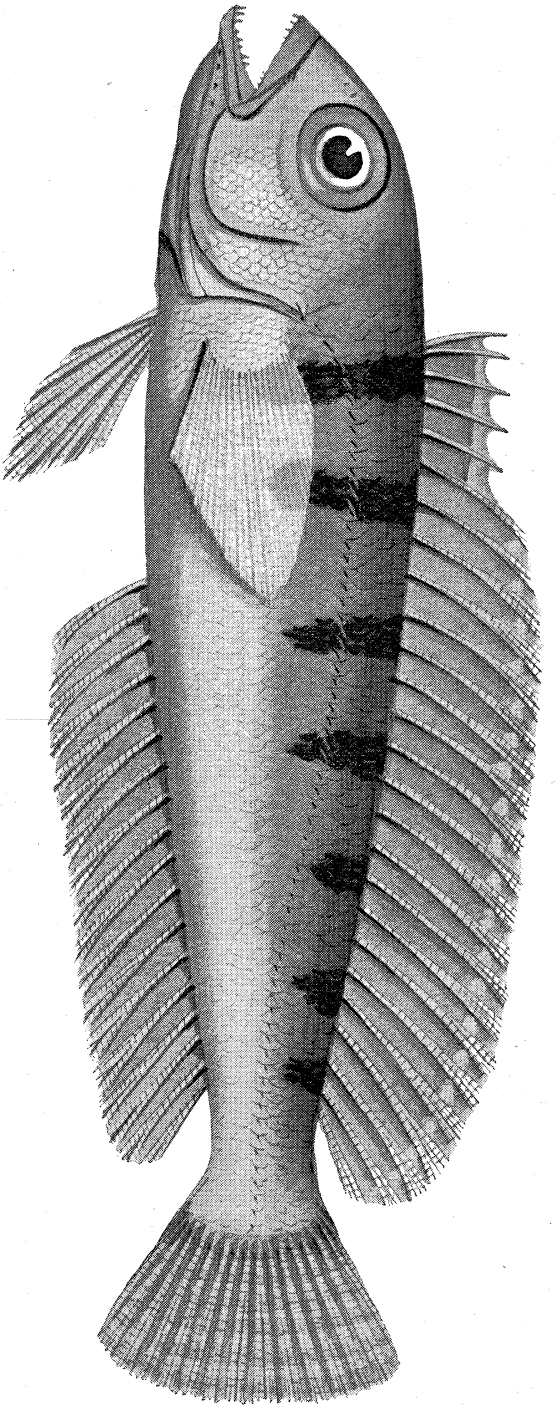
EXPLANATION OF PLATE XXIV.

Parapercis ocularis, Waite.

Natural size.



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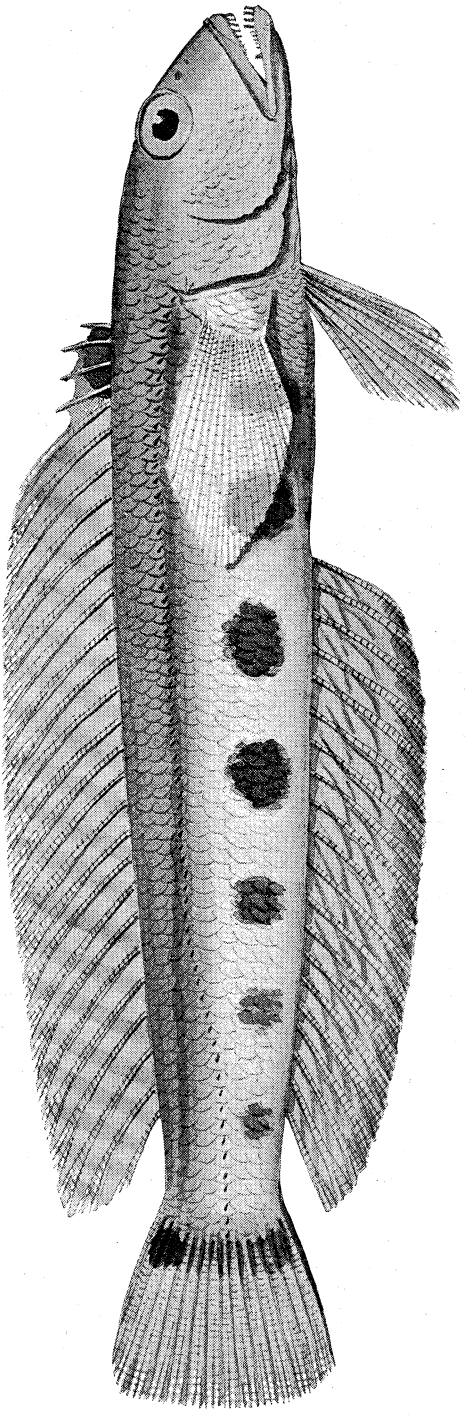
EXPLANATION OF PLATE XXV.

Parapercis novæ-cambriæ, Ogilby.

Nine-tenths natural size.



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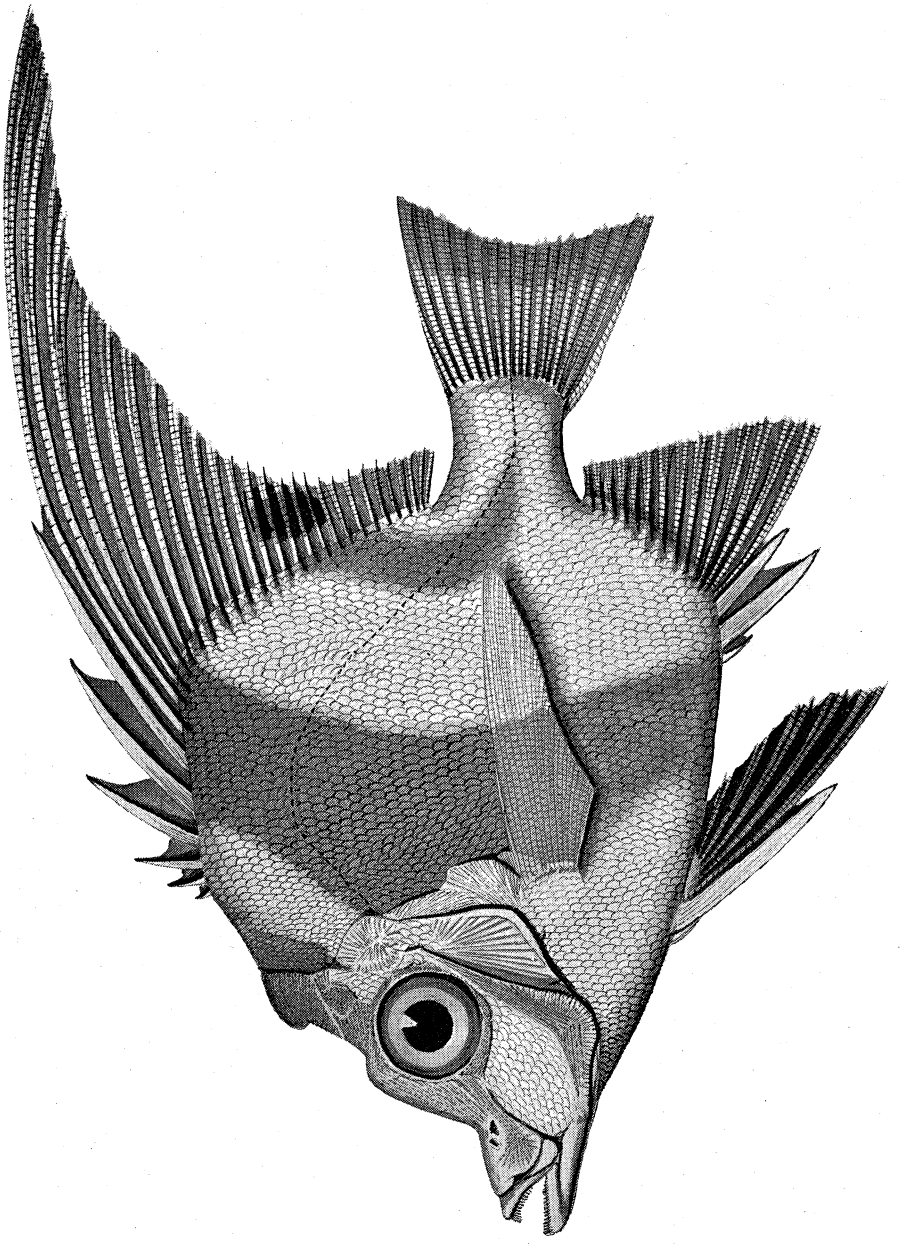
EXPLANATION OF PLATE XXVI.

Histiopterus elevatus, Ramsay and Ogilby.

Three-fourths natural size.



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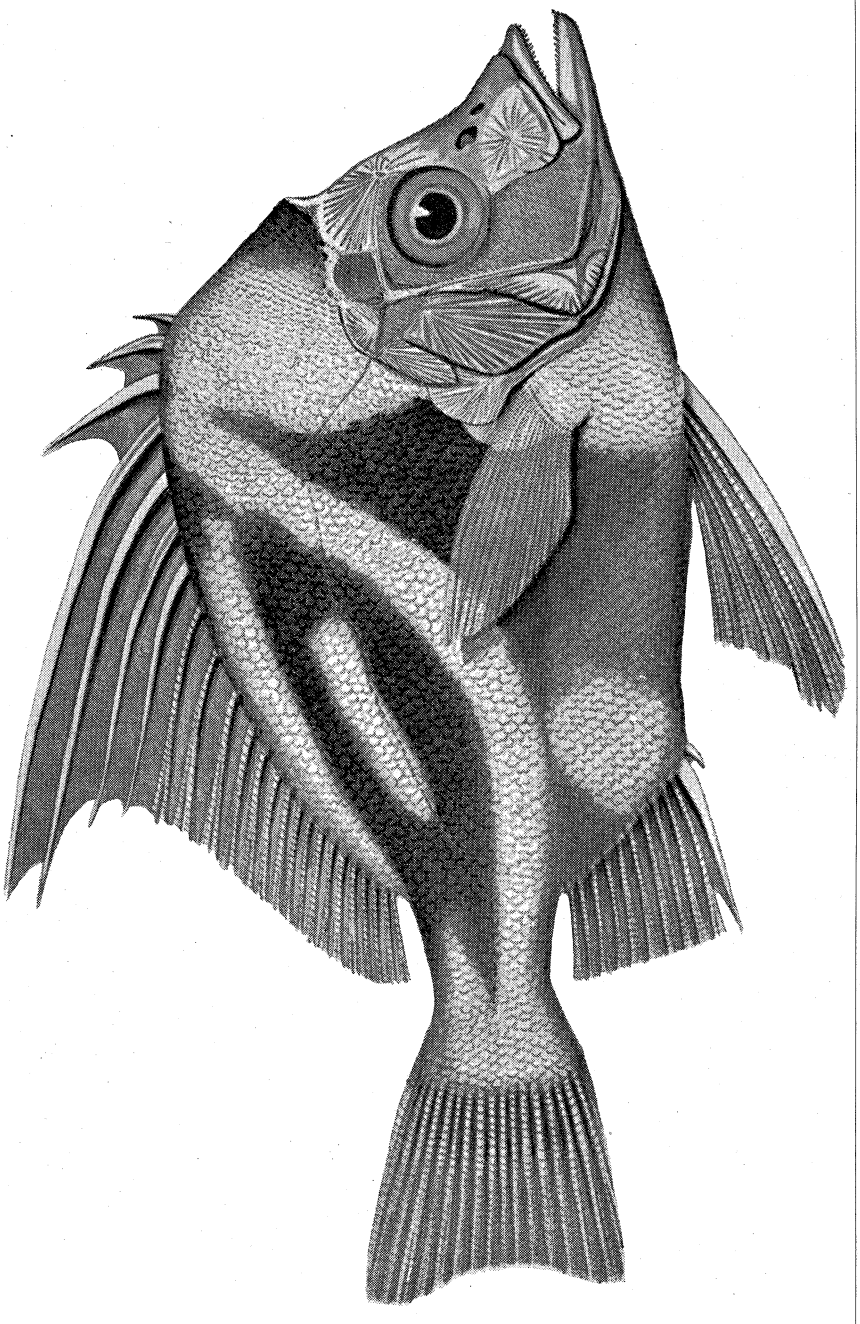
EXPLANATION OF PLATE XXVII.

Histiopterus farnelli, Waite.

Seven-eighths natural size.



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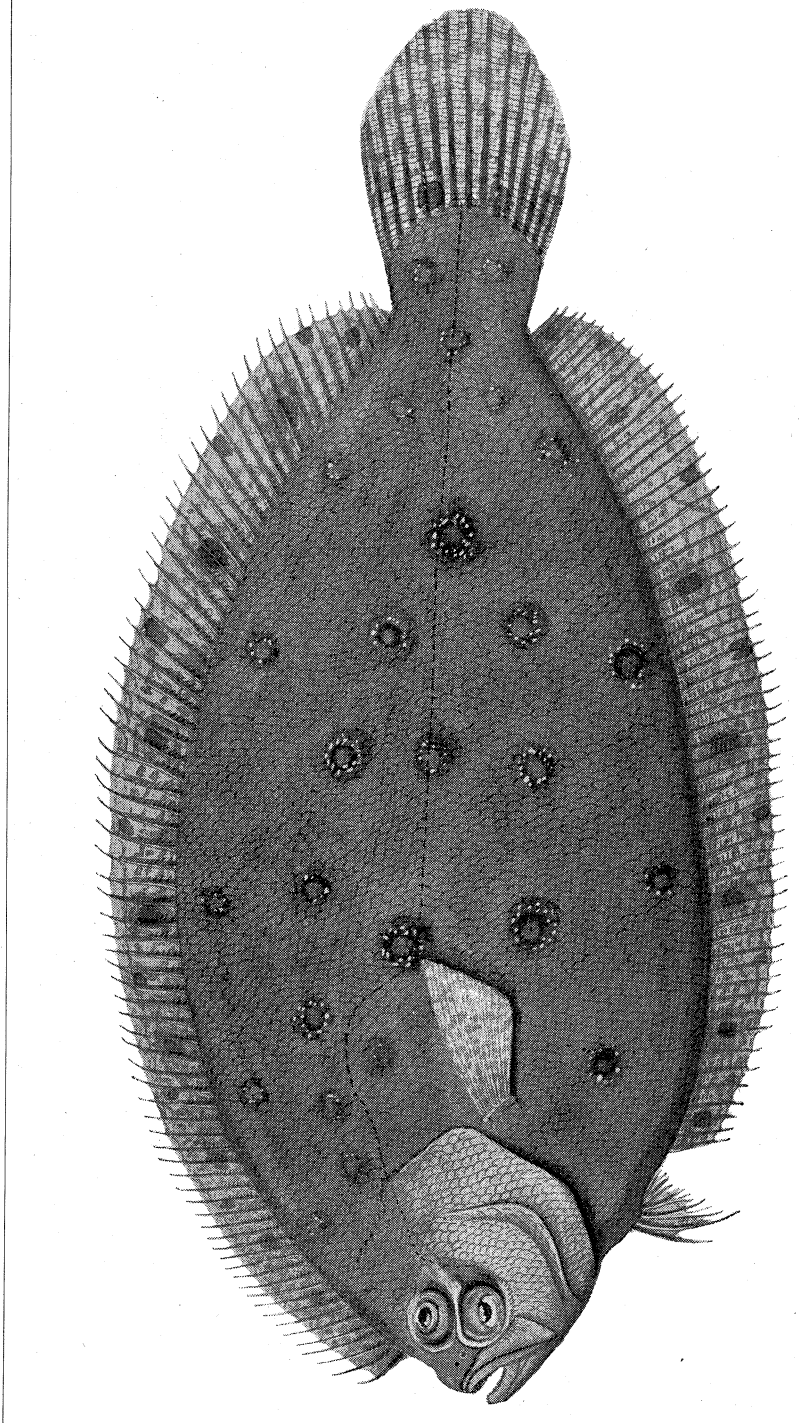
EXPLANATION OF PLATE XXVIII.

Paralichthys tenuirastrum, Waite.

Five-sevenths natural size.



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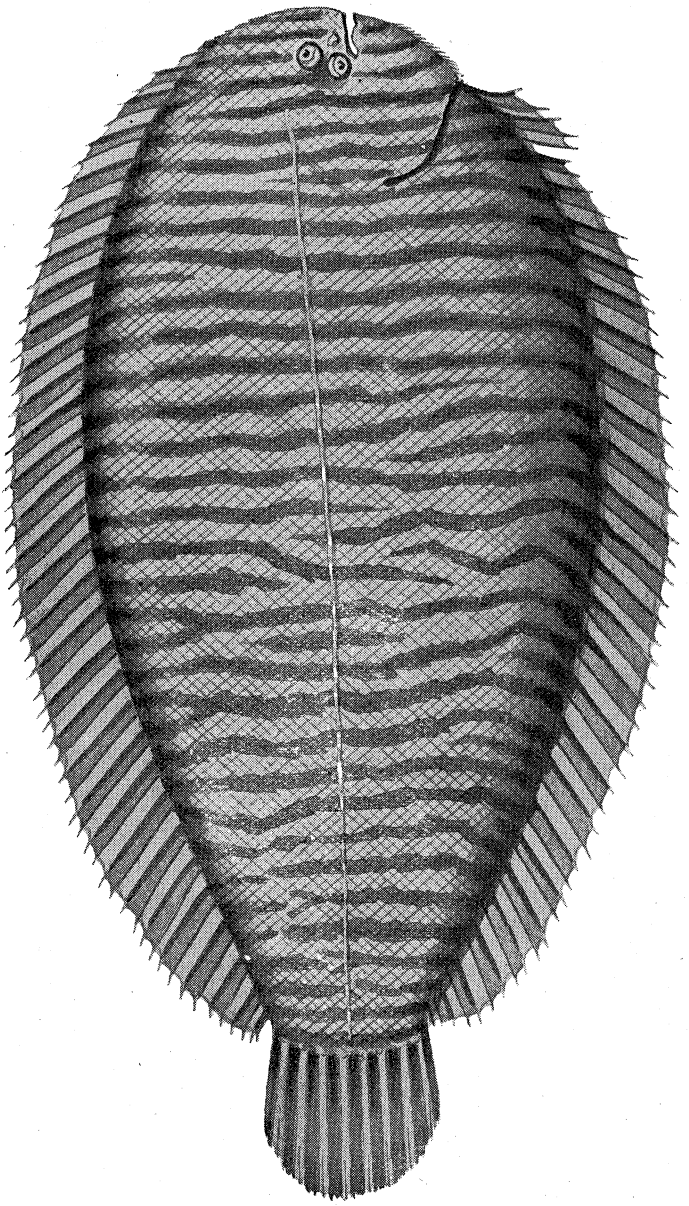
EXPLANATION OF PLATE XXIX.

Aseraggodes macleayana, Ramsay.

Natural size.



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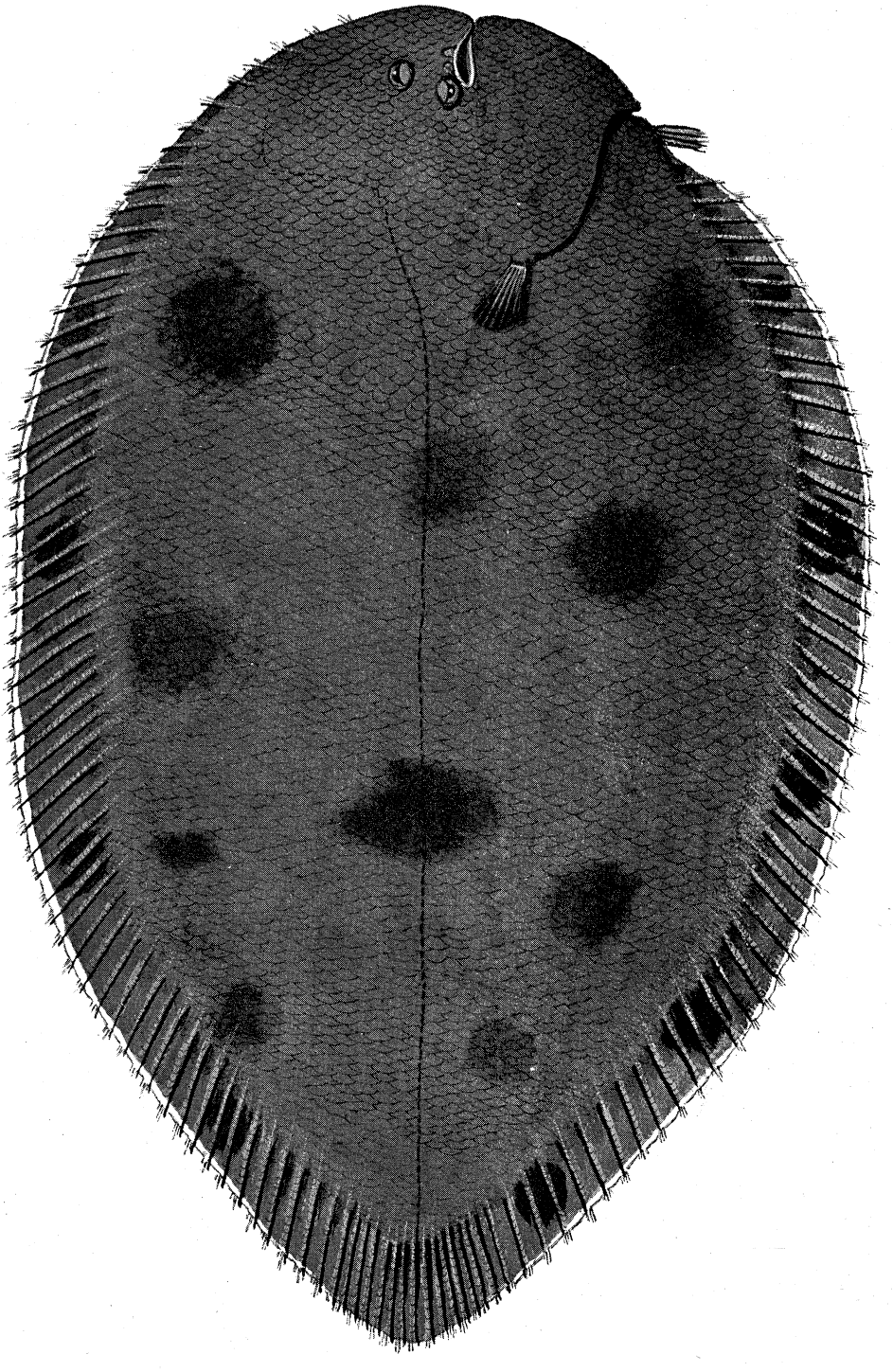
EXPLANATION OF PLATE XXX.

Synaptura nigra, Macleay.

Two-thirds natural size.



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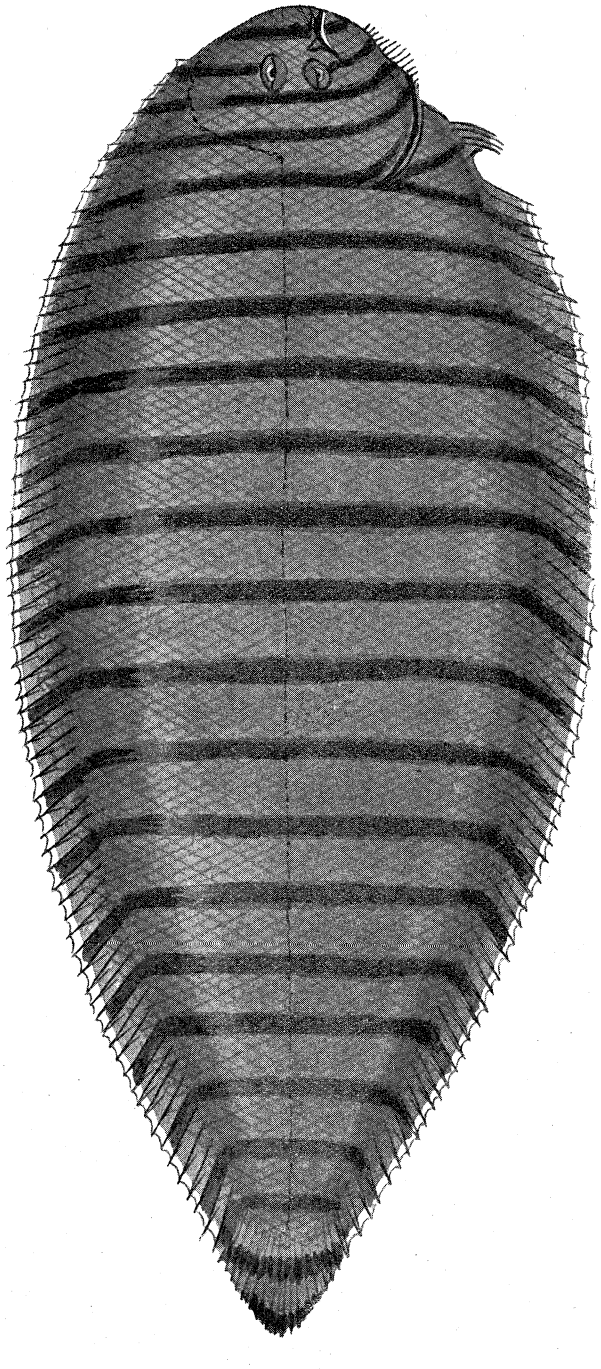
EXPLANATION OF PLATE XXXI.

Synaptura fasciata, Macleay.

Natural size.



EDGAR R. WAITE, Del. AUST. MUS.

ERRATUM.

Page 63, for CREEDIADÆ read CREEDIIDÆ.

SKETCH OF PORTION OF THE COAST

OF

NEW SOUTH WALES,

TO

ILLUSTRATE THE TRAWLING EXPEDITION

OF

H.M.C.S. "THETIS."

152·20 152.40.

31·40 32 32·20 32·40 33. 33·20 33·40 34. 34·20 34·40 35.

Crowdy Hd. 27 Manning R. 28. Manning Bight. 29. Halliday Pt. 30. Cape Hawke 31. 32. 152·40 Charlotte Head. Sugar-loaf Pt. Seal Rocks 17. Broughton Is. 18. PORT STEPHENS. Morna Pt. 19. 20. 33 Bight. 21. Newcastle 22 23 24 25. NEWCASTLE. 26. Red Head. 152·20. Lake Macquarie. 20 fathoms 50 fathoms 16. Bird Is. Bunbaree Norah. 15. 14. 11. Tuggerah Lakes. 10. 12 9. 13. C. THREE POINTS 8 2 BROKEN BAY. 1 4. Barranjoey 3 5 6. 55. 7. Narrabeen PORT JACKSON 34. 44. BOTANY BAY. 43. 56. 37. 36. 45. 35 PORT HACKING Tasman 38 46 58 41. 39 57. 42 Wata Moolla 40 47. Bulgo. Bulli. 48. Wollongong 49. Magnetic Var. 9. 36 E. Kiama 50 fathoms 100 fathoms 20 fathoms Shoalhaven Bight. 59. 51. 52. 53. 55 54. JERVIS BAY. 152. 151·40 151·20

150·40. 151

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